POINTER

Journal of the
Singapore Armed Forces

Vol. 31 No. 2 [2005]

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EDITORIAL

The *POINTER* journal serves to educate SAF officers on both professional and security issues by publishing a diverse range of articles of general and specific interests. Much care and attention are given in the choice of articles to ensure that the journal provides a good spread of articles covering warfighting and transformation; leadership and organisational development; and conflict and security studies themes. In keeping with this objective, we are once again presenting articles of a variety of topics.

In this issue, we are honoured with a lead article from our Chief of Air Force, MG Lim Kim Choon. In the article, "Connectedness and Cooperation in the 21st Century" MG Lim sheds light on the RSAF's perspective and practice of multilateral cooperation to enhance regional and global security. The article is adapted from a presentation at an earlier Air Chiefs' Conference and Symposium in Japan, and it addresses the new challenges of transnational threats and the collective responses required to deal with them.

Next, we add to the ongoing discourse and existing literature on effects-based warfighting concepts with an article contributed by LG Deptula, Vice Commander of the Pacific Air Forces. The article on "Effects-Based Operations: A U.S. Commander's Perspective" provides interesting insights into the application of EBO during the U.S. air campaign in Operation Desert Storm. LG Deptula gives an account on how the air operations were carried out on a combination of stealth and precision with effects-based targeting.

From the First Gulf War, we move to the next with Prof. Christopher Coker, Professor of International Relations at the London School of Economics. Prof. Coker adds to the discussion of warfighting with his article on the experiences and lessons drawn from the Second Gulf War and its impact on the ongoing debate on military transformation.

We are pleased to feature another article on training decision makers by COL Ong Yu Lin and LTC Lim Beng Chong. In their previous article "Decision Making in a Brigade Command Team: Integrating Theory & Practice" (*POINTER* Vol. 30 No. 4) they presented an analytical approach to decision making, which they complement in this issue with a naturalistic approach – complementing logical problem solving with intuition. They posit that a more complete approach to developing decision making skills in our leaders is to create a training system that develops both analytical skills and intuition, and proceed to develop a framework for "Training Expert Decision Makers".

Also in this issue is a contribution by LTC Cheong Kwok Chien that addresses the transnational threats to maritime

security and presents a comprehensive framework for combating maritime terrorism in his article, "Reflections on the Operational Framework for Internal Maritime Security".

Under the section of Tech Edge, we are privileged to publish an edited version of a research paper on aerodynamic shape design. This article is especially interesting as it is a research related to aircraft performance but written by the Army's Chief Signal Officer! Part of the research also won the Silver Award of an earlier CRAYQUEST Singapore in High Performance Computing.

In this issue's Personality Profiles, we continue with the third part of our four-part special profile on the great commanders of World War II. We compare and contrast the rival commanders on the Russian Front Marshal Georgi Konstantinovich Zhukov (1896–1974) and General Heinz Wilhelm Guderian (1888–1954), examining their lives and careers.

Last but not least, spurred by the recent sharing of BG Goh Kee Nguan of his Operation Flying Eagle experience in the last issue of *POINTER* (Vol. 31 N.1), one of our readers MAJ Nur Effendi wrote in to share his experience and perspective of the OFE. We are pleased to publish MAJ Effendi's candid account of the valuable lessons he learnt as an officer working the ground during the operation. We warmly encourage more readers to write in to share their thoughts and views with *POINTER*.

Editor, *POINTER*

Connectedness And Cooperation In The 21st Century: RSAF's Perspective And Practice Of Multilateralism

by MG Lim Kim Choon

Introduction

With a common purpose to seek peace, the sharing of knowledge will enhance our ability to meet today's security challenges. It is thus important for Air Forces to share knowledge and build mutual understanding.

There is a Japanese saying that, "Knowledge and virtue are like two wheels of a cart." The virtue which most nations seek, most would agree, is that of peace, without which there can be no progress and prosperity. It is unfortunately inadequate for nations to share this virtue alone, particularly in the face of transnational threats, which no nation alone can counter. Figuratively speaking, the other wheel to make the cart of progress complete is the sharing of knowledge. With a common purpose to seek peace, the sharing of knowledge will enhance our ability to meet today's security challenges. It is thus important for Air Forces to share knowledge and build mutual understanding. The emphasis of this article is on the importance of multilateral cooperation in this interconnected world. More specifically, it will delve on the Republic of Singapore's Air Force's (RSAF) perspective and practice of multilateralism.

Connectedness In The Information Age

The Information Age, penetrating practically every segment of society, has transformed the way we live. Today, anyone with an Internet connection can navigate and explore the world without even leaving the comfort of their homes. Traffic on the Internet is doubling every 100 days and 10,000 new websites are created every 24 hours. Anyone with Internet access can harness the power from the accumulated knowledge of a thousand years and a million minds at the touch of a single key. The world has never been more "wired up".

Besides effecting a knowledge revolution, the Information

Age has brought about a level of interconnectedness and interdependence among nations that is unparalleled in history. The term "global economy" is no longer some distant, amorphous concept, but a current, concrete reality. Our economies are so closely intertwined that domestic crises often have serious regional or even international implications.

The Information Age has also ushered in an era of connectivity in the military domain. Air forces are all talking about network centricity, where all elements in the system are interconnected to achieve comprehensive awareness and collaborative action. These benefits do not just apply to individual air force. By being connected to one another, partners engaged in multilateral cooperation can take collective action against common threats.

Security In An Interconnected World

So what is the security landscape like in this interconnected world? Even before the September 11 attacks, our security challenges have grown in spectrum to include Operations Other Than War (OOTW), particularly in the areas of Peace Support Operations (PSO) and humanitarian missions. Civil conflicts have significant spillover effects and the mass media has a great impact on public opinion and pressure for international intervention. On a broader scale, regional and international stability is crucial for global development and it is in the interests of all nations to help maintain peace, even in distant lands.

That our security is inextricably linked has become even more evident in this era of transnational terrorist threat that confronts practically every nation today. In this interconnected world, the very underlying technology that has raised our quality of life can also be exploited to do us harm. For instance, while information technology helps to connect the world for beneficial exchanges, it is also used by terrorists to spread propaganda and sow dissent.

Militant ideology has spread like a plague in this interconnected world. While modern technology has largely been a blessing, it has also made the world a smaller place, facilitating the global spread of this "disease". It used to be that threats were from a known source and war was usually preceded by a period of tension. Today however, the threats are from elusive groups of non-state actors, connected by invisible webs of transnational terrorist links, and driven by ideological fervour not amenable to reason or diplomacy. Such threats pose a different challenge from conventional attacks. To counter them would require close multilateral cooperation.

Security Through Multilateral Cooperation

International cooperation... an imperative in our effort to counter the threat of terrorism. Important areas of multilateral collaboration to fight transnational terrorist threats are information sharing and joint surveillance amongst nations.

It is unlikely that future wars will be between nations. It is far more plausible that the threats facing us are met by cooperation among nations. Nations the world over are facing similar conditions and constraints. Threats are increasingly transnational. This has led to significant changes in the role and involvement of air forces globally, with an increasing number of OOTW. The benefits of multilateral cooperation are particularly evident in joint peace support and humanitarian missions.

Most air forces are also facing similar constraints where budgets are tightening, platform and maintenance costs are escalating and technology is converging. The appeal of multilateral cooperation to achieve synergy and ease the burden of maintaining security is certainly a strong one. In fact, international cooperation has become an imperative in our effort to counter the threat of terrorism. Important areas of multilateral collaboration to fight transnational terrorist threats are information sharing and joint surveillance amongst nations.

In an increasingly interdependent world, there is a need for global stability and it is in the collective interests of nations to work towards it. Security is the foundation for economic development and for us to enjoy peace and progress. The security challenges today are borderless and transnational. International cooperation is the way forward to meet these challenges together. Through multilateral cooperation, nations can pool resources and enhance capabilities and inter-operability. Through cooperation, we build mutual trust and understanding, which is a crucial foundation for peace.

RSAF's Perspective And Practice Of Multilateralism

Tracing the development of the RSAF against Singapore's larger historical backdrop, there is a close parallel between the two. In both cases, we were compelled by constraints to look outwards, which eventually helped turn our adversities to advantages.

As a small, newly independent nation, we recognised the importance of making as many friends as we could. We joined regional and international organisations at an early stage. The numerous partnerships that Singapore established with other friendly nations have certainly helped in the nation's progress. Besides, Singapore stays committed to regional and international organisations like the United Nations (UN), Association of Southeast Asian Nations (ASEAN), Asia Pacific Economic Cooperation (APEC) and ASEAN Regional Forum (ARF). These international groupings are regarded as crucial arenas for dialogue, cooperation and the collective pursuit of common interests.

For the RSAF, following the impending pullout of the British forces in 1968, a decision was made to form the Air Force as part of the build-up of the Singapore Armed Forces. The Royal Air Force left us with significant air infrastructure, but we had little indigenous aviation expertise. The strategy adopted then was to tap foreign expertise to jump-start our development. Fortunately, crucial

assistance was received from the more established air forces in our formative years. The first batch of six Singaporeans was sent to the United Kingdom for jet aircraft flying training with the RAF, and pilots were sent to France to train on the Alouette helicopter. Over the next decade, we continued to receive critical help from countries such as Australia, New Zealand, the United Kingdom, the United States and India. They, and the experts from other friendly air forces, helped us put in place the appropriate building blocks that made the RSAF's subsequent development possible.

Today, Singapore believes that global and regional stability is best served by having a security architecture comprising strong bilateral relationships and multilateral arrangements. Singapore enjoys close ties with many countries and will continue to strengthen and deepen these bilateral relations. As an Air Force, RSAF stands ready to contribute to regional and global security co-operation. This is manifested in its involvement in many joint missions and professional partnership with other air forces.

RSAF's Approach to Multilateral Cooperation

Through bilateral and multilateral cooperation, air forces can strengthen ties and undertake joint efforts in meeting common security challenges. The scope of collaboration can take various forms such as exchange of ideas; joint R&D; bilateral or multilateral training exercises; and joint operations. RSAF's approach to multilateralism can be represented by 3Ts, which are: (1) trading skills and ideas, (2) taking responsibility jointly, and (3) teaming up for progress.

- **Trading skills and ideas**

The first "T" stands for "trading skills and ideas". Bilateral or multilateral interaction serves to level up our skills and knowledge as we learn from one another. Faced with similar conditions and constraints, much common ground can be found for interaction and exchange. Frequent interaction promotes mutual trust and understanding, which constitute the foundations for peace and goodwill between nations. And training with one another helps to strengthen ties and enhance inter-operability.

At the Air Force level, Air Chiefs' Conferences are excellent examples of international fora that promote dialogue and exchange of views and ideas. Here, there is an exchange of each other's perspectives, new ideas and best practices. There is clearly no monopoly of ideas. There is instead a marketplace where all can interact and exchange views. Such interactions will greatly enhance our transformation effort that needs to be driven by new perspectives and fresh ideas.

Training together is another avenue for mutual learning and exchange of professional knowledge. In this area, RSAF is actively engaged in bilateral and multilateral exercises, both within the region and further afar. Noteworthy examples are Ex Cope Tiger[1], Western Arc[2] and Pitch Black[3]. These realistic high-end exercises offer many opportunities to benchmark the RSAF against some of the most modern air forces.

Besides understanding how each operates and enhancing inter-operability, this form of training provides realism and diversity where new techniques and tactics can be learnt in a different environment. Such training can even enhance operational readiness in realistic scenarios. For instance, an Ex Pitch Black scenario was about repelling a terrorist attack using ground offensive backed by combat aircraft. Also significant was an anti-terror drill at sea featured for the first time in the 2004 Five Power Defence Arrangements (FPDA) joint exercise that addressed non-conventional security threats to the maritime environment.

Anti-terror drills conducted by FDPA member countries in Sep 04

- **Taking Responsibility Jointly**

The next "T" refers to "taking responsibility jointly". The transformation of the security landscape calls for greater cooperation and collaboration amongst air forces. Humanitarian relief missions, non-combatant evacuation operations, peace support operations (PSO) and counter-

terrorist operations (CTO) are some of the areas where collaborative airpower can make a difference. By mounting such joint missions, joint responsibilities are taken together as global citizens in a global community.

On its part, RSAF has contributed to such collaboration in various operations. A significant contribution, under UN auspices, was in helping Timor Leste's nation-building process from 2000 to 2003. The RSAF supported the UN-sanctioned INTERFET (International Force for East Timor) mission with a C-130 detachment and the UN-led UNMISET (United Nations Mission in East Timor) mission with a helicopter detachment. The RSAF also contributed to a multinational reconstruction efforts in post-war Iraq, deploying a C-130 detachment and KC-135 missions to the Persian Gulf region. More recently, the RSAF also actively participated in the tsunami humanitarian relief effort in Thailand and Indonesia, and in Hurricane Katrina relief operations in Louisiana.

Deployment of KC-135 tanker aircraft to the Gulf

In terms of enhancing regional security, RSAF will remain as an active participant of the Integrated Area Defence System (IADS) which is the operational element of the Five-Power Defence Arrangements (FPDA). In the larger context, the FPDA, which groups Australia, Malaysia, New Zealand, the United Kingdom and Singapore as members, is a unique and important component of the regional security architecture to which Singapore remains committed.

Mutual benefits can be reaped from conducting such joint operations. Smaller air forces can gain wider operational exposure and experience by participating in a coalition force movement. Long-drawn efforts that require vast resources would be more sustainable and effective if borne by joint forces. More than ever, the collaborative information sharing amongst nations is crucial to preventing or countering specific acts of terror and to disrupting, disbanding and eliminating terrorist groups.

- **Teaming Up for Progress**

The third "T" represents "teaming up for progress". Air Forces today are bound by resource constraints. They are also confronted with the formidable challenge of developing new capabilities for the future, whilst maintaining our operational readiness to guard against current threats. Against this confluence of concerns and constraints, Air Forces will find common interests in undertaking joint projects. Joint ventures help us optimise resources and create capacity to make progress.

Singapore has engaged in collaborative projects with our counterparts in the United States, France and other friendly nations who share common interests. One such example is the RSAF's participation in the F-35 Joint Strike Fighter

programme that facilitated access to proprietary information, including flight simulators. The Defence Science and Technology Agency (DSTA) and National University of Singapore (NUS) have an agreement to run a defence research laboratory in Paris with France's leading aerospace research agency, ONERA (Office National d'Etudes et de Recherches Aerospatiales), and the French university Supelec (Ecole Superieu d'Electricite). Such collaboration with these international partners is a good example that our transformation effort can be enhanced through cooperation.

Another form of collaboration could take place through joint flying training, for example, by forming a joint flying training school in Asia similar to the NFTC (NATO Flying Training in Canada) set-up. Such bonds when forged from young will become the cement that later binds partner organisations together. The effective use of funds through pooling of resources, i.e., sharing the costs for buying and maintaining a fleet of training aircraft, would consequently help create spare capacity in other areas. Furthermore, this venture could make a useful contribution to the local economy in terms of aircraft maintenance, administration and logistics support.

We could also establish joint training with foreign forces in the virtual world, such as linking up of simulators – it may be possible to conduct a Virtual Red Flag in cyberspace using linked simulators. This would allow an infinite play area that frees us from our airspace constraints and safety considerations.

The possibilities for cooperation are virtually infinite, limited perhaps only by our imagination. Faced with similar constraints and conditions, and sharing a common purpose of seeking peace and security, one can be confident that we will continue to find new avenues for cooperation.

Conclusion

In conclusion, the security challenges faced today cannot be contained by any nation alone. We may be travelling on different paths, given our unique history and culture. We may even have different dreams and aspirations. But there is an undeniable confluence of conditions and constraints, within which common security concerns can be addressed.

In this interconnected world, we find ourselves in the same proverbial cart. As we seek to maintain balance and make progress, it is crucial that we keep the two wheels strong and running. On the one hand, we pursue the common virtue of peace and security. On the other, we engage ourselves in cooperation, the foundation of which is the sharing of knowledge and ideas. In today's security environment, air forces around the world will find much common space together, to cooperate and collaborate so as to make the world safer.

This article was adapted from the Chief of Air Force's presentation at the Air Chiefs' Conference and Symposium in Japan, 2004.

Endnotes

[1] Ex Cope Tiger is an annual trilateral air exercise between Singapore, Thailand and the United States.

[2] Ex Western Arc is a bilateral exercise with the French Air Force.

[3] Ex Pitch Black is the largest multilateral air defence exercise in this region involving the Republic of Singapore Air Force, Royal Australian Air Force, Royal Thai Air Force, and the French Air Force.

MG Lim Kim Choon assumed his current appointment as Chief Air Force on 1 April 2001. A qualified F-16 and A-4 fighter pilot, MG Lim had held many principal appointments in the RSAF. In the course of his distinguished career, he served as Head of Air Intelligence Department, Head of Air Operations Department and Commander Tengah Air Base. MG Lim holds a Bachelor of Science (Second Upper Honours) degree in Production Engineering from the University of Loughborough, U.K., and a Master of Science (Management) degree from the Massachussetts Institute of Technology, USA. MG Lim also attended the prestigious Air Command and Staff Course in U.S., and the Australian Joint Warfare Course.

Effects-Based Operations: A U.S. Commander's Perspective

by LG David A. Deptula

Effects-Based Operations (EBO) is a fundamental concept behind what is required to really "transform" the future of how we conduct national or coalition security in depth. The basic idea behind this construct – that of causal relationships in conflict – has been around for centuries. However, it was only in the last decade that we have begun to reach the levels of technology necessary to accelerate an effects-based perspective to its fullest maturity. Still, capturing the essence of what many past strategists envisioned requires diligent analysis and innovative thinking.

Accordingly, EBO is at the heart of merging our security tools, and as such has application across the spectrum of those security tools. It is the exploration of control – which creates the necessary effects to secure desired objectives so as to regulate an adversary's ability to operate as he or she desires. Ultimately, this mastering of effects allows us to view the traditional military concepts of annihilation and attrition, with their focus on destruction, as only one means to achieve control over an enemy rather than the operative means of doing so.

