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## Editorial

The CDF Essay Competition 1998 attracted a total of 123 entries from across MINDEF and the SAF. The areas researched into by participants included SAF core values, military technology, strategy, geopolitics, leadership and professionalism. As has been traditionally the case, this April-June issue is dedicated to the winning entries.

*Grooming and Grounding Heartware: SAF Leadership Challenges at the Dawn of the 21st Century* by CPT Irvin Lim Fang Jau clinches the First Prize in the Competition. This essay essentially posits the thesis that amidst the frenetic pace of acquiring hardware in the SAF over the past decade, the grooming and grounding of heartware will present new challenges for the SAF leadership at the dawn of the 21st century.

The Second Prize winner, *Congruent Objectives, Conflicting Visions: The Rhetoric and Reality of US-China Relations* by CPT Kwek Ju-Hon, is an analytical comparison of US and China policies in the Asia-Pacific region and attempts to speculate about the likely nature of their relations in the 21st century.

In *Revolution in Military Affairs and Information-Age Warfare: Why Technology Alone Cannot Win Wars*, the Third Prize winner, LTA Frederick Teo Li-Wei argues that there is a need to understand the strategic implications and limitations of the Revolution in Military Affairs, in particular, the need to focus on its applicability in our unique operating environment.

In the Merit Award category, we begin with the article *The Impact of Technology on the Military: An SAF Perspective* by CPT Chen Yuanxin who explains that the growth and development of the SAF is a story of Singapore's success in overcoming the scarcity of strategic military resources. In *Advancement in Simulation Technology and its Military Application*, CPT Boh Choun Kiat highlights that simulation technology is expected to become the single most important element in the structure and planning of military establishments world-wide.

LTA (NS) Toh Boon Ho's *Yamashita and the Assault on Singapore: Was Yamashita's Success a Bluff that Worked or the Culmination of Calculated Risk Taking?* attempts to reconcile two contrasting assessments and argues that the Japanese victory was the result of deception, bold generalship and calculated risk-taking. *Geopolitics: The Need to Reconceptualise State Sovereignty and Security* by LTA Seet Uei Lim, examines how global events in the past decade necessitated the reconceptualisation of statehood, sovereignty and security.

In *Joint Vision 2010: The Concept of Future Warfighting for the US Armed Forces and its Relevance to the SAF*, LTA Tay Gek Peng, introduces the concepts of JV 2010, discusses its relevance to the SAF and explains how key enablers may help realise new operational concepts. *The Technological Capabilities of Our Defence Industries*, by 2LT Eugene Yeo, is an attempt by the author to discuss the rationale behind the emphasis on military technology transfer, and the technological capabilities of Singapore's defence industries. Due to space constraints we regret not being able to publish another Merit Prize winning essay by LTA Pritam Singh. Congratulations to the prize winners.

For the first time, the competition attracted entries from Warrant Officers. This is a notable milestone in the Competition's history as it shows a widening interest in the competition across the ranks. It is hoped that this interest will spur on many others to participate in the next competition. We are also pleased to announce that one of the entries by a Warrant Officer, 2WO Lim Soon Chye, was awarded a Commendation Prize.

*POINTER* would like to take this opportunity to thank the panel of judges, COL Lim Kah Kee (Chief Judge), BG Desmond Kuek, COL Peter Wong, COL Lim Ah Seng, LTC Sng Seow Lian and DR Quek Ser Hwee for their time and effort in selecting the essays.

Finally, the *POINTER* Editorial Board would like to invite entries for the 1999 CDF Essay Competition, which is now open. The competition ends on 31 December 1999.

# Grooming and Grounding Heartware : SAF Leadership Challenges at the Dawn of the 21st Century

by CPT Irvin Lim Fang Jau

*"The language of leadership is the language of heart."*

James C. Humes

*The SAF is not an organisation that lumbers on by resting on its laurels of achievements or leaps ahead by simply reaching out to a wish-list of big ticket purchases.<sup>10</sup> Rather, the SAF has been investing heavily in manpower training and development to match its incorporation of the latest technologies over the last few decades. The on-going acquisition and commissioning of new combat systems and capabilities are significantly reshaping SAF's doctrinal and tactical approaches to warfare.*

*With new tools of the trade, new ways of training and fighting mean new ways of organising. In this respect, the rapid 'informatisation' of the SAF with information technology has increased productivity and efficiency exponentially ever since its systemic introduction in the late 1980s. While technology is an energising force that builds new enabling structures of command and control, and combat capabilities, it is perhaps important to remember that new tools do not necessarily change the order or outcome of battles overnight. In fact, new tools often require new thinking, new psychologies of leadership which can then translate into new processes, new performance standards - new ecologies of learning. These will have to be built up over time; just like the building up of military hardware is a strategic incremental process. In other words, if the aim is to synergise the full potential of man and machine in combat, then growing hardware must also, just as surely, entail grooming and grounding heartware. My use of the term heartware here is intended as a catch-all concept to refer to the mix-bag of human resource issues that the SAF must grapple with as it faces the many demanding challenges of 21st Century military leadership amidst the milieu of growing hardware and capabilities.<sup>00</sup>*

## Change Leadership

A quick survey of the popular human resource management literature on new trends of organisations today<sup>20</sup> reveals a movement away from the administrative management philosophy of 20th Century industrial age, to strong change leadership as the leitmotif for the new millennia information age. Organisation in the SAF has of course been premised on a 'lead by example', 'lead by the front' model all along. Such a leadership development model is second nature to the profession of arms, but has of late become a fashionable buzzword in management. The return of the leadership model is somewhat timely given the undesirability of creeping careerism plaguing many of the developed world's armed forces today.<sup>40</sup> The ethics of loyalty and leadership in military service must not be reduced to a contractual regime subject to the vagaries of market forces. The renewed focus should be on reinforcing sacred military ideals of honorable service and patriotic duty above other more personal pursuits apparent in occupational civilian cultures.

In this regard, SAF command positions - spanning stars and stripes - are not mere management chairs. They are leadership hotseats. However, leadership for the 21st Century is not about entrenching positions, but about empowering relationships. 'Leading from behind' has become the new management mantra for greater empowerment. As Barbara Levy Kipper eloquently puts it:

*"I don't have to be out front. [My] Levy people do. And that's empowerment. If you are out front, it's hard to look back, whereas if you are in the back, you can see what's going on ahead".<sup>50</sup>*

In the context of the SAF, the 'lead from behind' mantra for *empowering leadership*, does not displace or contradict the traditional 'lead by the front model' of *exemplary leadership*. In fact, the former complements and completes the latter. An understanding and synergistic application of both models of leadership is timely and relevant, as it recognises that we need to groom the leader in every individual in order to unleash the talent, passion and commitment of the group.

Leadership training for all echelons of command must increasingly be premised on the notion of 'earned authority'. Rank may be earned as a reward for passing through a tough rite of passage or a trying professional course, but respect and reputation can only be earned through credible leadership that embraces, not eschew, the challenges of change.<sup>6</sup> The character of such leadership is all the more important given that we now interact more through e-mail, fax, telephone, wireless rather than on a person-to-person basis. Mediated-interpersonal relationships improve efficiency, but they can seem impersonal. Therefore, a premium must be placed on grooming a more intimate interpersonal or interactive leadership with good emotional intelligence<sup>6</sup>, complemented by institutional leadership with 'HAIR'<sup>7</sup> qualities. As "leadership is a reciprocal relationship between those who lead and those who decide to follow"<sup>8</sup>, the leader as change agent must serve as a catalyst for positive action.<sup>9</sup>

In this regard, micro-management is no longer feasible or desirable. This is especially so, given the complex nature of today's and tomorrow's combat system architecture. In tracking towards the techno-vistas of tomorrow's battlefield, trust is the doorway; teamwork is the key. In order to operate well as teams, leaders must first learn to become facilitators of learning. Facilitating that learning will mean traditional top-down modes of instructional methods which force-feed information in order to induce learning, have to give way to more dialogic feedback facilitation which encourage self-directed learning. In other words, standard pedagogy must give way to andragogy.<sup>9</sup> Training like teaching must become less of a didactic procedure of correction, but more of a dialectical process of continuous improvement. While rote learning and rigorous drilling are vital in operating and integrating combat systems, they only provide the necessary procedural knowledge. Knowledge per se is only as good as its use value and must be given additional value. Knowledge must lead to understanding, and understanding to mastery in performance. This is the continuum of learning towards greater excellence and synergy. Self-managing teams when coupled with enlightened command guidance, will create self-directed work environments which will then bring such learning to a higher plane of understanding and mastery.<sup>9</sup>

The argument for change leadership as a catchphrase for any successful organisation cannot be over emphasised enough. An organisation that is able to meet the challenges brought about by change is one that is constantly learning to shape the present and the future. The SAF is well placed, and has paced itself well to remain a vibrant and forward-looking organisation that keeps itself close to the pulse of change; one that is prepared to jettison obsolete policies for novel solutions. Change leadership will require strength of intellect, character and creative thinking. It must be able to forge consensus while valuing a depth and diversity of ideas. It encourages 'thinking outside the box' and 'breakthrough thinking beyond borders' to break free from the inertial momentum of a status quo. It must do all this while having the welfare of its constituents and the entire organisation at heart. Such critical qualities will couple creative cutting edge with the candor and courage to question current wisdom.