The goal of war... is to get an adversary to act according to our strategic interests... It is in our interest to get our adversary to act in accordance with our strategic interests without them even knowing that they have been acted upon. This would be the logical endgame of EBO - the attainment of security objectives without resorting to destruction or visible disruption.

Technology alone will not provide future victories. Instead, we must examine what new technologies have to offer as the basis for new concepts of operations. So under the circumstances, how does EBO apply considering that it is neither a framework, nor a system or organisation, and it is not service specific. Rather, it is a methodology or a way of thinking.

The goal of war, simply put, is to get an adversary to act according to our strategic interests. Ultimately, at some point in the future, it is in our interest to get our adversary to act in accordance with our strategic interests without them even knowing that they have been acted upon. This would be the logical endgame of EBO – the attainment of security objectives without resorting to

destruction or visible disruption. That may not be possible for quite a while, but it is not unrealistic, nor should our current inability to do so stifle our future aspirations. What is possible now are significant improvements in the way the military, as a part of an individual nation, or as a part of a coalition of nations, attempt to affect its adversaries' decisions.

If one puts the goal of warfare in that context, then one begins to see that desired effects should determine the engagement methods, and that force application becomes only one of a spectrum of options. In fact, EBO is a springboard for better linking military, economic and diplomatic instruments of national or coalition power to conduct security strategy in depth. So, if the focus is on effects i.e., the end of strategy, rather than force-on-force which is the traditional means to achieve it, then more effective ways can be considered to accomplish the same goal more quickly than in the past, with fewer resources, and most importantly, with fewer casualties.

The Impact of Precision and Stealth

Though applicable to all instruments of power, the essence of EBO is manifested in the role it played in the design and execution of the Desert Storm air campaign.

Over 150 attacks on separate targets consisting of well over a thousand aim points made up the master attack plan for the opening 24 hours of Desert Storm. This was a larger number of targets than attacked by the entire 8th Air Force in the combined bomber offensive in Europe over a period of two years in 1942 and 1943. In fact, it was the largest number of separate target attacks in the shortest period of time planned in history. What enabled this level of impact to be achieved? The short answer is the maturation of aerospace technologies merged with a theory of targeting for effects rather than absolute destruction.

Advanced technology – the combination of stealth and precision – in conjunction with a planning approach based on achieving specific effects rather than absolute destruction, enabled a new concept of operations known as parallel warfare; the simultaneous application of force across the breadth and depth of an entire theater. Combined, these elements became the linchpin of the revolution in military affairs.

Most people are familiar with the dramatic increase in precision that aerial delivered weapons have achieved over the last half of the 20th century. In some cases, a single aircraft and one precision-guided munition during Desert Storm achieved the same result as a 1000-plane raid with over 9000 bombs in World War II – and without the associated collateral damage. However, not many are as familiar with the leverage that stealth demonstrated in Desert Storm. A case in point involved the first non-stealthy attack on one target in the Basra area (Shaiba Airfield) with three aim points. The strike consisted of four Navy A-6s and four Saudi Tornado dropping bombs; five Marine EA-6Bs jamming acquisition radars; four Air Force F-4Gs

taking out one type of surface to air missile system; 17 Navy F-18s taking out another; four F/A-18s as fighter escort; and three drones launched into the area to bring up the enemy radars. That brought the complete force package to 41 aircraft – 8 of them dropping bombs on 3 aim points at one target.

The EA-6B prowler was the most important tactical jamming type used in the Gulf.

At approximately the same time, there were 20 F-117 stealth fighters, all dropping bombs on 38 separate aim points at 28 different targets. That constituted less than half the number of aircraft hitting over 1200 percent the target base. That leverage equates to a stealth multiplier of around 19, or put another way, it took 19 non-stealth aircraft to accomplish the effect of one stealth aircraft in this circumstance. That was one example on the first night of the air campaign. The effectiveness of stealth over the entire campaign is evidenced by the fact that stealth aircraft flew less than two percent of the total combat sorties flown in Desert Storm, but attacked over 40 percent of the fixed target base.

The impact of the stealth and precision equation enabled us to move from a standard of requiring multiple aircraft to accomplish an objective against a single target, to being able to achieve objectives against multiple targets with a single aircraft. So how do these transformational technologies affect military planning? Let me offer a simplistic, yet applicable analogy. The Desert Storm air campaign strategy capitalized on stealth and precision in conjunction with an effects-based planning methodology designed to paralyze Saddam Hussein's control of his own forces, neutralizing his capacity, and then his will to fight. The execution of this strategy has become known as parallel warfare, and was based upon achieving specific effects in the shortest possible time. The term "parallel" comes from basic electric circuit design. Anyone experiencing the frustration of trying to find a burned out Christmas tree light on a series circuit versus a parallel circuit will immediately understand the concept. A series circuit requires electrons to flow sequentially through each light bulb. Accordingly, one light must be lit before the next one does. Conversely, in a parallel circuit, the electricity reaches all the lights at the same time – simultaneous flow. Applying the same concept to the application of force in war yields the terms: serial (sequential) and parallel (simultaneous).

In air campaigns before Desert Storm, force was applied sequentially to "roll back" enemy defenses before attacking targets of the highest value. In series warfare, each target-set must be cleared in order to get to the next one. This continues until one eventually gets to the target-set of highest value. In parallel warfare, force is applied against multiple high value target-sets at the same time – leadership; key essentials; command and control; fielded military

forces; and the communications between them. This magnifies surprise, widens enemy paralysis, and inflicts fewer casualties in shorter time, and with greater probability of imposing effective control over the adversary.

The Impact of Effects-Based Planning

such bloodless victories have been exceptional, their rarity enhances rather than detracts from their value – as an indication of latent potentialities, in strategy and grand strategy." To be sure, neither strategist suggests reliance on achieving victory without bloody engagements. Instead, they advocate seeking alternative means to achieve victory – those that may, with favorable settings, do so more swiftly, and at less cost. Simply put, rather than the operative means to inhibit enemy activity, destruction should be viewed as only one means to achieve control over an enemy. In this approach, destruction is used to achieve effects on each of the systems the enemy organization relies on to conduct operations or exert influence – not to destroy the systems, but to prevent them from being used as the adversary desires. Effective control over adversary systems facilitates achieving the political objectives that warrant the use of force.

In terms of securing favorable conflict termination, rendering the enemy force useless is just as effective as eliminating that enemy force.

Targeting manuals include words about targeting to achieve effects, but pages and chapters are written about damage expectancy, probability of damage, and "weaponeering" to achieve levels of destruction. This focus on destruction results from two traditional concepts of war – annihilate an enemy through outright destruction, or exhaust an enemy before he exhausts you (attrition).

An alternative concept of warfare is based on control – the idea that an enemy organization's ability to operate as desired is ultimately more important than destruction of the forces it relies on for defense. In terms of securing favorable conflict termination, rendering the enemy force useless is just as effective as eliminating that enemy force. Furthermore, controlling an adversary can be accomplished quicker, and with far fewer casualties. In words attributed to Sun Tzu: "Those skilled in war subdue the enemy's army without battle. They capture his cities without assaulting them and over-throw his state without protracted operations."

Centuries later, B.H. Liddell Hart expanded on this idea adding, "While

During Desert Storm, conventional planners and intelligence personnel tended to think about targeting in terms of "the required number of sorties to achieve the desired damage against each target." The bread and butter of a targeting officer involved "determining the quantity of a specific weapon required to achieve a specified level of damage to a given target." A conventional evaluation of the effectiveness of one of the target sets during Desert Storm by traditional intelligence analysis demonstrated how focus on individual target damage rather

than the effects of attacks on the system under attack can be misleading.

On February 15, 1991, the Iraq target-planning cell received a report from the Central Command intelligence staff on the progress of the air campaign in accomplishing the electric target set objectives. The report stated that because all the individual targets in the primary and secondary electric target set were not destroyed or damaged to a specific percentage, the analysis concluded the objective had not been met. In fact, the electric system was not operating in Baghdad, and the power grid in the rest of the country was not much better off. The effect desired by the air campaign planners in attacking this system was not the destruction of each of the electric sites – it was to temporarily stop the production of electricity in certain areas of Iraq. The planning cell knew the operating status of the Iraqi electric grid and had already reduced actions against electric sites to maintenance levels. The determinant of whether to act (with lethal or non-lethal means) to effect an individual site was whether the electric system was operating in the area of interest, not the level of damage, or lack thereof, to an individual site. During the war, some Iraqi power plant managers shut down their electric plants to avoid targeting thereby creating the desired effect without exposing Coalition members to danger, and freeing up air resources for another task – Sun Tzu's dictum fulfilled.

While the virtues of planning to achieve systemic effects were discussed early in the conceptual phase of the air campaign planning effort, initial attack planning was done on the basis of traditional destruction-based methodology. For example, early in the process, intelligence identified two major sector operations centers (SOCs) providing command and control of Iraqi air defenses – one in Baghdad and one at Tallil air base in southern Iraq. Each was hardened to protect two underground command and control bunkers. Weapons experts and target planners determined it would take eight F-117s with a mix of Guided Bomb Units (GBU)-27 and GBU-10 2000-pound bombs to destroy the bunkers at each SOC. Since only 16 F-117s were available for planning at the time, destroying the two SOCs meant using all the available F-117s – an 8-to-1 aircraft-to-target ratio.

Intensive planning for the offensive air campaign began in theater on August 21, 1990. By August 30, the known targets in the strategic air defense system expanded almost tenfold. Further intelligence analysis of the Iraqi air defense network found not just two SOCs in Iraq, but four, and associated with each of these SOCs were three to five interceptor operations centers (IOCs), and associated with the IOCs were a number of radar reporting posts. The new information significantly increased the challenge of attaining the operational objective to "render Iraq defenseless and minimize the threat to allied forces." For the initial attack plan, the effect desired was to shut down the air defense command and control system in certain areas enabling non-stealthy aircraft to approach their targets without resistance. However, there were not enough stealthy F-117s to destroy each of the newly

discovered nodes of the air defense system simultaneously.

F117s can carry two different types of ordnance at the same time: GBU-10 and GBU-27

The solution lay in effects-based rather than destruction-based targeting. Postulating that a 2000-pound bomb could go off in the other end of the building in which the US air campaign planners were working, a case was made that the planning group might survive, and if so we would abandon the facility to seek shelter. The point was that the SOCs and IOCs did not require destruction. Targeting only had to render them ineffective, unable to conduct operations through the period of the ensuing attacks by non-stealthy aircraft.

By September 6, the attack plan was rewritten putting no more than two F-117 loads on any particular SOC. This greatly multiplied the number of stealth and precision strikes for use against other critical targets. Consequently, the opening 24 hours of the air war found 42 F-117 sorties flying 76 target attacks – almost a 1-to-2 aircraft-to-target ratio. This constituted just over 2 1/2 times the number of stealth strike sorties (from the original plan of 16). Yet, stealth platforms were now attacking 38 times the target base.

Linking Tactical Tasks to Strategic Objectives

Each tactical level task must be directly related to the highest order objectives of the operation. Failure to do so will result in random attacks of discrete enemy elements unrelated to the ultimate objectives.

The key to the success of effects-based operations is a top down approach where coalition strategy is translated to specific objectives at each level down to specific tactical level tasks. Each tactical level task must be directly related to the highest order objectives of the operation. Failure to do so will result in random attacks of discrete enemy elements unrelated to the ultimate objectives – not unlike what happened in Vietnam, and what some might say happened in the first half of the air war over Serbia in 1999.

In order to establish and maintain this linkage, a system to delineate the ties between the political objectives and tactical actions is required. In Desert Storm, we used the center of gravity model, and identified centers of gravity at the strategic, operational, and tactical levels that became respectively the target systems, the target sets, and the individual targets themselves. For each target set, specific effects-based objectives were identified and used by the principal air campaign planner to determine if additional weight of effort was required to achieve the objective. Additionally, every new target that came into the planning cell for consideration was evaluated according to how well it

could contribute to accomplishing those objectives.

So where do we go from here? How should we approach the future? Improved battlespace awareness, stealth, precision, and cyber war enable the production of the effects of mass without having to mass as we have in the past. The ability to impose effects can be independent of the massing of forces – the projection of force is becoming more important than the continual presence of force. Accordingly, what moves into a theater, and when, should be determined by the degree of effect it can have on an adversary. Operational timelines should be driven by the massing of joint effects, not simply numbers of forces.

Transformation

Technology is enabling new concepts of operations (CONOPS) that if properly exploited have the potential of radically transforming the means of warfare. Some of this potential was witnessed in the execution of Operation Iraqi Freedom where a joint force was effectively employed that was much smaller than legacy force-on-force attrition-based strategy dictate. Yet much more potential exists. In general, traditional joint employment strategies still lag behind actual capabilities that we currently possess. The promise of aerospace power is now reality – we need to capitalize on this capability. It allows for the unprecedented application of joint force simultaneously across the breadth and depth of any theater. New possibilities of engagement such as cyber war, nanotechnology, and biotechnology are emerging rapidly. It is necessary to be open to how they can be applied in concert with, or in lieu of, traditional military means to coerce potential adversaries to act in accordance with our desired strategic interests.

Transformation is much more than simply modernization. It consists of fundamental change involving three principal elements, and their interactions with one another: one; advanced technologies, because of the new capability that they yield, enable two; innovative and new concepts of operations that produce near order of magnitude increases in our ability to achieve desired effects, and three; organizational change that codifies the changes in the previous elements, or enhances our ability to execute our national security strategy.

The evolving security environment requires: Responsiveness – acting within hours rather than in weeks or months; Long range, and effective delivery – spanning the globe, delivering weapons or relief with precision to achieve desired effects, and; High leverage – reducing personnel, support, and overall dollar cost. Future military force structure should be determined by the technology-driven transformation in operational concepts that is affecting the relationship between manoeuvre, fire, and information. Each of the Services has a role to play in this future but it must be remembered that jointness is using the right force at the right place at the right time – it is not using every force, every place, all the time.

Summary

Most contemporary military thinking is still burdened to a degree by industrial-age assumptions about change. The

weapons engineers of World War II had very few options, almost all of which were bounded by materials. Today, the situation is reversed and one of the biggest challenges is choosing the most potent options from among a near-limitless array of promising possibilities.

EBO has the potential to reduce the force requirements, casualties, duration of conflict, and deployment sizes previously required to prevail in conflict. In other words to achieve the effects of mass without having to mass forces as we have in the past. Accordingly, effects-based methodology should drive our measures of merit, and evaluation. With the leverage this approach delivers, it may be an appropriate foundation for operational decisions, defense planning, and resource allocation. Too many people still view cost per weapon or platform as a valid measure of merit. Cost per target engaged or cost per effect desired is a much more valid measure of value of a weapon system, platform, or a concept of operations.

EBO is not an organization, or a system. It is a methodology, a way of thinking. Accordingly, EBO has value beyond its military utility. As a means of integrating the pillars of national security, perhaps it stands to achieve its most profound value. In fact, the effects-based approach is a springboard for better linking military, economic, information, and political elements to conduct national security in depth. Simply put, focusing on creating the effects underlying an objective forces exploration of the whole array of security options. In those cases where military force is required, this approach will move us away from massing forces to destroy an adversary, to a much broader application of security tools to achieve rapid coercion – an approach inherently less costly in lives and resources.

Winston Churchill once said, "Man will occasionally stumble over the truth, but most times he will pick himself up and carry on." If we are to meet the security challenges of the future in an era of constrained resources for defense, we have got to pick up the truth and hold on to it, and an effects-based methodology provides us a means to do that.

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The Second Gulf War And The Debate On Military Transformation

by Prof Christopher Coker

According to writer Colin Gray, one of the principal weaknesses of the American way of warfare lies in its strategic tradition. Principal historian on *The American Way of War*, Russell Weighley echoes Gray's point. Weighley bemoans the fact that traditionally American generals have a shallow understanding of strategies – the political agendas of the wars they have been called upon to fight in the nation's name.[1] American generals from McClellan to Pershing, even George Marshall have been stubbornly resistant to the political realities of war. The politicians from Lincoln to Roosevelt, by contrast, have had a much greater grasp of strategic realities.

The war against terrorism has found that both generals and politicians have little understanding of the strategic principles that have served the country so well in the past. This is due in part to the "war" itself, which is not a conventional war but a frame of reference within which the United States has fought two separate (and it would seem unrelated) military campaigns: one in Afghanistan (2002), the other in Iraq (2003). This has permitted the U.S. military to privilege the tactical over the strategic in the absence of any real understanding of the political agendas set by the Bush administration. It is this strategic vacuum which has also enabled the most enthusiastic exponents of the Revolution in Military Affairs (RMA) to make claims for it in the Second Gulf War that are not supported by the evidence. If anything, the Afghan war bears out some of the claims for network-centric warfare more than the war against Saddam Hussein. In the run up to the Second Gulf War (unlike the first) Saddam's generals sought the counsel of several senior Russian military advisers who did their best to draw up a war plan that would outfox the Americans. They failed mostly because the Iraqis had little or no grasp of the future face of battle.

Al-Qaeda, by contrast, was a different enemy. Like the U.S., it was able to communicate with its troops in the field through encrypted global communications systems, using cellular, fibre optic and fax modes. Both the U.S. and Al-Qaeda used small teams of specialised forces to assist in terminal guidance. U.S. Special Forces used lasers to direct B-52s to their targets:

Al-Qaeda used suicide squads that were just as effective to direct planes to their targets. Both ran their military operations from headquarters half-way round the globe: General Myers from the War Room in the Pentagon, Bin Laden from the Tora Bora cave complex. Both forces employed fuel air bombs to destroy high profile targets: Daisy Cutters carrying 12lbs of explosives in the case of the U.S., commercial airliners carrying 10,000lbs of jet fuel in the case of Al-Qaeda.

According to writer Bruce Berkowitz, the two organisations were distinctly different, both politically and morally but the comparison, while crude at best, is useful for it explains the difference between the Iraqi military and Al-Qaeda's central command. The former had no grasp at all of "network-centric warfare".[2]

Flaws in RMA thinking

The Information Revolution has undoubtedly transformed military power through the application of micro-electronics to military purposes which has resulted, in turn, in a quantum increase in accuracy (and hence destructiveness) of conventional munitions. Equally important is the introduction of smart weapons and the provision of real-time information, which has given commanders an overview of the battle, which has dispelled much of what Clausewitz called "the fog of war". But it has done little to challenge two essential features Clausewitz claimed gave war its universal nature irrespective of the age that fought it, or the society that pursued military aims.

Non-Linearity The first is the idea that war can be made predictable, that it is possible to abolish fiction. It is the term Clausewitz used for the perennial problem of war: that it never goes according to plan. Within months (these days within days) things start going wrong.

Linearity is derived from the old futurology of the 1960s and 1970s that postulates one can predict what would happen over a 25-year cycle. Unfortunately, you cannot. And this is why scenario planners in business come up with a range of different futures on which they base their own strategic planning. The basis of scenario planning rather than linear projections is chaos theory.

War is like weather. There are too many independent variables for us to predict accurately.

Perhaps, the best-known aspect of the theory is the metaphor of a butterfly that flaps its wings in the Pacific producing a hurricane over 3000 miles away. While it may be a crude metaphor, it stimulates the mind to consider the variables of chaos theory. Chaos theory tells us changes in weather patterns are not a matter of cause and effect but rather cascading effects. War is like weather. There are too many independent variables for us to predict accurately. One striking example of this was an incident in Atlanta's airport in November 2001 when a passenger, on realising that he had left his carry-on luggage in the airport lounge, decided to go back and retrieve it. Not wishing to be unduly delayed, he bypassed

a security checkpoint and ran up an escalator, which was moving in the opposite direction. This was a typical example of human behaviour. We all tend to forget things; we all take short cuts from time to time; we often act impulsively. The result of this particular occasion was the cancellation of all air traffic going in and out of Atlanta. 10,000 people were evacuated from the airport. And the cascading effects? For the next few days, flights across the country had to be re-routed and rescheduled, and tickets re-issued. Flight cancellations were frequent.

Donald Rumsfeld has been mocked for calling "unknown unknowns". Even their advantage in information must not be exaggerated. War, as an interactive process will always throw up surprises. It did so in the first week of the Second Gulf War when plans began to go wrong. Thus, plans had to change. While U.S. armed forces enjoyed a decisive technological advantage over the Iraqis, this had almost nothing to do with what the Americans understood as "military transformation".

War is not an active system (cause and effect); it is 'interactive' and what makes it so is that the enemy is not inanimate but animate, it tries to prevail by doing the opposite of what we expect.

Similarly, in war, a setback on one front, or one sector of the battlefield can produce a cascading effect that changes the whole campaign. War is not an active system (cause and effect); it is "interactive" and what makes it so is that the enemy is not inanimate but animate, it tries to prevail by doing the opposite of what we expect.

The absence of friction in the Second Gulf War was due, as in the First, not so much to U.S. technological dominance as the inability of the Iraqis to act unpredictably. As James Webb (a former U.S. Secretary of the Navy) remarked in the aftermath of the First Gulf War, "If the Vietnamese had placed 60% of their army in one spot where there were no trees, the U.S. Air Force would have blown it apart in forty days too."[3]

In future, however, the Americans must expect the unexpected, or what

What chiefly distinguished the U.S. effort in the Second Gulf War was the high level of education and training in the armed forces. The average age of a soldier was 21 years. That implies that the average new soldier is likely to have undergone some level of further study and had some college experience. The soldiers were well informed on world events through the internet, CNN and Fox News channels. They knew who the key players and the essence of the policy debates were. One embedded journalist found them well-trained, thoughtful, ethical and intelligent.[4]

Indeed, the U.S. army today is perhaps the best-educated in history, heir to the western rationalist system of thought. Beginning in the 1980s, it adopted an extensive integrated training programme for whole units. High quality volunteers were recruited; sergeants were schooled before promotion; commanders were given

special training courses. Hundreds of millions of dollars were spent each year in stressful operations training for battalions, brigades and even divisions. Expert observers during military exercises provided detailed, objective analysis of unit flaws. Education permits adaptability, and that is what U.S. forces displayed in the Gulf War: changing the time of attacks; changing the routes the units were asked to take; changing the objectives when the primary objectives could not be attained; and, of course, re-directing air power to different targets.

War as an ecological system The Americans have also discovered that war has many of the properties of an ecological system. The word "ecology" was first coined in 1869 and it is now used by scientists to describe everything from organisms to population pressures and weather patterns, everything – in a word – that interacts in a "single eco-system". Some military units in the U.S. have been encouraged to see war as a total environment. We do not know the consequences of our acts and therefore we must always be willing to "manage the outcomes". This is the very basis of environmentalism, and it is becoming the basis of military planning.

Indeed, "The Marine Corps After Next" (MCAN) Branch of the Marine Corps Warfighting Laboratory is exploring what it calls a "biological systems inspiration" for future warfighting. The following extract was taken from the MCAN website:

> For the last three centuries we have approached war as a Newtonian system. That is, mechanical and ordered. In fact, it is probably not. The more likely model is a complex system that is open ended, parallel and very sensitive to initial conditions and continued "inputs". Those inputs are the 'fortunes of war'. If we assume that war remains a complex and minimally predictable event, the structures and tactics we employ will enjoy success if they have the following operational characteristics: dispersed, autonomous, adaptable and small.[5]

The characteristics of an adaptable, complex system closely parallels biology. To deal with the biological is to do least damage to the environment, understood as the social, political as well as ecological context within which war is fought.

What matters is the outcome of victory i.e., stability, durability and the sustainability of a society once the war is over. Sustainable growth is the buzzword in economics: sustainable development in the politics of foreign aid. Sustainable societies should be the buzzword of regime change, especially when one country has the means, as it showed in the Second Gulf War, to effectively eliminate another's entire leadership, public administration and justice system in a matter of weeks. The aim of war is increasingly designed to preserve as much of a society as possible as well as to preserve the human habitat that enhances the quality of life and thus makes life worth living.

In the run up to the war, the U.S. Army War College was asked to review possible models for its prosecution. Traditionally warfare unfolds through 4 stages: "deterrence

and engagement"; "seize the initiative"; "decisive operations"; and "post conflict". Reality is never quite that neatly divided but the College report stressed that Phase 4: "post conflict" had to start before Phase 3: "decisive operations" or the war itself. In the end it listed 135 tasks which the military would have to undertake when Baghdad fell. None of these was adopted prior to the campaign. The same was true of the detailed recommendations included in the 13-volume study drawn up by the State Department in the immediate run up to the conflict. The fact that the campaign went very well but the post-war phase very badly only highlights the length of time it takes for a new paradigm to establish itself in the military mind.[6]

Confusing Tactics and Strategy

Perhaps, the main blind spot of American thinking, which the post-war operations phase in Iraq illustrates is that there is no quick victory. The problem with the RMA is that it does not tell you how to fight. All it offers is a way to address three traditional problems all armies face, which is bound to deliver the U.S. an advantage and often a critical one but not necessarily a war-winning one.

The first is the culminating point of operations – the point beyond which you cannot logistically support forces in the field, the point at which you are so successful that you are unsuccessful. This was the point that the German Army reached outside Moscow in November 1941 – it advanced too far to be logistically supported.

One of the successes of the Second Gulf War is that U.S. forces raced 400 miles to Baghdad in a few days, the quickest military advance in history. The Americans call it "pulsing" i.e., how an army can now operate 24 hours successfully at night time as in the day, and in all weathers. As an all-weather military the U.S. Armed Forces have a unique advantage. They can operate 24 hours round the clock.

Secondly, the Second Gulf War also illustrates how the U.S. now has the advantage of "information dominance" – almost complete knowledge of enemy dispositions. Satellite link ups; UAVs like the Predator watching the battlefield hours at a time; as well as the GPS system help it to pin-point targets when they are found. These technologies enabled military planners to fight a single, uninterrupted, decisive operation by merging the tactical, operational and strategic levels of war into a single one. In other words, the U.S. was able to fight more rapid, decisive, continuous operations.

A predator which flew a reconnaissance mission

The technologies helped the U.S. pioneer a more effective form of war in terms of the tempo of operations. It took only two months to destroy the Taliban and in only three weeks, the Baathist Party structure in Iraq. And

tempo means reducing latency in the decision cycle. The U.S. Chiefs of Staff call it "decision dominance": the time it takes to arrive at a decision and then execute it.

Finally, the war showed that the U.S. has the ability to paralyse an enemy's command, control and communications system: its true centre of gravity. In other words, the U.S. was able to destroy the Iraqi army's "situational awareness": destroying their command and control over their own forces. Once this occurs, an enemy is paralysed and it becomes possible to mop up forces in a few days as the Coalition did in the last days of the war.

It helped that 70% of the ordnance dropped was precision guided – so accurate that individual headquarters, houses, and even individual artillery pieces could be targeted. Most Republican Guard divisions outside Baghdad were not reduced in number by 50% (as some reports at the time claimed) but they were reduced to only 20% of their original combat efficiency by the bombing. With a thousand Coalition planes in the sky, coupled with a number of Apache and Black Hawk helicopters, and thousands of munitions directed to precise locations by ground spotters, the U.S. infantry was able to obtain the auxiliary power of several traditional armoured divisions.

In all three respects, the RMA technologies have certainly given the U.S. a decisive tactical advantage. Unfortunately many RMA enthusiasts tend to confuse tactics with strategy. Indeed, some fall into the trap of mistaking an operational or tactical victory on the ground for a decisive strategic victory once the conventional phase of operations is over. Before the war, some Air Force spokesmen even claimed that battle as formerly understood could be eliminated – that surgical strikes by air would eliminate the need for a clash of arms on the ground. To use the language of surgery, this form of warfare could be called an "invasive procedure". But the hard fought land battles that are still being fought on the ground clearly illustrate that battle has not been eliminated, and that tactical effectiveness by ground units is still required.

There have been many examples in history of generals confusing tactics with strategy. Napoleon, after all, won most of his battles except the last few. His victories, numerous as they were, never produced a permanent peace as he was never able to find a way to strategically defeat Britain or Russia in his 25 years in power. The same can be said of the Pacific War. After twelve months of uninterrupted victory in the field, the Japanese still had no strategy to defeat the United States: they merely hoped that their initial string of tactical successes would demoralise it so much that it would agree to a compromised peace.

The U.S. certainly has a strategy to defeat terrorism but it exaggerates the importance of technology not only as a force multiplier (a way of reducing casualties and maximising limited manpower) but also as a war winner. Technology may help a country prevail on the battlefield but it does not always determine the outcome of the war.

A second problem with conflating tactics and strategy is that speed can become the enemy of the good especially when an enemy collapses too quickly before ground forces of sufficient size can be committed. In Iraq, "going in light" meant sending 150,000 troops, half of the force that General Franks told Rumsfeld would be needed to turn victory into peace. In Afghanistan the situation was ironic in another respect. The campaign was over too quickly. The air war may have destroyed Taliban but it did so before troops could be committed on the ground (they were another month away). The result was that both Mullah Omar and Bin Laden were able to slip out before being killed or captured.

A month or so later during Operation Anaconda in the Shah-i-Kot mountains in Afghanistan, assaults employing precision munitions such as the Joint Direct-Attack Munition (JDAM) and fire from AH-64 Apache attack helicopters both failed to destroy the resistance of many Al-Qaeda fighters concealed in well entrenched defensive positions. In the end, two battalions of ground troops, from the 101st Air Mobile and 10th Mountain Divisions were forced to resort to orthodox combined arms, as well as fire-and-manoeuvre tactics.

U.S. soldiers deployed at Operation Anaconda

One of the main military lessons of Afghanistan would appear to be that advanced armies continue to require dismount-led combined armed forces for close combat in potentially complex terrain. Drawing an analogy with the over reliance of artillery bombardment in World War I, a recent study of the campaign concluded:

> Just as weeks of bombardment failed to kill the entirety of 1916's trench garrisons so 2001's precision-guided fire support killed many but not all of its Al-Qaeda opponents... The key to success, whether in 1916 or 2002, is to team heavy, well-directed fire with skilled ground manoeuvre to exploit their effects and overwhelm the surviving enemy.[7]

What the Second Gulf War showed was that there is no such thing as a short war, or a decisive political outcome independent of the national reconstruction phase that takes place after conventional hostilities are over. The military can win wars but it cannot impose victory. Often the international community is left with the messy aftermath of limited wars that neither its commanders nor political leaders are willing to fight to a finish. Of course, in the case of Iraq, the U.S. was willing to put in $87 billion and lead an international reconstruction effort, as was not the case in Afghanistan. But if Iraq taught anything, it was that embarking on wars in the hope that they will be over quickly offers no plausible definition of victory. Indeed, it can often be a recipe for short-term strategic failure.

There is as yet little evidence that advanced technology has the answer

to Iraqi-style insecurity. By the time power was transferred to the interim government, there were around 1,169 attacks by insurgents per month compared with 411 in February 2004. Long before then, the Navy and Air Force had gone home, their own jobs completed. On the ground, urban areas cannot be controlled by surveillance technology, and good human intelligence remains the most valuable resource. Admiral Arthur Cebowski, Director of the U.S. Department of Defense's Office of Force Transformation has argued in favour of a rebalancing away from capabilities for sustained war fighting towards those for constabulary duties and quick reaction forces.[8] Whether such a transformation is what the Americans understand by the "transformation of military affairs" is a moot question.

Conclusion

The belief that technology can substitute for strategy is a dangerous one. Williamson Murray and McGregor Knox have both warned that the cluster of innovations that constitute the military transformation lacks coherence and that this strategic vacuum is symptomatic of its deficient understanding of the political context of war[9]. Nothing that happened in Iraq immediately after the cessation of main ground force combat would suggest this view needs revision.

And as another American commentator Eliot Cohen has pointed out, a revolutionary change in warfare stems not only from technological developments but also from an adaptation of the military instrument to political purposes[10]. Enjoying an information edge over one's enemies does not mean that one will always choose the right enemies or the right allies. Indeed, history affords many examples of how tactical success on the battlefield has often resulted in strategic ruin.

While the RMA tends to be concerned with the conduct of large-scale, high-speed and high-intensity wars, America's enemies will seek as they have done in both Afghanistan and Iraq to play the asymmetric card. The conflicts likely to dominate the headlines in the immediate future will probably involve instability in or the collapse of, weak states and be characterised by prolonged low-intensity warfare. Modern wars will no longer have defined fronts. They will be largely fought by guerrilla forces and involve the civilian population, and be distinctively low tech.

Asymmetrical warfare of course is not usually taught in military academies as a practice. It is rarely pursued as a strategy of first choice by states. It is usually stumbled into by failing societies when the state fails, and the war goes "civil". The military war evolved into a civil war in Iraq the moment the Baathist regime collapsed. Massive looting took place – a shocking outcome, which could have been predicted given the absence of civil society in Iraq itself. By comparison, the post-war occupation of Germany and Japan (which the State Department began planning for only days after Pearl Harbor) eventually succeeded because neither society turned upon itself. Their museums were not looted nor their citizens targeted by suicide bombers.

Both societies held together even with their cities in ruins.

Western powers do not understand civil wars. Clausewitz never discussed them. Hobbes feared them above everything else because they produced non-state actors, private armies and armed political factions – what he graphically described in The Leviathan as "worms in the intestines of the state". It is those "worms" – Fedayeen and Al-Qaeda operatives, ex-Baathist party cadres, as well as criminals whom Saddam released from prison just prior to his fall that defy the certitudes of so many of the exponents of military transformation. On the political front, that transformation may merely lead the U.S. into a strategic endgame, an irony that Sun Tzu for one would have appreciated.

Endnotes

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Training Expert Decision Makers

by COL Ong Yu Lin & LTC Lim Beng Chong

Introduction

In our earlier article, "Decision-Making in a Brigade Command Team: Integrating Theory and Practice[1]" (featured in *POINTER* Vol. 30 No. 4), we argued that the SAF relied too heavily on an analytical approach to decision making and that it should be complemented by a naturalistic approach. While we believe an analytical approach to training is useful to develop desired skill sets, it is incomplete as a training pedagogy. The analytical approach to training decision making skills in our leaders must be complemented by the more naturalistic approach to decision making. That is, complementing logical problem solving with intuition. A more complete approach to developing decision making skills in leaders is to create a training system that develops both analytical skills and intuition.

Anyone who is sceptical about the existence or the usefulness of intuition should speak to the ground commanders involved in Operation Flying Eagle (OFE)[2]. Many of these commanders' decisions were made under time pressure and uncertainty. They did not have the luxury of time and resources, nor the information required to perform an analytical decision making process. Under these circumstances, they often made decisions based on their intuition. Critics may argue that these commanders had simply conducted all the analysis and problem solving subconsciously at the back of their minds. Yes, the critics are right, and that is precisely what intuition is about! A key aspect of intuition is the speed of decision making. Intuition is also about the ability to fill in any information gaps by matching the current perception of the situation to pre-existing knowledge or templates, and adapt them for framing the current situation. The more extensive the repertoire of pre-existing knowledge and templates, the more likely the commander is able to accurately make sense of the current situation.

To build up an extensive repertoire of knowledge and templates requires constant practice but yet the military profession is one where its members do not and cannot do so. Only a constant state of war would allow that. The honing and development of the military skills must therefore take other forms and through repeated practice. In decision making, there is no substitute for experience and there is no substitute for intuition that comes from repeated practice. Constant practice will develop what Clausewitz called coup d'oeil or intuition. Clausewitz described it as the commander's ability to recognise at the precise moment in battle the truth, or a high level of situational awareness "that the mind would ordinarily miss

or would perceive only after long study and reflection."[3] It is the ability to see patterns and opportunities in the "strike of the eye".