Change leadership also impacts directly on the way SAF's human resource policy is formulated and implemented. For example, today's commanders and specialists may be relatively younger than their predecessors of yesteryears, but their work-rate and scope have been significantly increased and enlarged. Future leaders are being constantly groomed to take over the torch of tomorrow. As the SAF constantly renews its ranks with fresh recruits and young commanders, there will be a constant need to bridge any (mis)perception gap aligning youth with inexperience; which invariably calls into question credibility and competency. Only by continuing to recruit and retain the best and the brightest, and adhering to robust training regimes with strict enforcement of the highest standards of meritocracy - regardless of gender or race -, can such apprehension be assuaged. In addition, there is also the wider societal factor of a greying demographic profile. Singapore has one of Asia's fastest aging populations. 300,000 (or 10 per cent) Singaporeans are now 60 years old and above. This figure will triple to 900,000 or almost 20 per cent of an estimated population of five million in the next 30 years.<sup>10</sup> In time to come, it is not implausible that even the hitherto hallowed 'Keep SAF Young Policy' may be in need of a re-think. As the organisation matures,

there will be a need to strike a new delicate balance between harnessing the vitality of youth and tapping the experience of age. This may mean redefining current notions of job security vis-a-vis retirement, with new notions of employability through continuous training and work process re-engineering.

In strategically managing such challenging changes over the long term, there will also be a need to look more closely today at job enrichment for our more educated personnel to better match abilities and meet aspirations. With faster career advancement and the tendency towards flatter or even 'middle-broad hierarchies, horizontal promotions' in appointments rather than traditional 'vertical promotions' in rank may come to feature more widely as an alternative way of increasing responsibilities and authority when the latter is no longer as rapid or available. In this way, vertical promotions need not be the only criterion for career satisfaction and loyalty. Job enlargement and empowerment opportunities for the officers, warrant officers and specialists corps should continue to be enhanced. Already, the recent inauguration of the Combat Technician Scheme<sup>11</sup> for our Specialists, and The New Partnership and Training Needs Management System for our officers, are vivid examples of some bold initiatives to meet the new realities of change. At the risk of stating the obvious, such initiatives must be managed holistically and circumspectly in order to ensure that they deliver on their promises, and not be stillborn.

## Corporate Memory

While it is undeniable that change leadership is important, there is also a need for consolidation. I would argue that in a time of rapid change, consolidation is even more vital to an organisation's health than ever. In order to cushion well the interminable shocks of discontinuity and dislocation brought about by constant change and increasing complexity, an organisation like the SAF must learn quickly to take stock; and learn it well. Taking stock means regularly re-focusing on what is important and remembering where the real objectives lie. For example, lessons learnt during training must not be re-learnt in the arena of combat. Competitive organisations can ill-afford the pain; least of all the SAF. Lessons learnt and the contextual rationales for certain decisions made at a point in time should be prudently documented and accessible so that when there is a manpower turnover, there will not be the malaise of 're-inventing the wheel' which may be exacerbated by corporate amnesia. It is here that corporate memory comes in as a useful resource:

*"The memory of an organisation is one of its greatest assets and one that the traditional hierarchical organisation is badly equipped to manage. In order to utilise information to its fullest, it needs to be shared and dispersed, not hoarded and doled out. Like other resources, information needs to be organised so that it can be retrieved and used. Unlike other resources, it is not diminished with use".*  
K. A. Megill<sup>12</sup>

Given the inexorable pace of force informatisation<sup>13</sup> throughout the SAF today, corporate memory need no longer reside solely in specific individuals or subject matter experts per se, but in networks. IT systems play an increasingly indispensable role in the way corporate memory can be captured and collocated for ready reference and review in distributed virtual learning websites. In addition, virtual intranet forums can ferment greater discussion and enliven corporate memory. With the on-going development of intranets, the SAF has already planted the first seedlings of corporate memory to generate and take root. Total Quality Management (TQM) initiatives like the attainment of Singapore Quality Class (SQC) status and ISO certification programme for the standardisation and documentation of all our key processes and procedures also play a useful role in the self-renewing process of keeping the diversified accounts of our overall corporate memory bank relevant.

Imbuing a collective understanding of the importance of history<sup>14</sup> is another vital process in enhancing corporate memory. Such an understanding must not be superficial or skin-deep. Rather, a soul-deep understanding of SAF's history - one which is closely and inextricably bound up with nation-building, vis-a-vis lessons and icons from the past and present - will motivate our soldiers to build on our corporate legacy with pride of purpose. With unit heritage rooms set up, and Service museums playing a more visible role in stimulating interest in SAF's history, coupled with the incorporation of historical studies and talks in the training curriculum, we can then perhaps begin to retrace any broken fragments of corporate memory. A

sense of shared history refreshes corporate memories, revitalises corporate traditions, reinforces corporate identity, and can further ground heartware, as hardware grows.

## Core Values

The laudable inauguration of the SAF Core Values<sup>15</sup> is another attempt at grounding heartware. Core values provide the organisation with a common compass for charting the currents of continuity and complexity. They also serve as valuable anchors holding steadfastly on to the highest ideals of the SAF in a sea of change.

Of course, any core value policy can be quickly implemented with some careful planning and allocation of resources. But core values only turn into corporate virtues when they are championed by the constituents themselves - our soldiers. Value education is a long-term transformative process which involves behavioral changes to individual heartware and group mindsets in order for values to become second-nature. Indeed, core values need to be hard-wired in hearts and minds.<sup>16</sup> The desired heartware changes may not be readily apparent or even measurable in a quantifiable bench-marking sense. Nevertheless, the core values formulation and campaign is a first step in the right direction. The next step of consensus-building and consultation across the ranks with regard to programme implementation and propagation will help translate process into performance. The realisation should be that our soldiers "are more than just followers of someone else's vision and values. They are participants in creating them".<sup>17</sup> A proprietary sense of common goals through active participation will help to re-affirm shared values. To achieve this, a culture of communication, feedback and the sharing of ideas must be encouraged to thrive so that healthy ecologies of learning and leadership can flourish throughout the organisation.

Besides the cultivation of SAF core values, a culture of safety awareness with its attendant risk assessment management systems has also steadily taken root throughout the organisation. While such a development is undeniably a good sign, there is a need to constantly guard against the underbelly of such a culture - represented by colloquialisms of kiasu-ism and kiasi-ism<sup>18</sup> - from slithering in. In other words, a culture of safety consciousness when applied in extremis may unwittingly promote a risk adverse and responsibility averse culture that is not prepared to make the necessary sacrifices and tough decisions. Such an anti-culture is deleterious and diminishes the organisation's heartware in facing adversity. As Zaleznik puts it:

*"Organisations are not suited for leadership that is risk averse. In the interests of avoiding harm, organisations will atrophy".<sup>17</sup>*

The strength, courage and creativity of our soldiers must not be unduly inhibited. A certain amount of error tolerance that is not rigidly punitive or excessively retributive for people who make honest mistakes, will encourage them to take responsibility for their actions, learn from and make up for their errors. Learning and innovation can hardly thrive without some measure of risk-taking or error. In the end, a healthy culture of safety awareness with prudent risk management practices will help to mitigate the risks and minimise the errors, while allowing us to continue to glean the rewards of robust and realistic operational training and support.

## Core Competencies

The emphasis on core values runs parallel with the need to clearly define our 'core competencies' in the business of warcraft. To do this, we must firstly identify our critical combat and support capabilities, which will enable us to sharpen our combative edge. We will then need to develop them into core competencies, managed by a critical mass of expertise, and keep them in-house. This issue merits serious attention, given the gathering wave of outsourcing in the SAF in recent years.