A Balance Of Analysis And Intuition

Decision making is a balance of intuition and analysis, and the current training of our officers in the areas of decision making focuses purely on the analytical aspects. Intuitive methods can complement the analytical methods to speed up the decision making process especially when we operate in the "Known and Knowable" or collectively termed ordered domains of the Cynefin framework (See Figure 1). Analytical methods such as the SAF's Appreciation of Situation (AOS) process perform very well in these domains and the analytical approach can be honed to achieve automated responses as the Cause-Effect relationships are obvious.

In an analytical process such as the AOS process, the decision maker is given a finite problem space and a specific outcome to achieve, and then is allocated a certain amount of time for the specific training. The dominant framework toward achieving the outcome is to follow a set of steps. Given specific outcomes to achieve, first understand the situation (mission analysis), determine a number of courses of action, compare them and identify the best option for execution. This is essentially a problem solving approach. Such an approach however throws up some questions: Is it robust enough to be employed in the unordered domain where there is high level of uncertainty? How are we shaping the cognitive process with this training approach?

The danger is that too much deference is given to the notion of "train as you fight". The problem arises simply because we confuse the training

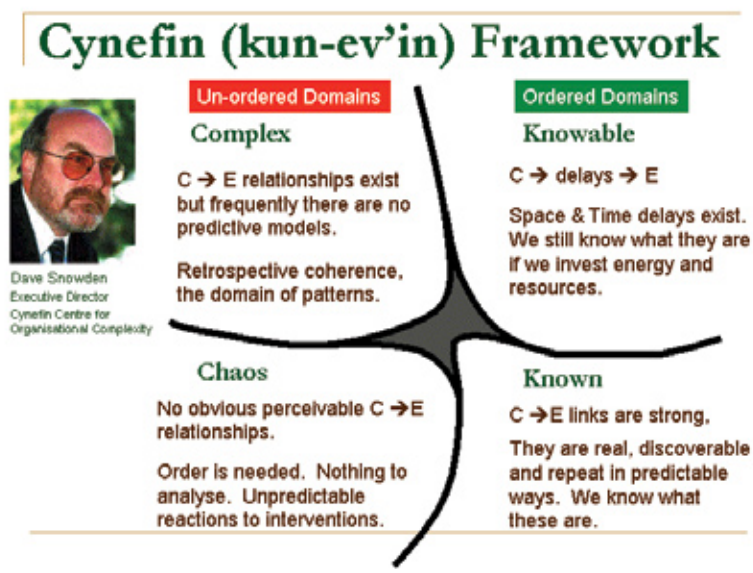

Figure 1. Snowden's Cynefin Framework.

procedures and training aids with the skills we are trying to develop with these training procedures and training aids. During training, we demarcate the problem space clearly, state explicitly the desired outcome to achieve, and stipulate a time when the exercise will end. We also put in place a battle procedure, depicting the steps to follow to ensure that planners work through the problems the way we want them to. This may be appropriate for training purpose, but it may not be applicable to real-time operational contexts where most decisions have to be made under time pressure and uncertainty.

Research has clearly shown that humans do not make decisions under time pressure and uncertainty the way we train them for. Under such circumstances, commanders do not think in the way they are trained under the current training approach. Commanders in operations often complement their analytical problem solving approach with intuition when under time pressure and uncertain conditions. This is not surprising if one understands the differences between the training context and the real operational context. The key differences are:

- **Ill-structured problem space** – the problem space is clearly demarcated and structured in the training context, not in a real-time operational context;

- **Outcome uncertainty** – desired outcome is explicitly stated in the training context, but not in a real-time operational context;

- **Time uncertainty** – there is certainty of when the training context will end, but not in the real-time operational context;

- **Tempo uncertainty** – pace of training can be regulated accordingly, but pace and intensity is often beyond the control of the commanders in a real-time operational context, and finally;

- **Information uncertainty** – there is more information certainty in the training context than in a real-time operational context where missing, ambiguous or unreliable information is the norm rather than the exception.

Considering these key differences between the training context and the real-time operational context, the question is how junior commanders could be trained to think during training so as to facilitate their thinking process and actions in an operational context. To incorporate such a process into the training processes, it is crucial that we develop a complementary intuitive thinking process to achieve a higher speed of command (making plans better and faster and a faster decision-to-action cycle). The need for a training method to develop both analytical and intuitive skills of junior commanders is critical as the future junior commanders will increasingly have to deal with issues that straddle the ordered and unordered domains, which can span any part of the spectrum of operations. Even then, the demarcations between various types of operations in the spectrum are also fast blurring. Krulak (1999) described it as the "3-Block War", one where "soldiers may be confronted with the entire spectrum of tactical challenges in

the span of a few hours and within the space of three contiguous city blocks"[4]. The SAF's Chief of the Defence Force, LG Ng Yat Chung in an address to SAF officers extended the idea to a "4-Block War", where soldiers have to contend with an enthused media as they execute the 3-block war. Other examples include humanitarian assistance and disaster recovery (HADR) operations, peace support operations (PSO) and homeland security and defence operations which have the potential to quickly evolve to pose a wider spectrum of tactical challenges. A common consequence regardless of whether soldiers are operating in one part of the spectrum or simultaneously over many parts of the spectrum is that decision making is now delegated to commanders at the lowest level. They will need to rely on their intuition to fill in the gaps, arising from the inherent uncertainties in a given situation and the lack of precise instructions and guidance from superiors, in order to act and execute their tasks with confidence in a semi-autonomous manner. What we want to hear is: "2LT Tan has exercised good initiative" or "CPL Ang is street-smart". This is the age of the strategic corporals and lieutenants.

An intuitive process draws heavily on experience and yet junior commanders, given their limited exposure, often lack the necessary experience. Hence, the need to equip them with intuitive skills has become even more critical. Moreover, junior commander training forms the basis upon which higher-order decision making and thinking skills are built. Many of the basic skills and behaviours acquired during their initial years are honed further over the course of their careers. However, in view of the "Keep SAF Young" policy, it is not only critical to be able to accelerate the experience gaining process of our junior commanders, but also to have a system which can capture experience from expert commanders (tacit knowledge) and translate them into doctrines, processes and systems (explicit knowledge) in order to maintain, grow and leverage on past experience[5].

In this paper, we put forward a training approach for decision making that, we believe, is currently not fully utilized in the SAF, and thus has great potential to make a difference to the way decision making abilities of our junior commanders can be trained to produce expert decision makers.

Expert Decision Maker

What makes a commander an expert decision maker? In short, an expert decision maker is one that can appropriately use both intuition and analysis in a given problem space. Hence, apart from continuing to do what we do best – training the analytical mind – we need to develop intuition in our commanders to make them expert decision makers. According to Gary Klein, given any domain, experts can be differentiated from novices based on eight aspects of their expertise (see Table 1).

So given what we know about the nature of expertise, what and how do we train our commanders to make them expert decision makers? Our proposition is for a training system that focuses on developing these six aspects of expertise in our commanders:

Diagnosing, Predicting and Mental Simulation	When experiencing a situation, experts are able to figure out how that situation develops, and they can think into the future to see where the situation is going. Among other things, this allows the expert to head off problems before they develop.[5]
Situation Awareness	Novices may only see bits and pieces of a situation. Experts are able to quickly build an understanding of the whole situation, 'the big picture' view. This allows the expert to think about how different elements fit together and affect each other.[6]
Perceptual Skills	Experts are able to detect cues and see meaningful patterns that less experienced personnel may miss altogether.[7]
Heuristics, Tricks of the Trade and Contextual Practices	Experts learn how to combine procedures and work the task in the most efficient way possible. They do not cut corners but they do not waste time and resources either.[8]
Spotting Opportunities and Improvising	Experts are comfortable improvising – seeing what will work in this particular situation. They are also able to shift directions to take advantage of opportunities.[9]
Meta-cognition	Experts are aware of their performance; they check how they are doing and make adjustments. Experts notice when their performance is not what it should be (e.g., due to stress or fatigue), and they are able to adjust to get the job done.[10]
Ability to Spot Anomalies	Experts can quickly spot unusual events and detect deviations, and they are able to notice when something that should happen does not happen. Novices do not know what is typical so they have a hard time identifying the unusual or atypical.[11]
Intimate Knowledge of Equipment/Tool Difficulties	Experts know that their equipment/tools can sometimes mislead. Novices usually believe whatever the equipment tells, they do not know when to be sceptical.[12]

Table 1. Nature of Expertise – Differences between Experts and Novices.

- Knowledge base or repertoire of patterns for a given domain through scenario-based learning (paper-based or PC simulations).

- Self-awareness of one's behaviours and actions through constant feedback (subordinate, peer and superior).

- Mental simulation skills using visualisation training and two-sided exercises to carry out the action-reaction process.

- Ability to recognise cues including anomalies, see relationships and construct possible stories through story telling exercises.

- Lateral thinking and hence cognitive adaptability by taking multiple perspectives on the same situation and developing multiple applications of a tool or procedure.

- Confidence to challenge sources of information (including equipment) when in doubt.

The Proposed Pedagogy – TALAC

These six aspects of expertise can be trained using a pedagogy that develops both analytical skills and intuition simultaneously during the learning process. The TALAC (Think and Act Like A Commander) pedagogy is

appropriate for training of all levels of decision makers. Its utility, in the training of officer cadets, is diagrammatically shown in Figure 2:

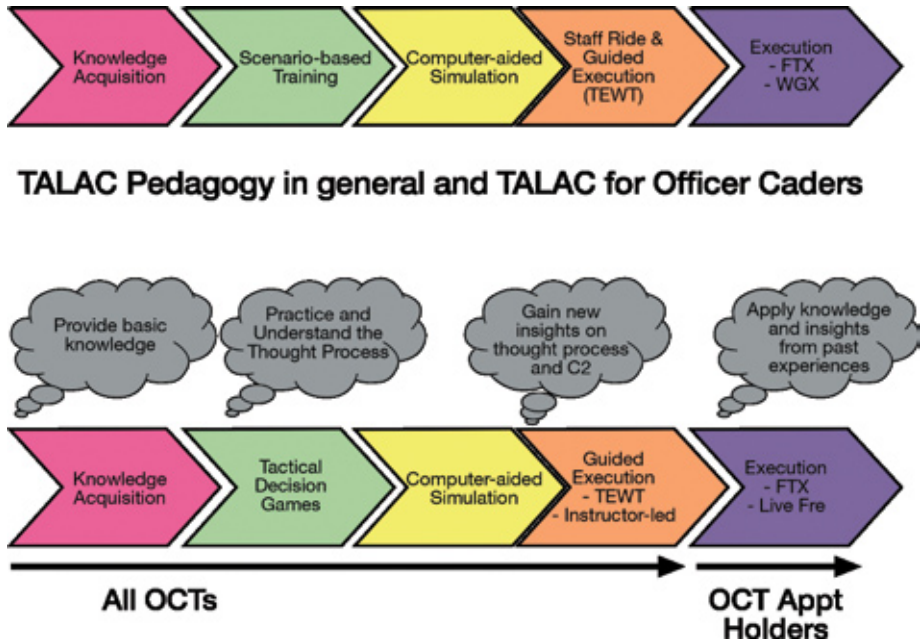

Figure 2. TALAC Pedagogy.

The TALAC pedagogy seeks to build a knowledge base or repertoire of patterns and pattern recognition skills through each of these activities. The values and limitations of these individual learning activities are well documented in research. Although many of these activities have been used independently to train decision makers as well as command teams, a holistic approach where the insights gained from previous activities are synthesised with the next activity to deepen the ability to see patterns and opportunities is often missing. The value of the TALAC pedagogy is that it is a learning value chain akin to Porter's value chain[13] of economic activities. The key to obtaining maximum value in this learning value chain is the ability to perform each activity as well as to leverage on previous learning to lift the learning value of the next activity to a higher order.

The objective of TALAC is to hold the learner in the cognitive frame of a commander and for the learner to reflect on their thinking process as and after they execute a plan. It is essentially a case-based reasoning approach.[14] As the learner progresses from one activity to another he draws on his prior experiences or reason from first principles to solve problems. The problem space becomes increasingly difficult and complex, with less information or cues and a wider range of possible options/solutions and consequences as the learner moves to the next activity. This graduated scenario-based training allows learners to see any emerging situation from multiple perspectives and challenges them to make sense of the situation by constantly defining the

problem, actively seeking cues and linking them to form possible patterns, seeking solutions and understanding the consequences of their actions while bearing the commander's intent in their minds. Throughout this learning process, feedback points are embedded within each activity to align learner's development to the six aspects of expertise mentioned earlier. This is a learner-centric approach with the instructors playing a coaching or facilitating role. The TALAC pedagogy is being implemented at the Officer Cadet School to strengthen the attainment of mission competency in planning, decision making and execution. The detailed approach is discussed below.

Step 1: The pedagogy starts with the acquisition of knowledge, which includes the study of concepts and principles and even the mechanics of analytical processes such as the Appreciation of Situation (AOS) process. The information and knowledge can be delivered in variety of forms ranging from written notes to interactive media streamed over a network of computers. The instructor may play the role of a subject matter expert to provide the information and knowledge or act as facilitator to guide the learner in his search for the information and knowledge.

Step 2: This step employs scenario or problem/case-based learning to practice the process, understand, apply and learn principles and concepts in simple but yet realistic conditions. As the understanding increases or the level of training increases, it can be expected that the problems will increase in terms of difficulty and complexity. To train expert decision-makers, an effective way is to employ tactical decision games (TDG) to encourage the learners to make decisions based on their understanding of the tactical situation and intent. TDG encourages a balanced use of analysis and intuition and is a "safe-to-try" and a structured means to acquire experience in cue and pattern recognition for a particular domain of interest. It also allows learners to generate multiple perspectives and hence story lines from a same set of cues. Subsequent group discussion of the TDG scenario provides the opportunity to hear and learn from one another. TDG can also incorporate newly acquired operational knowledge from recent conflicts to emphasize and disseminate learning points. However, one of the limitations of paper-based TDG is that it does not facilitate the learning process by allowing learners to execute their decisions and experience the frictions in the decision-to-action cycle. Given this limitation, paper-based TDGs are often kept simple. To build on the learning from paper-based TDGs, computer-based TDG simulations can be developed to capture or replicate the dynamic interactions of competing actions and reactions, and friction arising from terrain and weather factors.

Step 3: Computer-aided simulation provides the next level of value in presenting a virtual representation of the real world, with virtual actors. Advances in the speed of computer processors, high resolution graphics display, realistic surround sound technology and high speed networks have spawned popular and realistic commercially available PC games such

as Command and Conquer, Counter Strike, Operation FlashPoint (OFP) to high-end constructive simulated war gaming systems such as the SAF SIMLAB and the likes, in use in other military forces around the world. Simulation systems allow the learner to test his solutions including those from TDGs in a virtual yet realistic world repeatedly without the need to deploy large numbers of troops and equipment in a training area. Through repeated runs of the same scenario with different actions and reactions, learners can substantially and rapidly increase their repertoire of relevant cues and patterns associated with a particular scenario. In other words, experience that can only be gained through years of practice in the past can now be acquired with advanced technology. Such a technological platform can also be extended to two sided exercises to further enhance one's mental simulation ability.

Step 4: At this stage of their development, learners are ready to put their acquired experience to test. This is an important step as learners now can anchor their experience to reality – a reality check process. Staff Ride and tactical exercise without troops (TEWT) provide the opportunities for the learners to continue learning in a real environment from an expert's perspective. The Staff Rides consist of a preliminary detailed study of selected battle or campaign, a field visit to the actual battle site and an opportunity to learn and reflect on what went well and not so well. It differs from a guided battlefield visit in that the learners play an active role in discovering the "what happened?", the "why?" and the "consequences". It resembles a business case study but conducted on site. It is an opportunity to learn from the decision making of the commander by asking questions such as:

Basic set of questions:

- What were the critical decisions made by the commander? Why are these critical?

An Ops FlashPoint (OPF) game[15] with Blue and Red Teams at the Officer Cadet School.

OPF has been customised with local training areas and SAF equipment.

- Were they difficult decisions? Why were these decisions difficult?
- What were the cues/information and the understanding of the situation (i.e., patterns) by the commander that had influenced his decisions?
- What was that key missing information that would have helped the most?
- What were the other options considered but not chosen? Why?
- How would I have acted in his place?

Optional questions if appropriate:

- What were the anomalies in the situation that were observed by the commander? Why were these anomalies?
- Were there occasions where the commander challenged the validity and reliability of the information presented to him? What were these? Was the commander correct in not going with the information?
- Were there occasions where the commander was aware of his own actions and behaviours, and how these had affected the performance of his team/unit?

A TEWT focuses on tactical problems designed to emphasize the understanding and application of principles and concepts. TEWT uses terrain and not history as a teaching vessel; any relationship to historical events is usually coincidental. TEWTs are excellent follow-on to TDGs and they offer the opportunity for TDG plans to be executed on the ground. A TEWT involves a tactical execution of the plan by key commanders and units to gain deeper understanding of the strengths and weaknesses of the plan or a walking discussion of the various courses of actions and their plausibility for execution. The process can also be interactive and hasten learning by referring to a series of cue cards listing decisions tasks and actions required at various juncture of walking through the plan . Execution of the plan by walking on real terrain overcomes the limitations of a TDG and allows further opportunity to carry intuitive decision making to deal with real world issues such as communication screening, and previously unknown or unnoticed obstacles or terrain of tactical significance. The instructors may also role play the key commanders in a guided TEWT and share their understanding of the situation and the rationale behind their decisions so that the learners can observe their actions and "hear" their thought process.