Increased reliance upon external suppliers for critical support functions involves risks. The well-documented danger in commercial circles, is that industrial companies' reliance on other companies for manufacturing and technology has led to the rise of the "hollow corporation".<sup>20</sup> As more activities are outsourced, a

company's know-how or core competencies can become narrower and long-term competitiveness may become jeopardised. The SAF must never become a hollow force.

While outsourcing, as a low-cost strategy, allows the SAF to enjoy economies of scale as well as exploit the synergy of commercial expertise by reducing wastage and duplication, the potential pitfalls of outsourcing must be identified and addressed. The net effect of outsourcing is to transfer manpower costs to operating costs. As savings and efficiency will accrue only if reductions occur, there will be a need to review in detail the actual extent of outsourcing benefits and risks.

The other issue that impacts on core competencies, is that of technological dependency. While we would want to have a certain faith in our combat system integrity during actual conflicts, the reliance on technology as a media for critical decision-making can lead to problems of indecisiveness, inertia and loss of faith when things go wrong<sup>21</sup>.

In the event of system failures, we must develop greater mental preparedness and technical expertise in circumventing or overcoming the problems. This will invariably mean going back-to-basics or substituting rudimentary approaches for achieving the same net effect and goals. In other words, training must not completely sacrifice gritty realism for glossy simulation. Expanded use of training technologies must enhance traditional operational training. In this respect, failure training and stress management should feature more prominently in operator training in order to ensure optimal combat performance in the event of system failures.

The resilience of our damage control capabilities to respond effectively during crisis or failure must remain a major organisational concern. While systemic failure may answer to some immutable transcendental Murphy's Law of negative probabilities, crisis management and failure training are areas where positive human intervention is still possible. Contingency exercises like scenario planning and wargaming, while not wholly predictive or prescriptive, can also better prepare the SAF to manage the capriciousness of change, chance and crisis.

To be sure, increasing technology dependency is a human developmental inevitability, but it remains a clear and present danger. This is especially so for a rapidly "informating"<sup>20</sup> armed force as it takes on more sophisticated hardware onboard. Resilience in heartware means retaining core competencies in well-trained personnel who can then quickly, creatively and decisively bridge any hardware break-down.

## **Confidence & Commitment**

MAJ Dana Dillon, the Pentagon's Southeast Asian specialist has said that

*'Singapore's equipment, personnel, training and overall readiness are considered the best in Southeast Asia.... The SAF is clearly capable of protecting Singapore's interests, however it chooses to define them' (June 1997).*

An example of glowing international reviews and ratings of the SAF continue to be reinforced by the numerous compliments and awards our officers and men frequently receive when they do well in the foreign military courses and exercises they participate in.

Achieving a high tempo of participation in bilateral and multilateral exercises and foreign military courses not only serve to keep our soldiers fighting fit and razor sharp. They also present the SAF with invaluable opportunities to interact, to learn and to continually benchmark itself with the best in the business. Nothing builds confidence faster than knowing that you have matched-up to or even 'best-ed' the best in sophisticated mindgames and gruelling wargames.

Judging by the results of the *Combat Readiness and Morale Survey* conducted by the Applied Behavioral Sciences Department of MINDEF, our servicemen's confidence in the capabilities of the SAF are



reassuring<sup>23</sup>. The ABSD carries out extensive and in-depth surveys of each SAF combat unit annually to ascertain the fighting spirit of the commanders and soldiers. The data indicate that our soldiers have a strong sense of *esprit de corp* at the unit level. Looking at the bigger picture, they also show that a majority of our soldiers are confident in the SAF's capability to preserve and protect Singapore's National sovereignty and interests.

Of course, such accolades and results are not easily earned. They come at a price. That price is being paid daily by our 50,000 NSF and Regulars supported hand-in-hand by a 250,000 strong NSmen force, who stand ready to respond to any call of duty. Such commitment is hard to match.

The quick response of the SAF during the SILKAIR MI185 crash in Palembang on 19 December 1997, is a case in point.<sup>24</sup> The joint operations mounted by the Singapore Army, Navy and Airforce contributed significantly to the speed and success of the Indonesian recovery efforts. The SAF was tested again recently when it marshaled its resources to promptly deliver humanitarian food aid and medical supplies to hunger-stricken Indonesia. In another more telling episode, the SAF was able to mount joint Search-And-Rescue (SAR) operations in the South China Sea at a moment's notice to rescue a downed Royal Navy helicopter pilot despite real-time geopolitical constraints.

Without putting too fine a point to it, passing such peace-time 'operational tests' with flying colours, is crucial to fortifying the positive international and self-image of the organisation. They show that the SAF is highly trained, highly motivated, well-equipped and well-led to respond decisively and effectively to any emergency; in short, a potent force to be seriously reckoned with.<sup>25</sup> We are prepared to tackle difficult problems head-on or brainstorm creative solutions to shine through the fog and friction of contingencies. Such impressive capabilities must surely boost the confidence of those who pay for such premium services - the Singaporean taxpayers. They should just as surely bind the commitment of those same taxpayers who deliver such services - the Singaporean citizen-militia.

To be sure, confidence and commitment are not mercenary qualities which can be easily bought or inspired. They have to be built from the bottom up, across all ranks, and bound together over time. For a relatively young organisation like the SAF, that long drawn process cannot be left to circumstance or chance. The SAF must continue to care about how confident our servicemen feel about our capabilities and what we can do to keep them committed. We will need to continue to invest time, talent and effort to build up high calibre and competency to achieve this.

## Conclusion

The incipient growth of a culture of quality and learning is an unmistakable sign of healthy organisational heartdrive. As we seek to maintain a lean and fighting fit citizen military well into the future, the SAF must continue to be committed to being a caring, responsive and progressive organisation. It must be sensitive to the increasing demands placed on our servicemen, and it must address their concerns. An inclusive understanding of the multifarious yet intimately connected human resource management issues as I have argued, is vital to the way they can be better managed, and goes to the very heart of SAF's future. Indeed, the recent calls for the SAF to be 'First-class' or 'World class' will pose new challenges and sacrifices ahead. I would wager that amidst growing hardware, the test of how successful we are in overcoming them will depend more on the quality of attention given to grooming and grounding heartware.

## Endnotes

**1 James C Humes *The Sir Winston Method; The 5 Secrets of Speaking the Language of Leadership*, New York: William Marrow and Inc, 1991.**

**2 Although procurement of high tech hardware is the most obvious indicator of force development, the SAF is aware that new weapon systems alone do not automatically give more bang for the buck. This is because effective and comprehensive defences also require well trained, highly motivated personnel; besides efficient logistics, inter-service cooperation and high readiness levels. Without such an investment in human resource**

development, even new acquisitions may turn overnight into nothing more than 'white elephants' or 'red herrings'. See *The Straits Times*, 24 Jul 97:47; and Cunha (1996: 25).

3 See Sayles, 1993 & Renesch, 1994

4 See Sng, 1995; Tan, 1995; Chia, 1997; Ricks, 1998; Dunne, 1998

5 Cited in McFarland et al, 1993: 80

6 Emotional Intelligence: The idea that one's emotional maturity and people skills - qualities which can be groomed - matter more in achieving life's success, than reliance on so-called in-born IQ (Intelligence Quotient) alone. See Goleman (1996 & 1998) for his argument that emotional intelligence matters twice as much as cognitive abilities like IQ or technical expertise. And the impact of emotional intelligence is even greater at the top of the leadership pyramid. Being smart isn't just a matter of mastering facts, it's a matter of mastering your own emotions and understanding the emotions of the people around you. The good news ostensibly is that these crucial skills can be learned.

7 They are Helicopter Quality, Imagination, Power of Analysis and Sense of Realism.

8 Kouzes & Posner, 1993: 1

9 'Ped' is the latin root meaning child; Andra derives from the Greek 'aner' meaning *man* or *boy*. Thus andragogy studies how adults learn. It asks if they learn in ways which are significantly different from the ways in which children acquire new behaviors. See Dugan Laird (1982)

10 See The Straits Times reports: 'Getting Old is Dangerous', 17 Nov 98 : 2; 'Now's the Time to Fight Age Bias' and 'Retrain Mindset of Bosses' 24 Nov 98: 32.