Step 5: Nothing can replace the experiential learning of a live execution of the plan with the full complement of troops and equipment especially against a thinking adversary in a 2-sided exercise. To enhance the learning process, the learners can also attack and then subsequently defend the same objective to develop further unsights into the tactical decision making process as they will have the added opportunity to see it from the adversary's perspective. Field tactical exercises are, however, a resource intensive and costly training method that many militaries are increasingly substituting with other training activities. The instructor may play the role of a coach and even an evaluator depending on the desired training outcomes of the live exercise.

Role of the Instructor

The role of instructors in this pedagogy ranges from being a subject matter expert in providing the information, to that of motivator, facilitator, coach and even an evaluator. The learning responsibility is also shifted from the instructor to the learner, becoming more learner-centric further up the learning value chain. The instructor plays the role of a facilitator or moderator in a simulation exercise, during the staff ride or TEWT to the keep the game play going and the discussion focused, lively and purposeful. The instructor should only as a last resort intervene as a subject matter expert.

The role of the instructor is graphically summarised in Figure 3. Regardless of the role, key skills required are performance coaching (using the GROW model) and facilitation skills to elicit understanding and learning points for further reflection at each step of the pedagogy.

Key Processes Underpinning TALAC

There are two key processes instrumental to the successful implementation of the TALAC pedagogy – a cognitive task analysis (CTA), and a decision making critique (DMC). The former is to build the expert knowledge databases to design the decision tasks in each of the training activities and the latter is to facilitate the feedback on what went well, what did not and what was learnt.

The CTA process can be used to identify critical decisions a commander can be expected to make in a given military scenario. Expert knowledge databases are then built by eliciting expertise from experts (senior commanders and subject matter experts) on how they go about making decisions in these scenarios using CTA. Central to this methodology is the use of semi-structured interviews with cognitive probes designed to elicit expert knowledge behind decisions

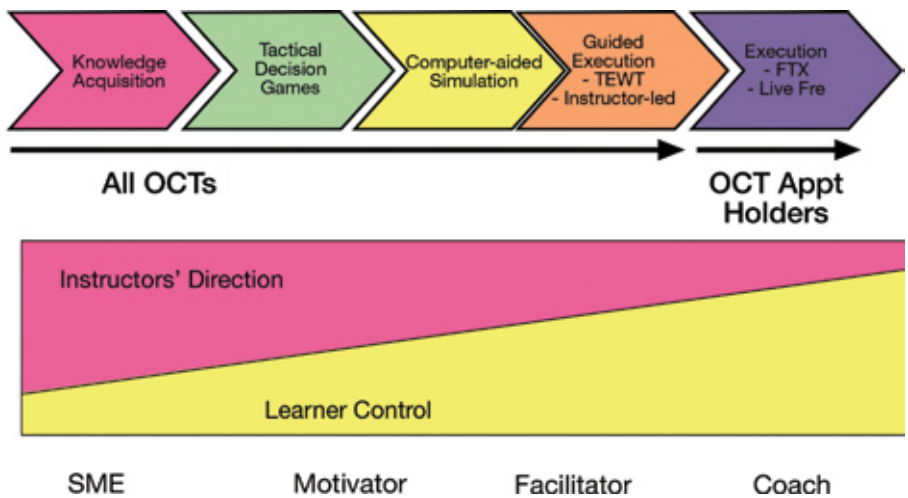

Figure 3. Role of the Instructor.

made under the conditions of time pressure and a complex problem space with many non-linear interactive elements. The acquired knowledge is then used to design the training scenario for each of the learning activities in the TALAC pedagogy.

The other key process is a decision making critique to obtain accurate and diagnostic feedback as part of the after action review (AAR) at the end of each training activity in the TALAC pedagogy. This feedback forms the basic experiential learning cycle of action-observation-reflection or the Kolb Experiential Learning Cycle. Pliske, McCloskey and Klein (2001)[16] described the decision making critique as "thinking about what went well and not so well during an exercise. It consists of a series of questions designed to identify the difficult decisions made (see Table 2). These questions explore important cues that might have been seen, assessment mistaken and the type of uncertainty encountered and they were handled". The decision making critique provides a tool to close the learning loops, deepen understanding and accumulate patterns.

Conclusion

To effectively train leaders to function in this increasingly complex and ambiguous operational context, we need to rethink the way we train our leaders. Here, we advocate a training pedagogy that develops commanders into expert decision makers. While we used officer cadet training as an example,

What are the tough or *critical* decisions? And for each of the decisions:

- Why was it so difficult or critical? What one piece of missing info would have helped the most?
- Why did the Commander choose that course of action? *What was the information that influenced his decisions?*
- *What were the risks taken and how were they mitigated, if any?*
- *What were the anomalies detected?*
- What other actions can be considered? Why were they not chosen?

What was the Commander's situation awareness when he made these critical or tough decisions?

- *What was his understanding of the Comd Intent for the entire operations and that critical phase of operations?*
- *What were the task and purpose of the unit and its subordinate units?*
- What were your biggest worries?
- *What were the anomalies detected?*
- *What were the prevailing locations of own forces, activities and sub-unit commanders' assessment of the outcomes?*
- *What are the current locations of enemy forces, activities and intentions? Assessed and known?*
- What do you think the situation will look like in the immediate future? (x hrs) Why?

General discussion at the end

- What would he do differently if he were in the same situation again?
- What was the biggest weakness? What was the biggest strength?
- What are some of important lessons learnt from this exercise?

Table 2. Decision Making Critique Questions.
Source: Pliske, R., McCloskey, M., & Klein, G.A. (2001). Decision Skills Training: Facilitating Learning From Experience.
Note: Italicised entries are the authors' addition.

the proposed training paradigm is equally applicable to the training of section commanders and higher-level commanders such as company and battalion commanders.

In conclusion, we believe that the key elements of a future training system must consider the following:

- Uncertainty is the norm. Remove certainty in terms of time and effects to achieve. Higher intent should want be vague. There is no certainty when an exercise ends, and it ends only when the desired outcomes are achieved.

- Train commanders to develop standard operations procedures (SOPs), and more importantly, evaluate adaptation of SOPs to novel situations.

- Create training scenarios with multiple perspectives and dimensions (military, psychological, social, economic, political).

- Evaluate what they can do other than just what they are trained to do.

- Train as you fight may have been taken too far. It is necessary to differentiate training procedures and training aids from skills are we training for. Often, we use training procedures and training aids to develop a desired skill. However, once the skill is developed, we may not need the same training procedure and training aids to execute the skill.

Endnotes

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6 Endsley, M.R. (1995); Klein (1997).

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15 OPF game in OCS has been customised with local training areas and SAF equipment.

16 Pliske, R. M., McCloskey, M.J., & Klein, G., *Decision skills training: Facilitating learning from experience*. In E. Salas & G. Klein (Eds.), Linking expertise and naturalistic decision making. (Mahwah, N.J.: Lawrence Erlbaum Associates, 2001), p44.

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Reflections on the Operational Framework for Internal Maritime Security

by LTC Cheong Kwok Chien

Introduction

The events of 9/11 have seemingly opened a Pandora's box of apocalyptic possibilities that can threaten any state's security. The subsequent attacks in Bali, Madrid and more recently in London have further reinforced the notion that the current spate of terrorist attacks will span the entire spectrum of activities that modern civilisation is engaged in. In particular, the observable trend that terrorists' preference to use various modern modes of transportation as a means to attack civilians will undoubtedly raise alarm for any state security apparatus. The reliance on these modes of transportation by modern societies also increases the attractiveness of these targets to terrorists who are bent on inflicting maximum destruction to both lives and property. Closer examination of the recent spate of attacks seems to reveal the possibility that the maritime realm is likely to be targeted next. A successful attack in the maritime realm will provide an added boost to the terrorists – in laying claim that there is no sanctuary from them.

This speculation may not be mere paranoia. The degree of destruction that can be inflicted in the maritime arena is congruent with the expounded intentions of Al Qaeda's chief strategist, Ayman Al-Zawahiri . Beyond the apparent correlation of the maritime threat to the terrorists' intentions, the fact that "maritime targets reside in the nexus of terrorist intent, capability, and opportunity" reinforces the possibility of a maritime threat. The capabilities that terrorists possess were clearly demonstrated in the 12 Oct 2000 attack on the USS Cole, when two Al-Qaeda suicide bombers rammed an explosive-laden skiff into the ship, killing 17 U.S. Navy personnel and injuring 42 others. The level of destruction to human lives would be unimaginable if such tactics were to be employed against an international cruise liner. Such a scenario is not merely another incredible Hollywood script because terrorists are capable of employing copycat tactics, even in the maritime arena. This was exemplified by two similar terrorist attacks (one in Asia and another in the Middle East) within months of the USS Cole incident .

With the assumption that the maritime terrorist threat is credible, we must plan accordingly to mitigate this threat. Herein lies the greatest

challenge to security agencies. The dilemmas include: the balance between surveillance and privacy; constraints of resources; and the level of acceptable risk, among others. The greatest paradox that can occur in the bid to ensure security is that terrorists are likely to target unsecured elements. Therefore, unless the state has infinite resources at its disposal, the threat of terrorism can never be fully eliminated. This realization necessitates the entire security umbrella to span from early detection to the eventual recovery from an attack, while forging international cooperation to further counter the transnational nature of the threat. In simple terms, this means that states must not only build a capacity to counter the immediate threat of an internal attack, they must also incorporate the ability to contain the fallout of any successful attack. In this context, this article seeks to discuss a possible framework in which smaller maritime nations, particularly Singapore, with limited resources vis-à-vis the expense of securing maritime vulnerabilities, can adopt in countering the internal maritime terrorist threats that exist within its territorial boundaries.

Framework for Maritime Security

The framework discussed in this article is an operational framework that includes the tactical measures required at the agency level. The wider scope of cooperation at the transnational level will not be examined as this would require other interactions beyond the capacities of the state's domestic security agencies. This framework will thus focus on the overall strategy within the nation, in particular, options for the various state security agencies.

The framework consists of 4 key components: national policy for maritime security; intelligence; legal jurisdiction; and policy options/ responses. Information is the vital link between these components.

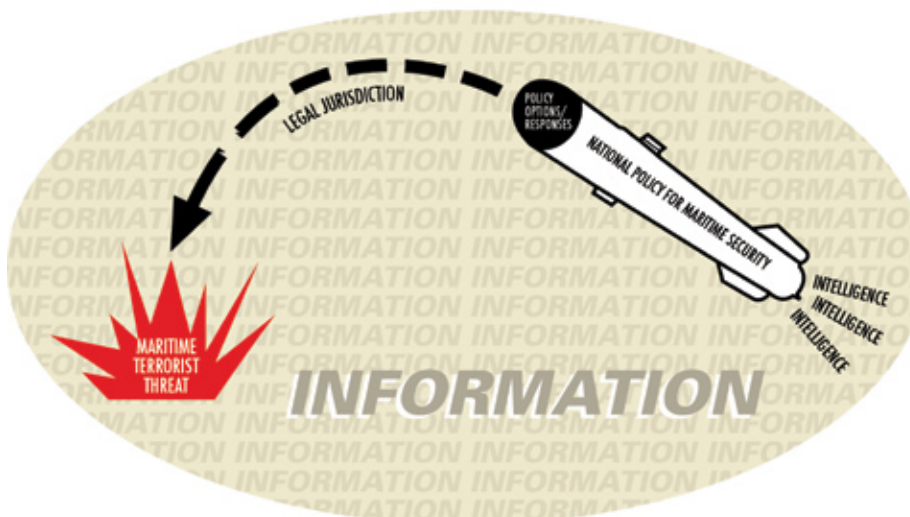

Figure 1. Framework for Maritime Security.

As an analogy, this framework can be visualised as a modern precision missile. At the core of the missile, the critical propulsion for the entire framework comes from the national will to fight terrorism. In the context of maritime security, this will be translated into a coherent and comprehensive national policy for maritime security. Triggering the deployment of the missile will be an intelligence network that is tuned to detection and assessment of the terrorist threat. Trajectory guidance for the deployed missile will comprise of a set of robust legal jurisdictions that will ensure that actions against terrorists are morally and legally justified. The policy options/responses can be visualised as the modular system of the warhead that can be configured against specific threats. Encapsulating the entire missile will be a sturdy frame of information that ensures that linkages between each component are seamlessly maintained. It can be envisaged that if one needs to deliver the fatal blow against the maritime terrorist threat, each component must be able to function perfectly in singularity and as a system in totality.

Propelling the effort – National Policy for Maritime Security

policy should be explicit in refusing any compromise to terrorism...a policy of uncompromising and relentless response to maritime terrorism...

It is obvious that the traditional security policy of deterrence and diplomacy has limited application in countering the maritime terrorist threat. Deterrence is only applicable when there is an underlying assumption that there are penalties that can be imposed on the potential aggressor to dissuade him from conducting the offensive act. In the context of these terrorists, when they are prepared to conduct suicidal attacks to achieve their political goals, it is unlikely any form of penalty will be effective towards achieving a credible deterrence. It may be more prudent and effective to adopt a policy that seeks to demonstrate the nation's capacity and capability to spoil any attempts by the terrorists. In broader terms, the national policy should expound the nation's intent to deny the terrorists any opportunities to strike and his ability to recover. This entails an active and regular demonstration of the nation's counter-terrorist tactics, aimed at showing preparedness and addressing any perceived vulnerabilities of the system. This is in contrast to conventional deterrence, where the ability to deliver a more devastating counter blow constitutes the overarching deterrence. Therefore, the national policy should clearly display the nation's determination to deny opportunities to any terrorist, while at the same time demonstrate the capabilities of the nation to respond tactically to any terrorist attempts.

In the area of diplomacy, it is even more apparent that there are no avenues for negotiation. Unlike secessionist terrorist groups like the IRA and PLO, the current wave of terrorism championed by the Al Qaeda network subscribes to a non-compromising agenda that cannot be negotiated. In the meantime, the techniques employed by these terrorists also negate all possible avenues of reconciliation by the victim nations.

Hence, it is conclusive that a distinct maritime security policy needs to be articulated to drive the nation's efforts against maritime terrorism. The articulated policy should be explicit in refusing any compromise to terrorism. It should also be a concerted effort by the nation to respond to any conceivable attempts by the terrorists. Such an uncompromising and relentless policy response to maritime terrorism would not only be able to drive and focus subsequent tactics to counter terrorism, but it will also act to galvanise national will through a clearly communicated message to address the threats posed by maritime terrorism. A coherent national policy would allay possible paranoia in the public while maintaining support for actions that need to be taken to implement the policy.

Triggering the system – Intelligence

...the intelligence system must be able to support spontaneous decision making to ensure that responses can be implemented promptly.

Since 9/11, tremendous efforts have been invested in ensuring comprehensive surveillance over the threat of air and land-borne terrorism. With the recognition of the maritime terrorist threat, an equal allocation of efforts to maintaining surveillance over the maritime domain must also be provided. Due to the proximity of the international straits plying the waters around Singapore, coupled with the high volume of traffic transiting these straits, surveillance efforts will be difficult without sufficient investment in surveillance capabilities. To deal with the various scenarios that can occur, it would seem more prudent to invest in a surveillance system that can provide a high-resolution capability in the classification and identification of vessels transiting the area. The capability of such a system is not purely a function of the radar and tracking systems. The entire surveillance system will require the ability to provide early indication of high priority targets well before they enter the straits. This may call for detailed historical tracking of these targets. To obtain such information, greater efforts will be required to institute measures to ensure early receipt of crew and cargo information of high priority targets. Taking a step back, a system to prioritise the various types of vessels transiting the straits must exist to allow speedy determination of the targets that will require a closer watch by the intelligence agencies.

Besides the ability to track and monitor vessels transiting the straits, another key component of the intelligence system is the ability to transmit relevant intelligence to the associated action agencies. The proximity of the straits will mean that reaction time to identified threats may be minimal. Hence, the intelligence system must be able to support spontaneous decision making to ensure that responses can be implemented promptly. Besides ensuring that intelligence from the maritime surveillance system can be rapidly disseminated vertically, effective lateral sharing between security agencies must also form an integral part of the intelligence system. Lateral

sharing of intelligence is important because a more complete picture of the developing situation can be apprised to the decision-makers to facilitate a more holistic decision, even under the stress of time constraints.

Guiding the actions – Legal Jurisdiction

to the law enforcement agencies to ensure that law enforcement agents understand their rules for engagement. This is most important in light of the tactical nature of responses that will be required in counter terrorism. In time critical situations, when dealing with maritime threats that can exist in a plethora of forms, it is important for security agencies to be familiar with the guiding legislature so that proactive responses will not be stifled on grounds of legal unfamiliarity.

In time critical situations, when dealing with maritime threats that can exist in a plethora of forms, it is important for security agencies to be familiar with the guiding legislature so that proactive responses will not be stifled on grounds of legal unfamiliarity.

The intense debate at international fora on the definition of terrorism clearly shows that the international legal system is still inadequate in addressing the legislative gaps that can be exploited by the terrorists. In the maritime arena, legal issues are further complicated by the grey areas that exist in the most commonly adopted legal regime stipulated by the United Nations Convention on the Law of the Sea (UNCLOS). These grey areas are compounded by the fact that some states have yet to ratify UNCLOS.

Bearing in mind the grey areas that exist in the international systems, it becomes even more critical for the nation itself to ensure that its internal legal system is able to address the terrorist threat. The legal system must first be transparent enough to convince the public that the nation is ready to address the threat on a legal basis and more importantly, on a moral high ground. Counter terrorism laws must never be misconstrued by the public as a means to oppress individual freedom. The legal system must be clearly transmitted

Delivering the 'knockout punch' – Options/Responses

To develop suitable tactical responses against the multitude of possibilities, it would be more effective to design .... layered form of defence around Singapore.

Tactical responses and options are perhaps the most visible means of countering the maritime terrorist threats. Within the myriad of options and responses that had been put forth by security agents throughout the world, ranging from naval patrols to Container Security Initiatives, the fundamental concern for decision-makers in the choice of options to implement is cost-effectiveness. The variety of threats emerging from terrorists with no regard for human lives is almost endless. Therefore, it is almost impossible for a

nation to implement a response to each of the conceivable possibilities.