11 Amongst the three armed services, the Republic of Singapore Navy is adopting this scheme on a big scale.

12 K A Megill, *The Corporate Memory: Information Management in the Electronic Age*, London: Bowker-Saur, 1997.

13 Force *informatization* involves the progressive application of information, communications and computer technologies across all systemic levels of a military organisation to enhance and integrate its multifarious warfighting processes. See Lee (1998: 35).

14 See Lim (1996)

15 The 7 SAF Core Values are: Leadership, Loyalty to Country, Professionalism, Discipline, Fighting Spirit, Ethics and Care for Servicemen.

16 See Singapore' Minister of Information and the Arts, BG George Yeo's discussion on 'common human values'in his article 'Asia and Europe Need to Talk' reprinted in *The Straits Times*, 29 Nov 98: 53.

17 Kouzes & Posner, 1993: 7

18 Both are infamous Singlish terms taken from the Hokkien Dialect. To be 'Kiasu' means to be afraid to lose-out; always wanting to win. To be 'Kiasi', means to be afraid of dying; not willing to take risk for fear of failure. Both are social behavioral syndromes popularly used to caricature Singaporeans.

19 Zaleznik, 1993: 530

20 See Jonas, 1986: 32

21 This brings to mind, the Y2K Millennium Bug problem, as a glaring example of a 'technological time-bomb' that looks set to deliver a crippling blow to many organisations world-wide if they have not successfully made their systems and processes Y2K compliant by then.

22 See Zuboff, 1985

23 This observation has been verified by ABSD.

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# Congruent Objectives, Conflicting Visions : The Rhetoric and Reality of US-China Relations

by CPT Kwek Ju-Hon

*It has become somewhat of a truism to say that the major determinant of the post-Cold War security environment will be the state of play of US-China relations. The collapse of the Soviet Union resulted in the removal of one major diversion on the strategic landscape, allowing both countries to refocus their geopolitical lenses sharply on one another. No where is this more true than in the Asia-Pacific region, across which both countries view each other with guarded caution.*

*In any strategic interaction between two players, be they individuals, organisations, or states, the nature of interactions and eventual outcomes is determined by two broad sets of factors:*

- *The players' aims and objectives in the overall strategic "game".*
- *Their perceptions and assumptions about the state of the playing field, including their perceptions of one another.*

*This essay will examine how the US and China match up along these two crucial interactive parameters, in an attempt to understand the likely nature of their relations in the 21st century. To put it simply, if there is a high degree of congruence over the two parameters, we can expect a relationship characterised by co-operation, and if there is a high degree of conflict we can expect one that is marked by conflict.*

## Methodology

The primary sources for this study will be two important sets of official documents recently released by the defence ministries of each country. These are the *US Security Strategy for the East Asia-Pacific Region*, published by the US Department of Defense in September of 1998 and the *White Paper on National Defense*, published by the Chinese Ministry of National Defense in August of 1998. Both documents purport to outline the assumptions and directions of their respective defence policies. The approach of this essay will be to consider one stage of potential interaction - it will examine the vision and strategies set forth in the American paper, and test them for congruence against the assumptions and analysis of the Chinese paper.

As both documents have been approved at the highest levels of government, they can, to a certain extent be reliably taken to express "official" views.

## Congruent Aims

*"The United States aims to promote a stable, secure, prosperous and peaceful Asia-Pacific community in which the United States in an active player, partner, and beneficiary".<sup>1</sup>*

*"It is the aspiration of the Chinese government and people to lead a peaceful and prosperous world into the new century".<sup>2</sup>*

It is with these lofty words, proclaiming their countries' benevolent intentions, that both policy papers begin to outline the perspectives on international regional and security issues that undergird their national defence policies. At the broadest levels, the two regional powers show themselves to be aware that they will be beneficiaries of a stable and peaceful security environment. Both profess a commitment to the peaceful resolution of disputes and active support of multilateral organisations that provide the infrastructure of international peace. To the Chinese, a peaceful regional environment is seen as a prerequisite for engaging

in the overdue process of economic and military modernisation. For the Americans, a stable environment provides a sound basis for the conduct of cross border trade, investment, and cultural exchanges.

The two documents display a similar degree of congruence in their broad strategic views of the future. The general outlook is one of optimism, with an explicit recognition that the end of the Cold War has led to a new era of relative peace. The US Department of Defense, for example observes that the regional "political security situation is relatively stable" and the Asia-Pacific is "a region mostly at peace, where interests converge and the reservoir of political will to deal with new challenges runs deep".<sup>3</sup> With similar optimism, China's White Paper notes how "the present international security situation has continued to tend towards relaxation . . . (and) . . . the factors for safeguarding peace are growing constantly".<sup>4</sup>

At face value it is easy to see such a congruence in views on broad areas as a cause for optimism, and to think that China and the US see eye to eye on crucial issues. Indeed one might say that it was agreement at such broad levels that has formed the basis for developing top-level dialogue between leaders of the two countries, culminating in reciprocal visits by Bill Clinton and Jiang Zemin in October 1997 and June 1998, and the subsequent talk of a "strategic partnership". The US and China do share common ground in a number of strategic areas; these include: stability in the Asia-Pacific and Asia's economic development, China's emergence as a stable prosperous nation, peace in Korea, and nuclear non-proliferation. Such common concerns are explicitly acknowledged by the US Department of Defense, which states that "the United States understands that lasting security in the Asia-Pacific region is not possible without a constructive role played by China".<sup>5</sup>

This broad agreement, or "congruence" in overall aims, forms the basis for the beginning of substantive interactions. However, agreement on such a broad level gives us little, if any, indication of what the nature of these subsequent interactions will be. For this we must delve deeper into the contents and nuances of the two documents. Yet when engaged in this process, we find that beyond the level of broad generalities, the consensus ends. A comparative reading of the two papers reveals a striking contrast in certain crucial assumptions about regional security and radically different normative visions of the idealised world order. Such divergence is seen most clearly across three broad issues: the role of the US in the Asia-Pacific Region, the architecture of the East Asian security community, as well as in normative approaches to international relations that are advocated by both countries. In fact, one might say that the areas of common ground between the two countries are equaled if not outweighed by these three "conflicting visions"

## THE REGIONAL ROLE OF THE UNITED STATES

*"The intention of the United States is to help dampen the sources of instability by maintaining a policy of robust engagement, overseas presence and strengthen alliances, while searching for new opportunities to increase confidence and a spirit of common security".<sup>6</sup>*

As summed up in the above quote, the US Department of Defense's strategy for East Asia envisages an active American role in the Asia-Pacific region. "Engagement" refers the degree to which the US will be active in the affairs of the region. This is envisioned as a multi-dimensional and multi-layered involvement with the explicit aim of establishing long-term relationships and norms of behavior. "Presence" refers primarily to the continued 100,000-strong overseas US military presence that will continue to serve as a deterrent and bulwark against instability in the Asia-Pacific. This forward military presence forces are described in the report as "the cornerstone of US national security strategy".<sup>7</sup> In addition the report adds assurance that the physical deployment of US forces at these levels will persist for the foreseeable future. Taken together, these first two aspects of US strategy constitute what is referred to by the Department of Defense an approach of "Presence Plus" - a continued and "robust" overseas military presence coupled with a plethora of non-military engagements within the region.

Between the lines of the doctrine of "Presence Plus" is an implicit assumption about the relative role that the US will play in the region. The fact that it confidently states its intention of deploying a 100,000-strong force in foreign lands suggests an assumption that the US is, and will continue, to be the dominant and unchallenged regional power. Lurking behind this is the further assumption that its corresponding role as

regional policeman is the key to maintaining regional stability. Such assumptions fit seamlessly into the framework of "Hegemonic Stability Theory" expounded by some scholars of international relations. 80 "Hegemony" is termed as a condition in which "one state is powerful enough to maintain the essential rules governing interstate relations, and is willing to do so".90 These "essential rules" form the basis for the maintenance of a peaceful and stable international or regional system. However, they are costly (in terms of political economic and military resources) to maintain, and hence their continued existence is dependent on the existence of a hegemon that reaps benefits from their operation. In this case, it is clear that the United States sees itself in the role of this benevolent hegemon, upholding the rules of inter-state relations, thereby preserving peace and stability in the Asia-Pacific region.

Yet it is these very assumptions that are challenged in the Chinese Defense White Paper. The paper warns against the dominance of one power, arguing adamantly that such dominance is a dangerous factor in the international system. In an oblique critique of the United States' intention to remain a dominant presence in the region, the paper states that "hegemonism and power politics remain the main sources of threats to world peace and stability".100 In a similar spirit and with similar obliqueness the paper expresses its misgivings with the United States' commitment to a continued military presence, as it refers to how "some countries by relying on their military advantages, pose military threats to other countries, even resorting to armed intervention".11

In contrast to the uni-polar, US-policed regional system that lies implicitly at the heart of the US Department of Defense's policy, China advocates a multi-polar system that is within which equality between states, and individual state sovereignty are the foremost principles. This view is captured in the "Five Principles of Peaceful Co-existence" that China champions as the basis for the establishment of peaceful inter-state relations. These principles include:

- mutual respect for territorial integrity and sovereignty
- mutual non-aggression
- non-interference in each other's internal affairs
- equality and mutual benefit
- peaceful coexistence".12

In these principles, we see a rejection of an international system based on a hierarchy of military and economic might - in effect a rejection of the US as the dominant regional power, and a desire for a scaling back, if not a withdrawal of the US military presence.

The Chinese White Paper states categorically that these five principles, and not a "hegemonic" US presence in the region "are the political basis for global and regional security". In fact, near the time when the two papers were released, the then foreign minister Qian Qicheng described the US as "the major obstacle of our foreign relations"130 It is also clear from this that the Chinese do not endorse the US role as a policeman of the Asia-Pacific and we can imply that they want to see the eventual withdrawal of American bases from the Asian side of the Pacific Rim

## **Regional Security Architecture**

The final and arguably most important pillar on which US strategy will rest is that of a security architecture built on alliances with friendly nations in the region. Such alliances are described in the report as "the linchpin of our security strategy in Asia".140 Almost as if to pre-empt a Chinese response, it offers the reminder that "China's economic modernisation has benefited from the conservative regional environment that US alliances in Asia have promoted".150 Alliances are an ideal political solution to the problem of entrenching the US involvement in the region; they suggest a reciprocal sharing of both the benefits and burdens of defence, and as such help "sell" the idea of continued overseas presence against calls from isolationists at home. In addition, they help counter accusations of unilateralism by giving at least the appearance of reciprocal desire for a US presence on the part of the alliance partner.

It is on this issue of alliances that the two documents decisively part ranks. The American proclivity to alliances as the panacea to all forms of regional instability is countered in the Chinese White Paper. In terms that are vague, yet unmistakable in their references, the White Paper discusses how "history has proved that the concepts and systems of security with military alliances as the basis and increasing military might as the means could not be conducive to peace during the Cold War"<sup>16</sup>. In an almost direct response to the American pro-alliance strategy, the paper states that "under the new situation, especially, enlarging military blocs and strengthening military alliances run counter to the tide of the times".<sup>17</sup>

In this objection from the Chinese, we see a recognition that alliances while bringing countries together, they always bring them together against someone or something else. With the demise of the Soviet threat, it is China's concern that the American advocated alliances are specifically alliances against China. No where is this divergence in views clearer than in the case of received guidelines on the alliance between the US and Japan. The Chinese White Paper expresses a concern that the region's defence is dangerously imperiled by the enlargement of military blocs and the strengthening of military alliances".<sup>18</sup> According to the paper, these alliances are based on the persistence of a certain "Cold War mentality".<sup>18</sup> It is likely the term "Cold War mentality" is an allusion to the US Cold War strategy of "containment" against the Soviet Union, a strategy that the Chinese fear is now being directed against them.

## Normative Approaches to International Relations

A final disjuncture in the views expressed in both documents concerns ideology, specifically, ideology as it impinges on the conduct of international relations. Despite the much vaunted death of ideology that followed the end of the Cold War, ideological concerns of this sort still form one of the building blocks of potential between the two countries.

Since the first Clinton administration, the US has accepted democracy promotion as a central tenet of foreign policy. This was born of an explicit acceptance of the presumption that democratic political systems rarely, if ever, go to war against each other. This assumption has allowed the administration to link American interests (understood in *realpolitik* terms) while satisfying American ideals (liberal values to be promoted worldwide).

Not surprisingly democracy promotion features prominently in the Department of Defense's exposition of US strategy; in fact the report dedicates an entire section to expounding on the links between "Promoting Democracy and Regional Security". The section announces that "continued US engagement in the Asia-Pacific region also facilitates the promotion of democracy, one of the three central goals of the 1997 National Security Strategy". It confidently states that "support for the growth of democratic institutions and processes in Asia will remain a key US security interest".<sup>19</sup> In general the US is more confident than ever that liberal institutions and ideology are the source of global peace and prosperity, and remains driven by a deep-seated impulse to spread these beliefs.

China, in contrast, stands firmly for relativism rather than universalism and emphasises the right of sovereign governments to conduct internal policies of their own choosing without being criticised by foreigners. The Defense White Paper indignantly argues that "each country has the right to choose its own social system, development strategy and way of life", and that "no country should interfere in the internal affairs of any other country in any way or under any pretext".<sup>20</sup> This stand is also bolstered by China's championing of the alternative world order contained in the "Five Principles of Peaceful Coexistence". It is clear that China wants to see a world that impinges less on Chinese "sovereignty" and "internal affairs" (mentioned in two of the five principles). This certainly precludes American interference in human rights or promotion of democracy.

## Conclusion

Despite such an overlap of interests at the broadest level, it is clear that both the Chinese and American governments conceive of these interests in radically different ways. Despite the "congruent aims" laid out in the documents it is clear from a comparative reading of the two documents that "conflicting visions" that



govern the respective governments views of the region and of one another. It is revealed in this contrast that despite a recognition of reciprocal dependence on one another for peace in the region, it is clear that both view each other with great suspicion. As mentioned earlier, China's former foreign minister Qian Qicheng has referred to the US as "the major obstacle of our foreign relations".<sup>21</sup> Similarly for the US, the Department of Defense notes that "China's rise as a major power presents an array of potential challenges". In the diplomatic language of White Papers, a challenge is a threat. To the US, the "international and regional focus of China's growing military power is worrisome".<sup>22</sup>

In both documents, we see two contrasting visions of a regional order. The vision articulated by the US is that of a status quo regional power that is seeking to play the role of benevolent hegemon in the regional system. China's vision, on the other hand, is that of an aspiring regional power, confidently staking out its claim to such status, while at the same time mindful of all efforts to contain it. In the words of Denny Roy, "the big picture reveals that a burgeoning China is beginning to push its shoulders against those of the leader of the current international system as well as the set of rules, norms and institutions governing political, economic, and diplomatic interactions".<sup>23</sup>

It is clear that these three crucial disjunctures in the strategic visions of the two countries will drive much of the tension behind US-China interactions in the 21st century, certainly prompting us to call into question the recent rhetoric of "strategic partnership" between the two. Instead, in recognising the "congruent aims" and "conflicting visions" we should come to recognise the less attractive reality of an ambiguous relationship with tremendous potential for conflict and co-operation.

The key task for diplomats and policy-makers alike is to recognise the divergences in strategic vision and to work towards unifying them. It is perhaps heartening that this challenge is explicitly recognised in the US Department of Defense Report, which notes that as China, the US and others in the region work to build that security architecture, "the greatest challenge will be to manage the gap that still exists in strategic visions and to develop mutually acceptable approaches to security".<sup>24</sup> Even in the complicated field of international relations, recognising the problem is surely the first step to finding the solution.