To mitigate this impossible task of implementing responses to all threat scenarios, while pursuing the policy of uncompromising and relentless denial of maritime terrorism, the policy makers would need to develop options that are flexible and sustainable. These options would need to be drawn out based on critical assessment of threats and prioritisation of these threats. Part of the assessment must include the possible level of destruction vis-à-vis the capability of the terrorist. For example, it is currently unlikely for the terrorists to conduct underwater demolition due to intrinsic difficulties in obtaining the relevant training and explosives to conduct such an attack. It seems that "terrorist groups have not yet perfected the art of transporting large underwater explosives and attaching them to hulls of ships". However, despite the low likelihood of such attacks, nations must understand that the capabilities of the terrorists will continue to evolve and improve – the terrorists are known to be constantly exploring and training for new methods to attack at sea. Therefore, the assessment of the maritime terrorists is a dynamic process that must be constantly refined and updated to remain relevant.

Currently, the most credible maritime terrorist threat can be largely divided into two conceptual categories: attack of land infrastructure from the sea and attack at sea. The former describes the use of maritime assets to destroy land-based buildings and other structures. An analogy would be the infamous 9/11 attacks, where aerial assets were directed towards buildings. The latter describes the physical attack of vessels at sea to achieve mass casualties and/or disruption to sea trade. Common to both concepts is the use of maritime vessels for the attack. The use of vessels can be categorised in several non-exclusive scenarios: "vessel as a means; vessel as a weapon; vessel as a bomb; vessel as a disruption tool; and vessel as a target". Based on the modus operandi of the Al Qaeda network, it is also highly plausible that a "coordinated multi-pronged attack" be conducted, combining some or all the above scenarios.

To develop suitable tactical responses against the multitude of possibilities, it would be more effective to design a conventional layered form of defence around Singapore. To ensure flexibility is built into the defence, the defensive perimeter should be constructed with the outermost layer consisting of measures that are sustainable and comprehensive, but likely to be most inflexible. Inner layers will be more directed and increasingly more intrusive and destructive.

Surveillance Layer

In the outermost layer, measures such as International Maritime Organisation (IMO)'s International Ship and Port Security (ISPS) Code should be enforced. Other measures can include enforcement of speed limits for various classes of vessels and the enforcement of anti-hijack devices and procedures for selected vessels. Vessel monitoring and tracking systems should be focused in this layer to ensure maximum reaction time. The intent of this layer is primarily to identify possible threats

from the onset so as to allow maximum reaction time. In the meantime, this layer will require minimal intrusive measures so as reduce disruption to commercial shipping. Most resources will be devoted in this area as the coverage and resolution required in this layer is most extensive. At the same time, this layer needs to operate continuously to ensure that our efforts are relentless. In Singapore's context, this layer could perhaps commence 20nm from Singapore Straits, extending inwards to the eastern and western edges of the straits. A graduated penalty should also be enforced on repeated non-compliance.

Containment Layer

The next layer will comprise containment measures that are more intrusive but not necessarily destructive. The intent of this layer is to ensure that deviant vessels are immediately intercepted and boarded to regain control of the vessels through the use of Rapid Maritime Response Teams (RAMPT). This layer could exist within Singapore Straits, whereby internal legal jurisdiction would allow boarding to be conducted. In order to achieve containment measures, physical assets will need to be deployed. RAMPT should comprise mainly high-speed intercept vessels and heli-borne vessel storming teams. These assets are critical because of the proximity of the straits to the mainland. These vessels need not be heavily armed as the primary role will be to intercept the deviant vessel. However, the boarding teams would need to be specially trained to regain control of a vessel in spite of armed resistance. These teams will also be required to deal with other contingencies such as suicide bombers and hostage situations. In the meantime, sufficient teams need to be operationally ready at all times to deal with a coordinated attack. In the current context, an empirical estimate may require a minimum of 12 fully trained and equipped teams, in order to cover both eastern and western approaches simultaneously by two teams each, while sustaining operations over an eight-hour watch. It should also be noted that unlike the U.S. Sea Marshal concept, RAMPT concentrates on precision instead of coverage. However, this will not preclude the use of RAMPT for demonstration through selected boarding of selected vessels. RAMPT will also be a flexible response that can be used for other functions when required, such as for patrol and escort, when the overall threat level increases. Complementing RAMPT will be other traditional assets such as naval, customs and coast guard patrols. On the whole, this layer will comprise highly mobile platforms to ensure maximum flexibility to respond to any emerging threats.

Naval Patrol crew on the look-out

Destruction Layer

The final layer, existing within the port limits of Singapore, will include

mainly destructive assets. The intent of this layer is to stop any threats in situ. Assets that are to be deployed within this layer should include remote capabilities that can be used to effectively disable vessels. Based on empirical estimation on the momentum of a Very Large Crude Carrier (VLCC), a minimum distance of 2-3nm from land will be required to ensure the vessel stops in good time. Secondly, the lethality of the payload must also be calibrated to prevent collateral damage to the cargo, which can be highly flammable and toxic. These considerations are thus likely to compel the use of remote means for destruction, including remotely piloted, high speed jet skis, packed with a pre-determined payload. These are relatively cheap means that can be man controlled to the point of impact. Other means will include quick inflation boons to further retard vessels. This layer will hence serve as a catch-all net by disabling the threat in minimal time.

This final layer will also include port security to safeguard land-based threat. Measures may include container security initiatives and redesign of cargo lay about in port. This article however will not address the land-based security measures.

Holding the entire frame - Information

Information is critical in holding the entire framework intact. The ease of information flow throughout the framework will ensure that eventual efforts are precise and appropriate. At the same time, the feedback flow when implementing measures will allow timely revisions by decision-makers to keep up with new emerging threats. Information sharing between security agencies is also vital against maritime threats as these threats do not respect any boundaries that exist between security agencies. A common frame of information within security agencies will ensure that boundaries between security agencies e.g., between Police Coast Guard and Navy, are not exploitable by the terrorists. At the same time, to prevent information overload, a processing unit should be instituted to collate and disseminate real-time and relevant maritime security intelligence across all the involved agencies. This unit may need to ride on current Vessel Traffic Separation Scheme (VTSS) and other coastal surveillance agencies to compile a coherent security picture throughout the maritime domain. This picture will need to be effectively disseminated to other elements within the framework to enable a common understanding of the maritime situation. Technically, this may require extensive integration of existing information systems within the security agencies. Therefore, information is a vital final component of the "precision missile" to complete the transformation of the various standalone parts into a competent framework against maritime terrorist threats in Singapore's waters.

Conclusion

The threat of maritime terrorism is very real. Before security agencies can reasonably tackle the various threat possibilities, it is prudent that a comprehensive framework is developed

to ensure that all efforts against maritime terrorism are concerted and resources are managed in line with an overall strategy. The framework discussed in this article offers one possible strategy for a precise yet flexible national response.

Endnotes

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LTC Cheong Kwok Chien, a Naval Officer, is currently the Assistant Operations Manager of a Frigate Squadron. He has previously commanded an Anti-Submarine Patrol Vessel and held staff appointments at the Naval and MINDEF headquarters. LTC Cheong holds a Bachelor of Arts in Chemistry from Cambridge University and was the top Navy graduate from the 2004 Command and Staff Course.

Aerodynamic Shape Design Using CFD and Stochastic Optimisation

by COL Lee Shiang Long

"This paper provides readers with an excellent introduction on the use of various optimisation schemes for the design of aircraft wing flying at transonic speeds. Two of the schemes expounded are Simulated Annealing and Genetic Algorithms. These are modern methods for computation and analysis. The paper covers their strengths and weaknesses with reference to current computing capabilities. These two schemes are definitely a step in the right direction in aircraft design. The paper should help to inspire our military officers who have a passion for science and technology to pursue their interests as their ideas may create breakthroughs that will allow the SAF to benefit from their creativity."
– Prof Lui Pao Chuen, Chief Defence Scientist

"This article is interesting in that the Army's Chief Signal Officer had written a paper which in reality is ONLY useful for the RSAF. It has even won a Silver Award in CRAYQUEST, Singapore in High Performance Computing! This article is a simplified version of COL Lee's PhD thesis. It is good that SAF officers develop depth and breadth of technological knowledge as a result of personal interest. This provides diversity in the SAF and we need both technological depth and diversity in the journey of the 3G SAF."
– BG Jimmy Khoo, Futures Systems Architect

Introduction

The design of aerodynamic structures is of practical interest in view of the desire to achieve optimal aircraft performance. One of such design problems that is constantly being worked on by aeronautical engineers is the design of aircraft wing (airfoil) shapes so as to enable aircraft to cruise efficiently and yet able to achieve aerodynamic stability and control. This problem is complex in two ways. Firstly, aerodynamic flow over the airfoil involves complex turbulence phenomena, which is difficult to assess accurately using mathematical models. Secondly, the design process will encounter many locally optimal results where designers are frequently caught in and therefore not able to achieve the globally optimum design. The early approach to this design problem was based on the cut-and-try method[1], where designs were placed in the wind-tunnels to verify their aerodynamic performances as shown in Figure 1 and modified accordingly. Obviously, this process does not provide sufficient

details of the aerodynamic flow. Also, it has to be repeated continually until an optimum design is discovered – a procedure which is extremely tedious and often wasteful.

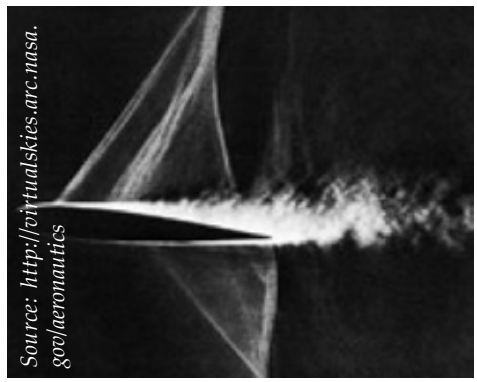


Figure 1. Aerodynamic Flow Around An Airfoil In The Wind Tunnel.

Computation of Aerodynamic Flow Around An Airfoil

In recent decades, the advent of the high-speed computer technology combined with the development of efficient numerical algorithms for solving aerodynamic flow have revolutionised the traditional way of aerodynamic design. Leveraging on computer power, a new technological approach called Computational Fluid Dynamics (CFD) has been introduced to model the complex flow phenomena. CFD uses highly precise and robust algorithms to solve the Navier-Stokes equations, and these equations accurately represent the aerodynamic flow over an airfoil flying from subsonic to supersonic speeds. As a result, designers are provided with the details of the aerodynamic flow and are able to identify the causes of poor aerodynamic performance.

As part of this project, a CFD algorithm was implemented based on the finite volume scheme developed by Jameson et al[2]. The algorithm broke down the flow field into small quadrilateral grids as shown in Figure 2 and the Navier-Stokes equations were modelled within the grids to compute the complex flow, fluid separations and turbulence. As the flow near the airfoil usually begins with well-behaved streamlines, and subsequently transits into turbulent flow, the grids are clustered around the airfoil to provide better resolution of complex flow phenomena at this region. To accelerate the computational process, an efficient multi-stage time-stepping scheme was adopted[3].

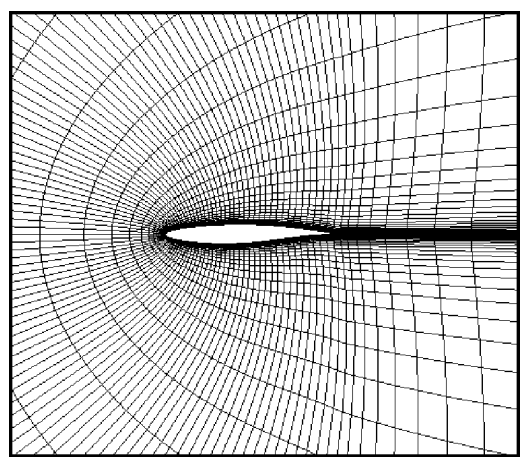


Figure 2. The grid used in Computational Fluid Dynamics.

Optimisation Algorithms

Besides leveraging on computing power to model the flow, the abilities of the computer have also been exploited by designers to develop optimisation algorithms to replace the traditional cut-and-try approach. Broadly, the optimisation algorithms are classified into two groups, namely deterministic and stochastic. Deterministic algorithms locate optimal design by using gradient information along search directions and stochastic algorithms search randomly in the design space. The deterministic algorithms are advantageous as they are efficient in searching for the optimal design in a smooth design space. However, the search often gets trapped in locally optimal results in a complex design space. Much research done[4] on aerodynamic design used deterministic algorithms and the results were not satisfactory. This project aimed to adopt robust stochastic algorithms to determine optimum airfoil design operating at transonic speed, which is the transition from subsonic to supersonic speeds. At this speed, the design space would inherently be complex. As the stochastic algorithms require larger computing effort, the algorithms were run on main-frame computers and efforts were placed to improve their efficiency. Two stochastic algorithms were used – Simulated Annealing and Genetic Algorithms.

Simulated Annealing and Genetic Algorithms

Simulated Annealing[5] is a stochastic algorithm based on the analogy "annealing of metal". In condensed matter physics, annealing is a thermal process to soften a piece of metal by lowering the internal energy. The process involves heating a metal until it melts and then carefully lower the temperature until the atoms arrange themselves in an orderly fashion thereby achieving minimum internal energy. This process is analogous to achieving the global optimum. In Simulated Annealing the design space is searched widely and randomly in the early stages of the process. As the algorithm lowers the temperature slowly as in the real annealing process, the search settles into a local region containing the global optimum. When the process is trapped at a locally optimal result as in Figure 3, Simulated Annealing uses random jolts to jar the search out of the trap and set it on its way. The method is relatively easy to implement and reasonably robust for solving a range of complex problems. To improve its efficiency and reduce computing effort, an enhanced algorithm called Simulated Annealing with Constant Acceptance Ratio (SACARA) was developed as part of this study, where the temperature would be able to adapt itself to accelerate or slowdown the search process based on the nature of the design space.

Genetic Algorithm is another random search algorithm that is based on Darwin's model of "survival of the fittest". In this algorithm, the airfoil shape is represented by a series of long bit strings or "chromosomes". The optimisation process selects promising and fitter chromosomes from the current generation and randomly generates a better generation of chromosomes.

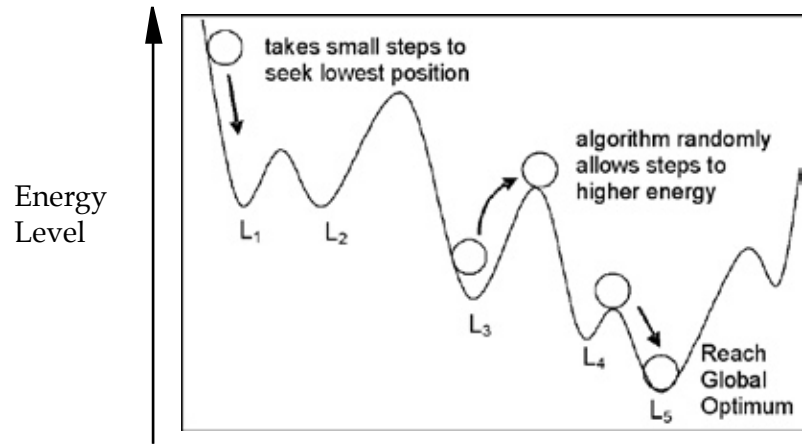


Figure 3. Illustration of Simulated Annealing.

After many rounds of iterations, global optimum will be achieved by selecting the fittest chromosome. Similar to Simulated Annealing, this algorithm is robust and easy to implement.

Design Process for Optimal Aerodynamic Performance

The design process involved determining the aerodynamic performance of a particular airfoil shape using CFD and progressively changing the shape according to the stochastic optimisation algorithms. One simple approach to change the airfoil shape was to adjust the grid points on its surface. However, this approach required tremendous computational effort as there were simply too many points to adjust. Therefore in this project, changes to the shape were made by adding a few smooth curves onto a baseline shape as shown in Figure 4.

Accelerating Optimisation Process Using Parallel Computing

To accelerate the laborious optimisation process of searching for global optimum, parallel computing was also implemented[6]. The approach was simply to divide the search process into a few clusters based on the number of parallel computers in use. After a few iterations, the search results obtained by individual computers were cross compared before forming new search clusters. Based on the results, using four parallel computers halved the computing time, whereas sixteen computers reduced computing time to a quarter.

Optimisation Results

The optimisation results showed that Simulated Annealing and Genetic

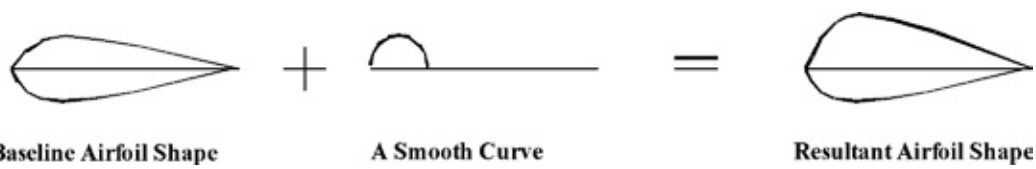


Figure 4. Design Process for Optimal Aerodynamic Performance.

Algorithms could yield globally optimum aerodynamic design, where the aerodynamic drag was reduced by 9-11% and aerodynamic efficiency (defined as lift over drag) was improved by 23-29%[7]. These results were superior to those obtained using deterministic algorithms. Figure 5 shows the desired smoothened pressure profile of the optimum airfoil.