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# Revolution in Military Affairs and Information-Age Warfare: Why technology Alone Cannot Win Wars

by LTA Frederick Teo Li-Wei

*With the coming of the digital age and the revolution in information technology, there have been tremendous changes in military affairs. The Gulf War has been hailed as a watershed; wars of the next century will be fought with even more sophisticated systems - from using Global Positioning System (GPS) satellites for dominant maneuver to laser-guided precision munitions for increased lethality. However, there is a real danger that the current preoccupation with new and fascinating technology, and accompanying high-tech platforms, will increasingly overwhelm the debate about how the revolution in military affairs (RMA). In short, these new technologies are also driving what Lawrence Freeman calls a "revolution in strategic affairs" (RSA). The effects of information technology are truly revolutionary only in combination with proper political direction, total knowledge of self and adversary, and a proper doctrinal framework within which to apply the technology because technology alone cannot win wars.*

*There are two parts to the paper. The first argues that the real revolution is not in the mere application of information technology to warfare, but in the new dimensions of war that has become possible and legitimate with the advent of these new technologies. At a strategic level. The successful conduct of information-age war in these new dimensions does not depend on superior technology alone. The second section argues that superior technology is not a sufficient condition for victory even at the operational level. By considering the case of information warfare, it will be shown that other components must work in tandem with superior technology to obtain the desired outcome.*

## CAN TECHNOLOGY WIN WARS?

Much of the discussion about the RMA has been dominated by the United States and other Western countries, especially as a result of the Gulf War (1990-1991). The incredible results of the Gulf War have led some to declare prematurely that information technology will win the battles of tomorrow. But the Gulf War was a unique situation, labeled by some as the "mother of all military anomalies".<sup>2</sup> The Gulf War did not show that superior technology alone was the sufficient conditions for bloodless victory. The spectacular success of the Allied forces was due to a coincidence of "offensive skill, defensive error, and advanced technology" operating in an environment - the desert plains of Persia - which maximised the potential of new navigational and communications technology as well as interacting in a powerful non-linear way.<sup>3</sup>

To understand the true effects of the RMA, it is necessary to reexamine the purpose of the use of force. Clausewitz has pointed out that war is a "continuation of political intercourse, with the addition of others means".<sup>4</sup> War is an instrument of the state to achieve its political objectives by other means. The importance of this cannot be over-emphasised. Indeed, one of the most important aspects of the conduct of modern war, especially limited war, is the "military-political interface".<sup>5</sup>

But, as Hans Morgenthau correctly adds, the "political objective of war itself is not *per se* the conquest of territory and the annihilation of enemy armies, but a change in the mind of the enemy which makes him yield to the will of the victor". The timeless truth has not changed with the current RMA. The use of information technology may provide advantages in military conflicts of the traditional kind, but it does not necessarily follow that it will help to better achieve the political objectives of waging war.<sup>6</sup>

What is more important is how new technologies have given rise to a revolution in the number and scope of "the other means" that are available to effect the "change in the mind of the enemy". More dramatically, it has changed our perceptions of what 'centres of gravity' (CG) can be. Clausewitzian conceptions of CGs will be grossly inadequate in the next century.<sup>7</sup> There can be no unique definition of what an enemy's CG is. That will depend on the perceptions, value-systems and cultural contexts of the enemy. Defeat of an

enemy's army may not fulfil the political objectives of the war if the enemy continues the armed struggle in an unconventional way, e.g. through guerrilla warfare or terrorism.

Effecting a change in the mind of the enemy (the ultimate object of war) cannot be achieved with superior information technology alone, regardless of the hype about the potential of the RMA because securing a tactical military victory may be insufficient to guarantee the strategic political victory.<sup>8</sup> For this reason, one should not get carried away with the effectiveness of superior technology on the battlefield in guaranteeing the desired political outcome.<sup>9</sup> As the Vietnam War clearly showed, a mere analysis of the relative military power and technology of the warring sides - the North Vietnamese and the Americans - would have given no indication of the final strategic result.<sup>10</sup> Despite their superior fire-power, training and technology, the Americans could not defeat a technologically-inferior enemy that was ideologically motivated, and had a great stake in the outcome of the war.<sup>11</sup> Ho Chi Minh supposedly declared that even if he lost ten men for every one American, he would still prevail.<sup>12</sup> Despite having lost only 43,000 men as compared to over one million estimated losses for the North Vietnamese, the Americans had to pull out of Vietnam.<sup>13</sup> This clearly shows that a "balance of resolve must be set against a balance of military power".

Indeed, it is only by understanding the political, economic, social, environmental and moral contexts of both sides - what the Soviets call the 'correlation of forces' - can one make sense of the outcome in Vietnam as well as the defeat of France at the start of World War II.<sup>14</sup> A pure military comparison alone cannot explain why the French were overrun in six weeks.<sup>15</sup> Soviet military science, according to S. A. Tiushkevich's *Laws and Customs of War* (1977), states that the course and outcome of war depends not only on the correlation of military forces of the contending sides, but also on the moral-political economic and scientific capabilities of the struggling sides.<sup>16</sup>

Even though superior technology can yield better information that can prove useful in a military conflict, information does not equal knowledge or wisdom.<sup>17</sup> Knowledge goes beyond simple information acquisition to include the quality of information analysis.<sup>18</sup> It includes an understanding of the "thought processes and value systems of both the leadership and general population of an adversary and the interaction, if any, between the 'leaders' and the 'followers'".<sup>19</sup> In trying to "change the mind of the enemy", it is vital to understand what the enemy leadership and civilian population think and perceive what they hold dear; and what is not values.<sup>20</sup> As Professor Freedman aptly noted, "questions of force must always be put in a wide context, if only to make sense of the particular causes of conflict".<sup>21</sup>

More recent examples exist as well.<sup>22</sup> Superior American special forces could not achieve the American political objectives in Somalia in 1993 against Mohammed Farah Aidid and his primitive<sup>23</sup> forces.<sup>24</sup> Despite a kill ratio of around 75:1 in a fire-fight in Mogadishu on 3 October 1993 - a "massacre in anyone's language"<sup>25</sup> - the Americans lost the political fight and had to accommodate Aidid in subsequent negotiations.<sup>26</sup> Similarly in the most recent crisis in mid-December 1998 Iraq when the US and Britain carried out a four-day strike, the laser-guided munitions and advanced information systems of the US and Britain, failed to achieve the political objectives - the destruction of Saddam Hussein's weapons of mass destruction (WMD) production capabilities, and his removal from power.<sup>27</sup> At the end of the strikes (where more cruise missiles were launched than in the whole of the Gulf War), Saddam's WMD capabilities have been set back by only a year<sup>28</sup>, and Saddam Hussein's control over power remains unshaken.<sup>29</sup> Even the military objectives were not satisfactorily accomplished despite American claims of relative success in "degrading" targets : only one of the 27 surface-to-air missiles and integrated air defence systems attacked on the second night of the bombings were completely destroyed.<sup>30</sup>

There is a need to consider the overall context of the conflict when deciding what capabilities can really force the enemy to capitulate, noting that as in the case of Vietnam, conventional superiority may be insufficient.<sup>31</sup> National political objectives of war, and the knowledge and understanding of what will force the enemy to capitulate must be taken into account when deciding on future force structures and capabilities.<sup>32</sup> Such factors must dictate the application of technologies, not vice versa.<sup>33</sup> What the above discussion has shown is that superior technology in itself is insufficient to accomplish the political objectives of war at a strategic level.

Some of the literature on the RMA have entered into the debate about whether it is truly revolutionary or merely evolutionary.<sup>14</sup> But that is almost an irrelevant issue - the crucial question must be whether information-age technology can help to achieve the political objectives of war in a revolutionary way.

Much of the discussion about the RMA does not call for a fundamental paradigm shift in our conception of warfare.<sup>15</sup> If new information-age technology merely enables us to prosecute a conventional war more effectively, and our paradigm is still constrained by attrition levels in terms of number of soldiers, tanks and guns, then it is obvious that there has been no revolution in military affairs.<sup>16</sup> A progressive improvement in the quality of sensors, and the lethality and precision of weapons do not constitute a RMA.

Other commentators, such as the Tofflers, have not simply seized upon these technological changes, but have also predicted new forms of warfare : "niche wars", robotic combat, the use of nano-technology and cyberwar which they think will revolutionise the way we fight.<sup>15</sup> Though the tofflers have been accused of presenting an incomplete analysis of the current revolution because they never constructed a psychologically sophisticated notion of why people fight<sup>16</sup>, they have nevertheless shown that new technological possibilities are opening doors to new *dimension*s of warfare.

The real revolution is therefore about institutionalising and legitimising war by other means (WBOM).<sup>17</sup> Wherever one stands in the debate, one must be aware that exploiting RMA technologies and waging WBOM are merely means to an end - they are not ends in themselves.<sup>18</sup> The emphasis of US-defined RMA has always been on technology.<sup>19</sup> The Soviets, who identified these trend-lines in the 1980s, conceived of these changes as a "military technical revolution".<sup>20</sup> The danger of perceiving current change in military affairs in largely technological terms, like the Tofflers, is to get caught up in what I call *technogasm*.<sup>21</sup> The real revolution lies in strategic affairs rather than technological matters.

## **IS TECHNOLOGY SUFFICIENT FOR VICTORY IN INFORMATION WARFARE?**

Information Warfare (IW) has been touted as a key feature of the RMA and the future form of warfare.<sup>22</sup> IW is not merely an extension of command and control warfare (C2W) or electronic warfare (EW).<sup>23</sup> IW is increasingly being used to encompass a broader set of information-age warfare concepts.<sup>17</sup> Former US Secretary of Defence William Perry once noted :

*"We live in an age that is driven by information. Technological breakthroughs ... are changing the face of war and how we prepare for war."*

The promise of strategic and operational IW have been overhyped because there appears to be simplistic assumption that superior information technology will mean victory in information warfare.<sup>24</sup> Indeed, to fully maximise the potential of IW, other factors are necessary.

## **Understanding Information and Information Warfare**

One of these factors is a proper understanding of what information is because the nature of information is because the nature of information has many significant implications.<sup>25</sup> Information is different from other inputs such as fuel or ammunition; unlike fuel or ammunition, it is not subject to interdiction as there are multiple forms of access.<sup>26</sup> Information is also not a good in and of itself.<sup>27</sup> While we can hardly complain of having too much ammunition, too much information as opposed too little can result in a problem of 'noise' and 'information overload'.<sup>28</sup> Also, as there are multiple points of access (not just multiple forms of access), many users can receive the same information at the same time.<sup>29</sup> Unless we understand these characteristics of information as a commodity, we could face serious problems of command and control.

Furthermore, information is subject to manipulation and interpretation.<sup>30</sup> As Keohane and Nye notes, "when Iraq invaded Kuwait in 1990, the fact that CNN was an American company helped to frame the issue, world-wide, as aggression.<sup>31</sup> Had an Arab company been the world's dominant TV channel, perhaps the issue would

be framed as a justified attempt to reverse colonial humiliation".<sup>18</sup> The ability to manage perception is necessarily predicated on the credibility of the information provider. Keohane and Nye went on to add, "Political struggles focus less on control over the ability to transmit information than over the creation and destruction of credibility".

A proper understanding of information and IW also means appreciating the technical limits. This will prevent us from expecting too much and making inaccurate assumptions. How does one gain 'dominant battle-space awareness' when air-borne surveillance sensors cannot penetrate the foliage of tropical jungles, an environment more familiar to us? While space-based satellites may be pick out armour formations in open deserts, and J-STARS (joint surveillance target attack radar system aircraft) to co-ordinate attacks against individual enemy armour vehicles, can similar systems identify enemy soldiers hiding in built-up areas, or in well-constructed tunnels running dozens of miles with equal effectiveness? In other words, we must be wary of slogans like 'dominant battle-space awareness' which sound impressive but mean very little to use because of out different operating environment.

Finally, there is a need to understand that the cost of information is becoming less prohibitive, thus adversaries to easily overcome asymmetries in information. One of the most striking features of information-age technology is the rapid depreciation of capital. IW systems are not becoming more expensive, in fact, the opposite is the case. Given the low cost of entry into the information game, it is not difficult to imagine potential adversaries who can purchase high-tech sensors commercially off-the-shelf and plug into the information flow during the battle. Therefore, not only is acquiring superior information a difficult task, to attain information dominance - i.e. to obtain information and to deny information to the enemy - is probably unrealistic. As Charles Dunlap noted, "savvy militaries will focus on developing doctrine and strategies for operating in an environment of information transparency or information parity".

## Information Warfare and Organisational Culture

To reap the benefits of information technology and IW, a compatible organisational culture must be in place. Though information dominance may not be realistically possible, the increase in availability of information to commanders when making decisions will be a reality and this will pose several cultural challenges. First, there will be a need for restraint on the part of commanders higher up the chain of command to avoid micro-management from the top.<sup>20</sup> There may be an inclination for senior commanders to direct close combat due the greater availability of information from the ground. However, this will go against the very benefit of information technology - to empower the junior commander in the field to creatively and convincingly carry out his mission, acting with initiative and confidence :

*[T]he real promise of information age warfare is not that it will allow the centralisation of decision making and the exercise of increase control, nut rather that it will liberate the initiative of junior officers and non-commissioned officers to perform independently and synergistically within the limited of operational and strategic commanders' intents.*<sup>21</sup>

Second, commanders may develop 'information dependence' - a refusal to make decisions until the next bit of information comes, hence lengthening, instead of shortening, the OODA (Orient, Observe, Decide, Act) cycle. To develop a culture capable of exploiting, but not becoming dependent on, information will require not only training, but a more far-reaching overhaul of our education system - something which is already taking place with the concept of 'Thinking Schools, Learning Nation' - to foster innovation and creativity in the usage of information.

## Systems of systems

US Admiral Willam Owens has famously coined the phrase "system of systems" to define the RMA.<sup>22</sup> However, by reducing this definition of RMA to the acronym C4ISR (command, control, communications, computers, intelligence, surveillance and reconnaissance), it misses the sense that the keys to the RMA are the development of information systems that can integrate all this data in real time, and the development of the appropriate doctrine and tactics to use the 'system of systems' effectively in combat.<sup>22</sup>

System integration skills are perhaps the most demanding aspect of the RMA.<sup>23</sup> For example, just having real-time information is insufficient because commanders may not be able to act upon the new information; there is a need for real-time logistics as well.<sup>24</sup> Integrated logistics support and maintenance (ILS-M) and other 'unfashionable' aspects of the RMA are just as crucial to ensuring operational effectiveness.<sup>25</sup> Creating an integrated system is not just a function of technology, but of technical skills and creativity.<sup>26</sup> In short, the quality of our human resources is crucial.

Development of an appropriate new doctrine to engage in information-age war is also essential.<sup>27</sup> There must be method in our application of technology.<sup>28</sup> The benefits of this is described eloquently by Douglas Macgregor whom I quote in full (emphases are mine) :

*Military doctrine, the collective body of thinking and writing that describes how a military organisation expects to fight, is designed to support national strategy by assuring that **military establishments are organized and postured at all times to further national goals.** Military doctrine underpins national military strategy by rationalising the development and use of military power on every level : tactical, operational, and strategic.<sup>29</sup> To the military professional, the existence of a genuine military doctrine is of great value.<sup>30</sup> It provides a body of knowledge rooted in military experience on which to draw for the solution of contemporary military problems.<sup>31</sup> Moreover , the existence of a warfighting doctrine and its universal application in the sphere of military affairs mean that all officers, non-commissioned officers, and soldiers will **betrained and educated along roughly the same lines.** In addition, the basic tenets of a warfighting doctrine can be applied not only to field forces, but also **to research and development and to production of military equipment.** Thus, a warfighting doctrine exerts a **potentially unifying influence and supports the co-ordination of operations, tactics, training and modernisation.**<sup>32</sup>*

## Technology as Strategic Vulnerabilities

Technology is a double-edged sword.<sup>33</sup> While one can exploit the potential of information for offensive use, the increasing use of information technology also creates strategic vulnerabilities, especially in civil society.<sup>34</sup> Hence, the need for defense against information attack.

Singapore is the most highly wired-up country in the whole of Southeast Asia.<sup>35</sup> We are reliant on information systems for everything from communications to financial services.<sup>36</sup> If anything, we are becoming more reliant on these systems, and they lend themselves to information attacks.<sup>37</sup> An accidental nine-hour failure of the AT&T network in the US in 1990 led to a loss of close to 70 million calls and the financial costs were incalculable.<sup>38</sup> More recently, a satellite malfunction in the US caused the loss of about 15 million pages.<sup>39</sup> Such occurrences will damage our reputation and hurt our attempts to become the leading financial centre in our time zone.<sup>40</sup> Indeed, the damage to our reputation may be irreversible.

These quoted examples of the US were all accidents.<sup>41</sup> However, in an age where war can be waged by other means, it will be increasingly difficult to differentiate between accidents and attacks.<sup>42</sup> Information-age warfare may therefore begin to challenge the basic assumptions of our defence planning - that Singapore is able to respond pre-emptively, swiftly and decisively against any potential aggressor.<sup>43</sup> This ability depends on being able to perceive threats *before* the enemy is able to strike.<sup>44</sup> The examples of information attack need not require the traditional mobilisation of enemy forces, and as such strategic surprise is far easier to achieve.<sup>45</sup> Surprise attack is contingent upon giving the enemy insufficient, not short, notice.<sup>46</sup> As Richard Betts noted, "strategic surprise occurs to the degree that the victim does not appreciate whether, when, where, or how the adversary will strike"<sup>47</sup> - ominously like an IW attack.<sup>48</sup> If it becomes impossible to differentiate between accidents and attacks, a massive and rapid response may be difficult.<sup>49</sup> Even if we can, the nature of an information attack is such that it offers little time for counterattack before the damage is done.