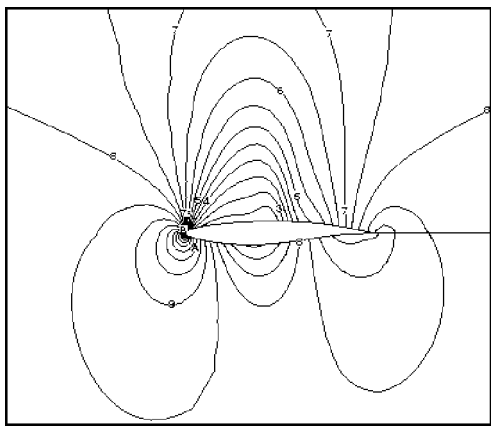


Figure 5. The smoothened pressure profile around the optimum airfoil.

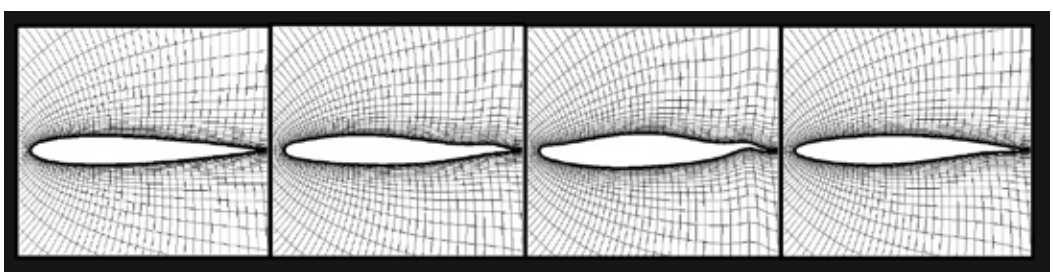
Simulated Annealing performed better than Genetic Algorithms in terms of computational effort required. However, the former involved the slow and careful lowering of annealing temperature in order to achieve the global optimum. Figure 6 shows the evolution of the airfoil shape during the design process . Overall, the design process leveraged on computing power to obtain the optimum design and avoided repeated wind tunnel testings.

Military Application and Potential

Design of high-tech military systems often requires optimisation of system components to achieve optimum system performance. In addition to the design of the aerodynamic structure, the stochastic algorithms developed can be applied in the design of military systems that frequently involves searching for optimum design in a complex design space. The algorithms can also be used to maximise operational payoffs such as in the scheduling of the key logistics resources to derive maximum operational outcomes for a given set of resources.

Acknowledgement

The author is grateful to Associate Professor Murali Damodaran for his guidance and support, and to the Nanyang Technological University for its computing facilities.



n = 0
Baseline Airfoil

n = 50

n = 500

n = 5000

Figure 6. Evolution of Airfoil Shape during the optimisation process (n represents the number of iterations).

"Shiang Long uses cost effective tools to solve complex military problems. The CFD tools provide a low cost solution to what would have been an expensive if not impossible effort in using wind-tunnel and scaled models for designing Aerodynamics Shape for Optimal flight performances. Shiang Long develops new and smart algorithms that converged to the global solution using lesser resources in complex iterative cycles of Model-Build-Test-Evaluate system of design. This is the hallmark of our 3G SAF, where we confront complex problems and find smart solution using less resources."
– Pang Chung Khiang, Dy Dir (TM-Systems Architect), DSTA

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COL Lee Shiang Long is currently Chief Signal Officer. Prior to his current appointment, he served as Deputy ACGS (Plans) in G5 Army and Head Info Ops Branch in G3 Army. COL Lee holds a PhD in Engineering from Nanyang Technological University, MSc (Comp.) from National University of Singapore and MBA from Cambridge University and Diploma (Mech.) from Singapore Polytechnic.

My Experience and Perspective of OFE

As a participant of the recent Ops Flying Eagle, I read with special interest your journal's recent articles on the key success factors of Operation Flying Eagle and BG Goh's sharing from the senior commander's perspective of the mission (Vol. 31 No.1). These articles have taken a close look at the experiences and lessons learnt from the mission at the strategic level. As a middle echelon officer serving in the capacity of a liaison officer, I have also learnt some valuable lessons from this mission and these are, from a personal perspective, some of the key reasons for the successful execution of the operation.

First and foremost, the ability to communicate in a common language was the most basic necessity in our operation. I recall that during initial discussions, the liaison team was not included as part of the advance party. This meant that except for COL Tan Chuan-Jin[1] and one of his staff officers, none of the other advance party officials was able to speak Bahasa Indonesia. Thankfully, this decision was reconsidered and liaison team leaders as well as Indonesian-speaking staff were brought along as part of the advance party that arrived in Meulaboh on the 7th day of the disaster. This mattered

[1] COL Tan Chuan-Jin was Commander of Humanitarian Assistance Support Group.

as we were immediately connected with our Indonesian counterparts at various levels of command and staff. From the moment we arrived we greeted and hugged our Indonesian counterparts and we never had any problems communicating thereafter. Having a common language enabled us to quickly move on from the formalities to the primary business of carrying out the mission. In our nightly meetings chaired by COL Geerhan Lentara (the overall commander of the disaster relief effort in Meulaboh) we discussed and prioritized what were the more pressing needs for support and what were 'good-to-have'. We also kept him informed of our timeline for the delivery of supplies. In this way we were able to make an impact in terms of our responsiveness to their needs. This would not have been easy had we not been able to communicate in Bahasa Indonesia. On the ground, the locals also felt very comfortable with us as we were able to communicate with them and made them feel at ease with our presence.

Another key lesson learnt from the operation was the value of understanding the culture of our neighbours. The tsunami had been a setback to the people of Meulaboh, but they are a dignified race with a rich and colourful history. In our mutual dealings, we were sensitive and respected each others' needs. We regarded each other as partners and friends facing a common crisis, working alongside, helping each other in carrying out our defined roles – they, trying their best to rebuild their lives; and us, trying our best to bring relief to the disaster-hit area. We were also especially mindful of their respect for their women folk. The Indonesians address ladies in general as 'ibu' or 'mother'. We made sure we accorded the same level of respect, not only in the verbal address but also in our behaviour and attire while working among them.

Towards the end of the operation, a decision was made by our leaders to provide the funds for the purchase of 20 buffaloes for slaughter as a gesture of donation so that the people of Meulaboh could celebrate their Hari Raya Haji with proper meals that included meat. The locals had for the duration of our stay there been eating rice and dried fish and little of anything else. Twenty buffaloes on a normal occasion may mean nothing to them but during those trying times, it showed them that we truly understood their culture and traditions, and genuinely considered their interest. This simple gesture of sincerity was greeted with widespread smiles and in the more affected villages, some of the locals were so touched they had tears in their eyes. It became one of the defining moments of our stay there.

Another positive takeaway from the OFE experience had been how we benefited from our safety culture. In the unfamiliar environment, we were acutely aware of the hazards that were inherent in our daily tasks. We stretched our safety boundaries but took calculated risks, and we always discussed safety issues in detail before proceeding with any task.

On the ground, our troops were especially careful when delivering supplies from our Super Pumas.

We would have personnel watching the tail end of the helicopters just to be sure that the villagers did not, in their haste and excitement, run towards the helicopters. We were mindful of the need to teach and guide them and kept a watchful eye on their approach at all times. Our pilots were also mindful of the effects of the downwash to the houses close to the Landing Points (LPs) for supplies and medical evacuation. We made a point to take off vertically to a suitable height, before moving off in the intended direction to minimize the discomfort of the people on the ground around the LPs.

Our vehicle convoys traversing through the main roads also travelled at a slow and safe speed. This became increasingly important when the roads were cleared and the villagers swarmed the roads in their bicycles and trishaws to return to their destroyed homes to retrieve any usable items that they could salvage from the rubble. It became a daily challenge to move through the human wave but we kept our composure and discipline to ensure we operated safely, both for ourselves and the locals.

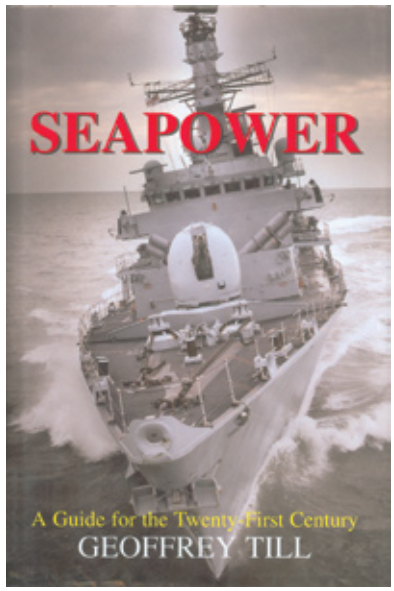
I will also put our mission's success down to our application of the SAF Core Values – a combination of a little of each of the core values especially that of Discipline, Professionalism, and Fighting Spirit. The SAF contingent flew in with the barest knowledge of what the situation was like and what the days ahead held for us. The values we had been schooled in helped us overcome the challenges and gave us an 'internal compass' that shaped our course of action and our conduct throughout the operation.

I was also particularly inspired by our mission leaders. They have created an environment that brought about excellent team play and cooperation. This was a key success factor too as internal disorganisation and strife can negate any grand mission plans.

From a personal perspective, the OFE experience is far more than words can describe. It has been a comprehensive educational experience akin to completing a 'field practice' of the Humanitarian Aid and Disaster Relief (HADR) module of the Command and Staff Course. It was not only a field test of our operational concepts, but also a test of the SAF's core fighting spirit. At the risk of being cliché, I felt we succeeded because we shared a common vision, a goal we all subscribed to, and a common set of values. Our strongest motivation and formula for success was that we all wanted to be there, we all wanted to contribute and play a part. Hopefully we made a difference in the aftermath of a tragedy that was so overwhelmingly devastating.

MAJ Nur Effendi
Head Training,
Basic Military Training Centre
(Served as Liaison Officer,
Ops Flying Eagle from
31 Dec 04 to 24 Jan 05)

BOOK REVIEW



Geoffrey Till's *Seapower: A Guide for the Twenty-First Century*

Geoffrey Till is the Dean of Academic Studies at the Joint Services Command and Staff College and Head of the Defence Studies Department at King's College London's War Studies Group. He has written extensively on maritime history and strategy and recently published an article in a recent issue of Pointer (Volume 30 No. 1) on The Transformation of Seapower and the New World Order. The article is loosely based on the final chapters of his latest book Seapower: A Guide for the Twenty-First Century.

This latest treatise on maritime history and strategy is the 23rd book in the Cass series on naval policy and history. George Baer from the US Naval War College, in his review of the book in The Journal of Military History, writes that "[Till's] strong analyses read forward and backward: any historian interested in naval strategy will learn much from this reliable guide to the past as well as to the urgent present concerns of our naval and oceanic futures." We at Pointer concur.

In understanding Seapower it is necessary to view it in the context of Till's larger body of work on the subject: Seapower at the Millennium (2001), Seapower: Theory and Practice (1994), The Sea in Soviet Strategy (1989), Maritime Strategy and the Nuclear Age (1982) among others. The evolution of seapower as a concept in this body evolves too with Till's point of view, through the geopolitical power shifts in our generation. In these previous works, he examined the concept of seapower in its history, its theory, its present and potential future practice – and in this volume synthesizes them into what Proceedings calls 'the best and most up-to-date discussion of sea power currently in print'. In that, it is a culmination of

his work, a comprehensive analysis of doctrine, practice, and strategy – Robert Rubel, also from the Naval War College, calls it a 'structured intellectual journey through the theory of seapower' – and add to the existing reservoir of knowledge on seapower with his ideas about emerging trends and the future direction of seapower.

First, Till derives a definition of seapower from inputs and outputs of maritime and naval activity, exploring distinctions between concepts of seapower as 'power at sea' and 'power from the sea', and the relative nature of comparative assessments of seapower possession and what constitutes a 'sea power'. He determines four attributes of seapower: the sea as a resource, a medium for trade, a medium for informational exchange, and a medium for dominion – and the interdependent nature of these media in what he terms a 'virtuous maritime circle'.

Next, Till compares and contrasts the various theories of maritime strategy and naval doctrine, in both Western and non-Western military thinking in exploring the evolution of maritime theory. In particular, he addresses Corbett's and Mahan's concepts of seapower and their impact on modern naval strategy, and in turn, examining how modern developments in technology and theory – such as operational art – and what future maritime theories might be.

Till's taxonomy of seapower breaks it down into its constituent factors, namely: population, society, and government; maritime geography; maritime resources; maritime economy; technology; and the other services – discussing and illustrating how each determinant factor plays a role in the maritime capacity of a nation. He goes on to categorize naval powers according to their relative effectiveness, and identifies the factors that make effective navies: professional skill; readiness; supply and infrastructure; and balance. He further considers the role of technology – including information and network technology – in the transformation of seapower, and discusses factors that contributed to the historical transformation of navies.

A key concept Till deals with is that of 'command of the sea', and he discusses the evolution and history of the concept, in terms of time, place, extent, strategic consequence, and necessity. First, he addresses how to achieve it – through decisive battle and victory, fleet-in-being, and blockade – to how to exploit it – amphibious operations, operational manoeuvres from the sea, sea-based strategic missile attacks, attacks on maritime communications and trade.

One of the most interesting aspects of seapower that Till examines is on "Naval Diplomacy". In Till's chapter on Naval Diplomacy, he brings forth its different facets, from "Naval Presence" to "Naval Coercion" and "Coalition Building". He makes it a point to use different relevant examples to help explain his ideas and thoughts about the various facets of "Naval Diplomacy". His examples stretch from the missile crisis across the Taiwan Straits in 1996 to the evolution of the German U-boat war between 1914 and 1918. In addition, he tries to tease out, for readers, the important future trends in Naval Diplomacy such as the growing importance of multilateralism

and coalition building in the twentieth-first century. While stressing the vast changes in naval diplomacy across the ages, he also notes that some aspects of Naval Diplomacy have been around for a long time. He uses a poignant quote from a noted British military historian, Malcolm Murfett to remind readers about the enduring relevance of seapower in the realm of global diplomacy and geopolitics:

"Despite the vast changes that have taken place in the world since the mid-Victorian era, the coercive role that a navy – whether great or small – can perform in peacetime against a littoral state has survived virtually intact."

In the chapter, "Good Order at Sea", he provides a balanced critique on the importance and the components of achieving "good order at sea". He also views the sea as part of the natural environment that humans must strive to protect due to the dangers of climate changes and rising sea levels. The recent news blitz about the potential of maritime terrorism in the Malacca Straits and the diplomatic exchanges regarding the responsibilities of littoral states along the Straits reveals the increasing need for transnational efforts in the maritime realm and the inherent sensitivities about state sovereignty that it provokes.

William S Dudley, former Director of Naval History for the US Chief of Naval Operations, calls the book 'provocative'. Till's view of the future of seapower is that of increased competition for scarce oceanic resources, and the increasing impact of maritime terrorism and piracy. These factors would necessitate a global 'maritime consortium' for the defence of 'good order at sea' in a globalised trading system – and increasingly curtail concepts of a mare liberum and free navigation of the high seas. Till's conception of such a maritime consortium would be multilateral cooperation at all levels, and would require rethinking of key assumptions in modern maritime theory and doctrine, such as the relationship between navies and coastguards, or even Mahanian concepts of navies defending national economic interests.

Till's book will appeal to two types of readers. Its systematic survey of maritime history and theories will be of most use as a textbook for naval professionals and students. Its final two chapters project observed trends in international law and naval technology, and draw conclusions about the future of navies and naval affairs, which will be of interest to naval historians and analysts. As such, it is deservingly placed on the UK Joint Services Command and Staff College Commandant's supplementary reading list for naval power, which describes it as 'exactly what it says' – a guide on seapower for the twenty-first century.

FEATURED AUTHOR

Geoffrey Till

Professor Geoffrey Till, a maritime strategist and scholar, is the Dean of Academic Studies at the Joint Services Command and Staff College, Shrivenham, U. K. and Head of the Defence Studies Department at King's College London's War Studies Group. Prior to that, he was Professor of History at the Royal Naval College at Greenwich. He has taught at the Britannia Royal Naval College at Dartmouth, in the Department of Systems Science at the City University, in the Department of War Studies at King's College London, where he completed his MA and PhD, and at the Open University. He has been a NATO Defence Fellow and a Visiting Scholar to the U. S. Naval Postgraduate School at Monterey, and has held the Foundation Chair in Military affairs at the U. S. Marine Corps University at Quantico, Virginia. He is also currently Visiting Professor at the Armed Forces University, Taiwan.

Professor Till has been Reviews Editor for the *Journal of Strategic Studies* since it was launched in 1978, General Editor of *Brassey's Seapower: Naval Vessels, Weapons Systems and Technology* series since 1987, contributing its first volume on modern sea power, and general series editor of the Frank Cass series on naval policy and history. He has edited *Coastal Forces* (1994), *Seapower: Theory and Practice* (1994), and *Seapower at the Millenium* (2001). In addition to many articles and chapters on various aspects of defence, he is also the author of several books, including *Air Power and the Royal Navy* (1979), *Maritime Strategy and the Nuclear Age* (2nd ed, 1984); *Modern Sea Power* (1987); *The Sea in Soviet Strategy* (2nd ed, 1989) with Bryan Ranft; *The Challenges of High Command: The British Experience (2003)* with Gary Sheffield; and *Seapower: A Guide for the Twenty-First Century (2003)*. His works have been translated into eight languages, and he regularly lectures at staff colleges and conferences around the world.

Throughout his academic career, Till has developed a keen interest in the evolution of maritime strategy and policy around the world. The core aspect of his current research programme is to analyse the way in which the end of the Cold War, globalisation, and the so-called Revolution in Military Affairs will require a radical re-think of conventional wisdom. He is also interested in the way in which maritime affairs interact with the security situation in defined regions, such as the Asia-Pacific, the

Mediterranean, the Gulf and the Indian Ocean. Of late, he is interested in the problems faced by small navies and the convergent manner in which navies and coastguards are increasingly being drawn together to perform a wide variety of unconventional as well as non-traditional security roles in the current age of complex global security challenges.

Till has written extensively on maritime strategy and history, and for *POINTER* in the recent Vol. 30 No. 1 (2004) with his article, "The Transformation of Seapower and the New World Order." In his article, he argues for the increased relevance of maritime security in a globalised trading system. With 90% of world trade by weight and volume moving on water, and increasing reliance on the sea for resources, the security of sea-based trade and industry has become crucial to the global economic environment. Against the transnational threats of maritime crime, terrorism, and pollution, Till calls for greater maritime multilateralism, and for a redefinition of the relationship between navies and coastguards. By leveraging on the inherent flexibility and maneuverability of naval forces, nations can project maritime power to police the globalised trade system in which the international community have a stake in.

This article is loosely based on the final chapter of his most recent book *Seapower: A Guide for the Twenty-First Century* (2003). Dubbed as "the best and most up-to-date discussion of sea power currently in print" by *Proceedings*, this 23rd book in the Cass series on naval policy and history draws on Till's extensive knowledge of the history of naval thought. It provides a comprehensive assessment of maritime theory from classic and recent doctrines of naval warfare, the purposes of sea control, and the limits and potential of naval power. A highly recommended read for students of naval thinking as well as for the general readers, it is perhaps of most interest to readers of *POINTER* given his mention of Singapore's circumstances and maritime policy in his final chapter on the future of seapower.

Though we are now in the post-Cold War era, Till's work with Bryan Ranft in *The Sea in Soviet Strategy* (2nd ed, 1989) remains highly influential as a study of modern maritime strategic policy. Till addresses the rise of the Soviet navy, placing it in its domestic and international context with an assessment of its roles, by examining its ships, submarines and aircraft, its exercises and patterns of deployment, and by interpreting Soviet naval doctrine. Some interesting (though perhaps unsurprising) conclusions are how Soviet maritime policies and naval development have been influenced by its political structure and ideological rigidity despite the pragmatic revisionism of its leadership towards the end of the 20th century.

Another Cold War era work is Till's *Maritime Strategy and the Nuclear Age* (1982), which examines how the advent of nuclear weaponry has affected maritime strategy, exploring the effect of political, technological, and legal developments on the world's navies. It describes the historical evolution of maritime strategy through a review of

literature from the classical thinkers – Mahan, Colomb, Corbett – to the contemporary maritime doctrines of the superpowers. The book considers the transformation of seapower from ancient to modern times, and contrasts both the theory and practice of naval warfare with a survey of significant naval events of the 20th century.

Till's early interest in maritime strategy and history is seen in his work *Air Power and the Royal Navy 1914-1945: A Historical Survey* (1979), which examines the decline and subsequent rise of the Royal Navy's Fleet Air Arm through the wars. Based on seven years of research and personal interviews with members of the Royal Navy and Royal Air Force, Till examines the political, economic and institutional reasons for the failures of the Fleet Air Arm in the early part of the Second World War. *Pointer* readers might find of interest its relevance to British naval policies that led to the destruction of the HMS Prince of Wales and HMS Repulse off Malaya during World War II. Although Till's conclusion places final responsibility to the more general economic predicament than to institutional competition or individual decisions.

The broad thematic consistency of Till's writing is the evolution of his thoughts on global naval developments juxtaposed against the constant flux in world maritime affairs events through the latter twentieth century into the new millennium. His impressive and scholarly work is perhaps analogous to the voyage of a ship over turbulent sea – tossed by the waves of chaos and change – yet holding steady in its well-helmed analysis, which has stood the test of time. Till's insights and contribution in providing a holistic and authoritative account of naval strategic history continues to be watched closely and highly regarded as he continues to track contemporary naval developments of concern towards the hazy horizon of tomorrow.

World War II – Russian Theatre: Zhukov versus Guderian

To commemorate the 60th year of the end of World War II, *POINTER* is profiling some of the great commanders who were involved in this historic event. In this third instalment of a four-part series, the featured personalities are two prominent commanders from the Russian Theatre, namely: Marshal Georgi Konstantinovich Zhukov (1896-1974) and General Heinz Wilhelm Guderian (1888-1954).

Introduction

In this issue of Personality Profiles, the careers and achievements of two great commanders of the Second World War are featured. Marshal Zhukov was simply the most brilliant Russian commander of World War II. He was instrumental in the defence of Leningrad and Stalingrad in 1941-3. In 1945, he led a final assault on Germany, capturing Berlin and accepting the Nazi surrender on 8 May 1945. General Guderian was one of the leading theorists of armoured warfare during World War II. He played vital roles in the Polish Campaign, Battle of France as well as the Nazi invasion of the Soviet Union.

Zhukov (1896-1974): His youth and early military career

Georgi Konstantinovich Zhukov was born into a poor peasant family in the Kaluga Province southwest of Moscow on 1 December 1896. He was conscripted into the Imperial Russian Army in 1915 due to the outbreak of World War I. He served in various cavalry units and was awarded two Orders of St. George for bravery at the front. The revolution of 1917 swept away the old tsarist order and provided Zhukov with the opening to improve his station in life. His poor working class background meant that he was

a natural supporter of the revolution, thus he joined the Communist Party and supported the Red Army in the ensuing Russian Civil War.

Zhukov proved to be a bold and competent leader and constantly improved himself through self-education and hard work. By the spring of 1923, he was assigned as the commander of a cavalry regiment. His potential was acknowledged by his superiors and in 1924-5, he was sent for a cavalry course for command personnel in Leningrad. Four years later, he attended the advanced course for senior officers at Frunze Academy, Moscow. In 1933, he was assigned the command of the Fourth Cavalry Division. In the winter of 1938, he was reassigned as the deputy commander of the Belorussian Special Military District.

In June 1939, he was appointed as commander of all Soviet-Mongolian troops and tasked to fight the Japanese incursion into Mongolia. He swiftly moved to reorganise defences and replaced weak commanders. On 20 August 1939, he launched a massive offensive against the Japanese troops. He coordinated infantry attacks with armour, artillery and aircraft. His careful planning and daring deception paid off when his two armour brigades joined the front from the flanks and captured the Japanese supply areas and encircled the Sixth Japanese Army. By the end of August, Zhukov succeeded in clearing the Japanese from Mongolia. This prompted the Japanese to sign a non-aggression pact with the Soviet Union. Zhukov was awarded the title "Hero of the Soviet Union". This great victory by Zhukov, though little known outside the Soviet Union at that time, demonstrated his ingenious use of mobile armour.

Zhukov: World War II and the Russian Theatre

Zhukov was promoted to General of the Army ahead of schedule and assigned to command the Kiev Special Military District in June 1940. In December 1940, Stalin gathered his top military officers to the Kremlin for top secret wargames. Zhukov excelled in these wargames as he led the "blue" side representing Germany to defeat his adversaries. His outstanding performance led to his appointment as the Chief of the General Staff.

On 22 June 1941 the Germans invaded Russia. During a meeting of the Soviet Military High Command on 29 July 1941, Zhukov suggested to Stalin that the Red Army withdrew from Kiev and act to stabilise the frontline before staging a counter-offensive against the German Army. This was rejected by Stalin who then accepted Zhukov's resignation. The latter was assigned to command a reserve northern frontline battle zone.

Zhukov's next significant role in World War II was the task of defending the Leningrad Front in September 1941. He managed to impose discipline on the troops and led a sterling defence of the city. By early October, Zhukov had stabilised the situation in Leningrad and reported that the Germans were now on the defensive with heavy losses. Meanwhile, the situation was deteriorating at the Moscow Front with the German war machine planning a

massive offensive. In this crisis, Stalin appointed Zhukov as the commander of the Western Front and assigned him the responsibility of defending Moscow. The bitter Russian winter helped to halt the German war machine on the outskirts of Moscow, just a mere 23 miles from the famed Red Square. The weather gave Zhukov and his troops much needed time to organise a small-scale attack to push the Germans back across the Volga-Moscow canal. Stalin overestimated the capabilities of the Red Army after this minor victory and ordered a massive offensive despite Zhukov's objections. In December 1941, Zhukov obeyed his commander-in-chief and commanded an offensive with 15 cavalry divisions, 88 infantry divisions and 1500 tanks on a 200-mile front. Once again, Zhukov's military expertise was proven when the Russian counter-offensive against the Germans came prematurely to a halt.

In August 1942, Stalin appointed General Zhukov as his Deputy Supreme Commander-in-Chief. Zhukov's first task after his promotion was to defend Stalingrad, a city which had all but fallen to the Germans. He spent time massing food and ammunition supplies before launching carefully executed attacks against weak links in the over-stretched German lines. Zhukov's Red Army defeated the Sixth German Army in the famous Battle of Stalingrad, though at a very high cost in human lives - up to one million Russians died in this battle alone. In January 1943, Stalin named him the Marshal of the Soviet Union. In July 1943, he orchestrated the largest tank battle in history at Kursk and pushed the Germans to the defensive again. Zhukov was both an excellent commander of troops as well as a great military strategist. He was equally at home in the capital city planning for the defeat of the German forces or orchestrating battles in the frontline.

The crowning glory of Zhukov's career must be his successful capture of Berlin, but this victory was by no means easy. By early February 1945, the Red army had reached the Oder and Berlin lay within reach, but he had to postpone the attack due to Stalin's politicking at Yalta. The Germans made good use of this time to bolster their defences and to reorganise their front. The Ninth German Army was reinforced and its numbers increased to an estimated 200,000. By the end of March, Zhukov had secured Kustrin – an important crossing point to Berlin. Stalin then ordered Zhukov to seize Berlin quickly as the Allies was advancing towards Berlin from the west. Zhukov had the daunting task of capturing the huge Nazi capital city of Berlin. He had a replicate model of the city done, and used information from prisoners of war, reconnaissance activities, and captured documents. On 19 April, the Ninth German Army fell apart and the breakthrough to Berlin was achieved. Although Berlin was heavily fortified, the Germans only had a maximum defence force of 300,000 troops while Soviet troops advancing to Berlin numbered over a million. On 8 May, Zhukov presided over the unconditional surrender of the Germans at Karlshorst. Without a doubt, Operation Berlin was the culmination of Marshal Zhukov's career.

Guderian (1888–1954): His youth and early military career

Heinz Wilhelm Guderian was born at Kulm (in present-day Poland)

on 17 June 1888, into a family of West Prussian landowners. Guderian developed a passionate interest in the military during his childhood and attended various military schools. After graduation, he joined the military and attended the German War College just before World War I.

During World War I, Guderian held various appointments – commander of a wireless station, assistant signals officer, and brief command of an infantry battalion. This latter appointment provided him with a first hand view of the horrors of static trench warfare and would lead him to become a leading proponent of fast, mobile warfare. In February 1918, his work with the German General Staff enabled him to gain valuable experience in the deployment of huge numbers of troops.

In the Inter-war years, Guderian specialised in armour warfare. He was influenced by British manoeuvre warfare theorists J. F. C. Fuller and B. H. Liddell Hart. In 1922, he was assigned to the Inspectorate of Transport Troops. Eight years later, he rose to be the chief of staff of the Transport Troops Inspectorate. His superior, General Oberst Oswald Lutz was highly supportive of Guderian's ideas about the future of mechanised forces in modern militaries. Hence, the groundwork for the creation of a modern Panzer force for the German army was laid. In 1935, General Lutz gained approval for the creation of three armoured divisions and Guderian was appointed the commander of one of these divisions.

In 1937, Guderian published a compact book titled, *Achtung! Panzer* [Attention! Armour], which reveals his ideas about mechanised warfare and its importance in the new age of warfare. This book gained wide attention and generated much debate among German officers. Guderian saw the potential use of armour not merely for infantry support as many more traditional minded officers saw it, but as a breakthrough weapon in its own right. Besides publishing his ideas, Guderian played a part in the annexation of Austria. In 1938, he led the Second Panzer Division in its march to Vienna. In November that year, Guderian was promoted to General and appointed commander of the mobile troops.

Guderian: World War II and the Russian Theatre

World War II gave Guderian the opportunity to prove the validity of his theories on the battlefield. From the Polish Campaign to Operation Barbarossa, his theories were proven accurate and his armour forces were critical to the success of the German offensives. Guderian's Nineteenth Army Corps was tasked as vanguard for the Nazi invasion of France in 1940. His unit swept across the Meuse River at Sedan, reached the English Channel coast, and was rushing to Dunkirk when it was halted on Hitler's order. Guderian's forces, aided by sporadic air support, managed to throw the Allied armies into chaos. Many historians noted that the German invasion of France in May 1940 marked the zenith of General Guderian's military career. His forces had demoralised and

outmanoeuvred Allied forces and the whole of continental Western Europe was the Nazis' to capture.

When Hitler decided to launch his ill-fated invasion of the Soviet Union against the advice of many, including Guderian on 22 June 1941, Guderian found himself entrusted with huge responsibilities. His reinforced Second Panzer group was part of Field Marshal Fedor von Bock's Army Group Centre during Operation Barbarossa. His 850 tanks smashed through the Soviet defences and reached Dnieper in only fifteen days. The speed at which his troops advanced earned him the nickname of "Schneller Heinz (Fast Heinz)" among his troops. His armoured force captured Smolensk and was poised to launch a huge offensive against Moscow, when he was redirected southwards to Ukraine by Hitler.

Guderian played an important role in the great encirclement battle around Kiev. In October, the advance was refocused on capturing Moscow but by then only half of Guderian's vehicles were in working condition. Another serious problem faced by Guderian and his men was the extremely inhospitable Russian winter, which the German army was ill equipped to withstand. In spite of all these obstacles, Guderian still managed to lead his men to Tula, which was around 100 miles south of Moscow. Confronted with stiff enemy resistance, concerned with the welfare of his thinly clad men, and faced with severe shortages in ammunition and food supplies, Guderian made repeated requests for permission to withdraw from exposed positions. His requests were rebuffed and in desperation, he simply pulled back his troops wherever he saw fit. His repeated acts of disobedience led to his dismissal from command on 26 December 1941. This was his last front-line command appointment.

Guderian suffered a minor heart attack before his dismissal and spent the next 15 months in enforced retirement, recuperating from his illness. In March 1943, he was appointed as the Inspector General of the Armoured Troops which gave him direct access to Hitler. By this time the Nazi armies had been badly mauled on the Russian Front. After a failed assassination attempt on Hitler in July 1944, he appointed Guderian as the Chief of Army General Staff. In this post, Guderian set about reversing German setbacks on the Russian Front and protecting his beloved homeland from Allied attacks. He grew increasingly disillusioned by the ill-advised interference in military decisions by Hitler, and they had many arguments during which Guderian was fearless about voicing his frank opinions. Finally, Hitler dismissed Guderian in late March 1945.

Commentary on both Commanders

Both Zhukov and Guderian were among a rare group of officers who were both men of action and men of ideas. Both were brilliant commanders on the frontlines in World War II and had published their own ideas about the latest military tactics and strategies. They both supported the expanded role of armour in modern warfare while it was still a debated issue within the military intelligentsia of both countries. Guderian espoused his theories about

the role of tanks and aircraft in modern warfare in *"Achtung! Panzer"* while Zhukov wrote manuals and textbooks on various military subjects.

These two commanders also liked to experiment with new military tactics on the battlefield. In the early 1920s, Zhukov experimented with tank warfare when it had not yet become a mainstream idea. During World War II, Zhukov was always ready to try out new ideas and innovations, though these did not always succeed. Guderian was extremely innovative and inventive; he was one of the main architects of German armour and the Blitzkrieg art of warfare in World War II.

Both commanders were excellent leaders of men. Guderian was a frontline commander of undoubted courage and tactical ability. Both managed to get the best out of their men, getting them to give their all in each battle. Guderian's troops were touched by his warm humanity and went all out for him because they felt that he fought at their side, the way few commanders did. One of Zhukov's most valuable command skills was his ability to force his men forward, regardless of how daunting the task ahead was. He achieved this with a mixture of strict discipline and by instilling a sense of mission in his men. In addition both men possessed great moral courage in that both were not "yes" men to their respective political masters and dared to voice their dissenting views.

Zhukov and Guderian were loyal to their Commander-in-Chiefs. The former was one of the very few men whom Stalin respected and trusted, while Guderian did not break his military oath and stayed loyal to Hitler in the midst of an assassination attempt in July 1944. Both knew their place as deputies to dictatorial political masters and manoeuvred carefully to achieve success on the battlefield and in the best interests of their nations within the constraints and perimeters set upon them by their superiors. They often had no final say in military decisions due to the larger political considerations and objectives of their Commander-in-Chiefs.

One of the starkest differences between these two great commanders was their attitude towards their troops and their level of concern for the loss of human lives. Guderian was so concerned about the welfare of his troops that he disobeyed his tyrannical superior's "steadfast" orders and pulled back his troops during the Battle of Moscow. He was one of the few top German generals not charged with war crimes in the Nuremburg Trials. He was seen as having acted consistently with the proper conduct of a professional soldier during the war. On the other hand, many historians considered Zhukov's conduct during the war as ruthless. He viewed human casualties as a natural by-product of war. He executed thousands of his troops for cowardice and in the Battle of Stalingrad, up to one million Soviets died. However, calling Zhukov callous and brutal might be unfair given that the Soviet Union and the Slav people were fighting for their very survival.

Conclusion

In conclusion, both commanders were good strategists and excellent

leaders of men. Both were able to operate successfully at the front as well as manage deployments from their headquarters. Guderian was the better tactician and armour theorist of the two but Hitler's repeated ill-advised interference into military decisions adversely affected Guderian's plans, especially the diversion of forces from Moscow to the South during Operation Barbarossa. History will remember Marshal Zhukov as the more successful frontline commander with his victories at Kursk, Moscow, Stalingrad and Berlin. However, it is worth noting that in all four instances, he enjoyed numerical and material advantages over the opposing forces. Guderian, on the other hand, suffered from a numerical disadvantage in both the invasion of Russia and the Battle of France. Nevertheless, he was able to swiftly crush his numerically superior opponents in France as well as capture a significant amount of Soviet territory before the offensive was disrupted by Hitler and later thwarted by the Russian winter.

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