In January 1995, the US Secretary of Defence formed the IW Executive Board to facilitate the "development and achievement of national information warfare goals"<sup>50</sup> Bringing together senior members of the national security community as well as representatives from national security-related telecommunications and information systems industries, it was a co-ordinated effort to develop an overall national strategy for

information warfare. Future threats to our national security from IW may not be purely in a military sense. In IW, there is not front-line; conversely, the front-lines are everywhere. As Singapore plugs into the information revolution to position itself economically for the future, it is increasingly urgent to talk about an overall national strategy for information warfare as apposed to a purely military response. This will facilitate an appropriate response should we ever become subject to an information attack. A further implication of this is that the development of military doctrine can no longer be a purely military affair.

## CONCLUSION

Though this essay has questioned the singular importance of information technology in shaping the future of our forces, it does not deny the significance of information technology as one of many components in shaping our armed forces beyond SAF 2000. Indeed, Singapore appears technologically well-placed to participate in the RMA. Singapore is perceived by many to possess the capability to defend its interests "however it chooses to define them"<sup>29</sup>. Similarly, we must participate in the RMA in a manner which fulfils our political objectives and serves our strategic interests. Accepting US-defined RMA wholesale will be neither sensible nor helpful.

The current RMA and the IT revolution accompanying it holds great promise for us. Futuristic conceptions of war expand our horizons in thinking about future conflicts. But to assume that future wars will only be fought in cyber-space and that bloody, closed combat has no place in future war is dangerous. As one keen observer noted, "to act as if force has no utility for us creates utility for our potential enemies".<sup>30</sup>

In our force modernisation efforts, it is perhaps most important to remember that technology is only a force-multiplier; it is still the human being that counts. We must seek to "equip the man, not man the equipment".<sup>31</sup> In our enthusiasm for technology to augment our capabilities, we must not forget that people, politics and the overall context of war matter, and that they must be factored into the equation when considering the structure of our forces for the future. Technology matter, but very often, it is not the most important.

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# The Impact of Technology on the Military : An SAF Perspective

by CPT Chen Yuanxin

*The growth and development of the Singapore Armed Forces (SAF) is a success story of our constant efforts to overcome the scarcity of strategic military resources in the shortest possible time. This was achieved through the efficient management, distribution and use of these resources, which traditionally include labour and capital, and now in the age of information, information. We achieved this right from the start by investing and incorporating the very latest technology in our military hardware either through research and development, adaptation and upgrades; or through technology transfers.*

*Technology in modern warfare has reduced the traditional reliance on numbers, mass, and endurance while increasing the capacity for rapid and precise application of very large amounts of force, albeit for a comparatively short time. This has significant implications for a small nation state like Singapore with a comparatively small armed forces and which has neither the numbers, mass, and endurance in the traditional sense. It is often said that the ultimate objective of any military organisation is not to win wars but to avert them at all costs. The effectiveness of the policy of deterrence adopted by the SAF therefore lies in its true capability and capacity to deter and successfully defend the country competently against potential aggressors with minimal costs. Our commitment to technology is therefore self-explanatory.*

*This essay will study the impact and consequences of the technology that has been introduced to the SAF. This essay will also examine how our country's investment and growing dependence on information technology (IT), with its tremendous advances and growth in recent years, has drawn the military into the information age; and compels us to look into the subject of information warfare with greater urgency and scrutiny.*

## Smarter Weapons Require Fewer, Smarter Soldiers

The continual push towards the use of more sophisticated and automated military hardware in the SAF over the years was soon overtaken by the realisation that although the use of new technologies required fewer operators, they had to be better educated and better trained. In short, the popular description of high tech equipment and weaponry (smart weapons) as "idiot proof" or "being designed by geniuses to be operated by idiots"<sup>1</sup> is far from true.

The SAF competes with the rest of society for the necessary talents needed to manage, operate, and support its military hardware. Therefore the complexity of today's weapon systems translates directly not only to higher capital costs but to higher labour costs. Fewer people meant a bigger need for smart weapons with the SAF having to go through great lengths to ensure the safety of these weapons before committing them to combat. Smart weapons therefore require fewer but smarter soldiers to use and to support them in order to be a true force multiplier'. Technology, therefore, has made us more efficient.

## Less On The Frontline, More At The Back

The procurement of modern highly computerised military hardware (e.g. the MILAN anti-tank missile system, F16-C/D multi-role fighters and the *Harpoon* surface to surface missile system); and the research and development of our very own weapons, for example the FH 88 and FH 2000 155mm howitzers guns and the *Fearless Class* naval patrol vessels are often perceived to give the SAF the apparent cutting edge in fighting capability and capacity. What is not apparent is the increased need for non-combatant support personnel, like highly specialised technicians and logisticians. This is a significant impact that new technology has introduced. Although fewer trained personnel are required at the front, far more are needed behind it. The number of nominally non-combatant personnel necessary to make the new weapons effective has been growing in concert with the new capabilities we have acquired. Most of today's smart weapons

have not only multiple roles but distinct and often narrowly defined missions and tasks that must be monitored, evaluated and integrated. The operational and support requirements of such sophisticated, computerised weapon systems are far more demanding than for the simpler systems of the past. Over time, our training infrastructures (institutions, simulators and other training facilities) were consistently upgraded and new facilities added. Our manpower policies were constantly revised and more logistical support agencies were commercialised for greater productivity.

The increased number of non-combatant support personnel provided the main reason for us to standardise our weapons as one direct consequence. For example the 76mm *OTO Melara* Super Rapid naval gun is used across three classes of ships. Institutional expertise is more effectively passed between trained operators of the upgraded equipment than between untrained operators of completely new equipment. Support agencies have been established for upgraded equipment thereby reducing the need to create new agencies. In order to reduce the growing costs of training and support for newer systems, we have found it cost more effective to upgrade our existing hardware than simply buy them fresh off the shelf. We have successfully upgraded our ageing A-4 *Skyhawks* and F-5 fighter planes with more powerful engines and up-to-date advanced avionics that has helped extend their capabilities. The upgrading of our first generation Missile Gun Boats with modern C3I and EW capability as well as shipboard weapons' and missile control systems has helped to extend their operational life-spans. We gave our AMX 13 light tanks more powerful engines and better navigational controls to increase their speed and mobility on the field.

## **The Transfer of Technology**

The price of military technology has fallen in relative terms as the purchasing power of countries increases with their growing economies and as more sophisticated military technologies, especially IT, are used in the civilian world thereby increasing research and development, and greater demand. Lower technologies, prices meant any military could buy sophisticated technology off the shelf at a fraction of the price that it would have cost had it been custom-built. However, few of these off-the-shelf solutions are ever comprehensive enough to meet our stringent requirements and local conditions. In this respect, we have found it necessary to be proficient in not merely operating the systems but to also acquire the underlying technologies that created such systems. A few notable examples include the acquisition of the design, engineering and technical expertise to build small naval ships and field artillery pieces that are custom designed for our local conditions. The first ships in our *Victory* class Missile Corvettes (MCVs) and in our *Bedok* Class Minehunters (MCMVs) were built overseas while the rest were built locally. This acquired capability not only increased our capacity to carry out our tasks, it has also helped us stay cost efficient given the limited capital that was allocated for defence spending which never exceed 6% of our GDP as a matter of policy.

Another important consequence is that the introduction and transfer of technology has spurred the development and growth of our own local defence industry. The Defence Technology Group (DTG) of companies and organisations are principally government-funded organisations that have brought together the best and brightest research scientists and engineers in the country. Their principal role is to search, tender or design new military technologies to meet our various projected plans. Such organisations include the Defence Science Organisation National Laboratories (R & D), Defence Materials Organisation (Procurement and Implementation), Singapore Aerospace and the logistics departments of the three services. The highly distinct role of each organisation and the high level of integration amongst the three services have averted inter-service rivalries and helped to pool all relevant expertise together into a cohesive and productive entity.

## **The Impact On Our Training Systems**

The latest computerised weapons systems being introduced to the SAF today are highly specialised and platform/type specific. A soldier will have to be cross-trained on multiple platforms if he is to be competent. The need to re-train and re-learn systems for a soldier as he progresses from one unit to the next is a principle problem encountered in the SAF. There should be time to consolidate, document and disseminate the institutional experience of the "Jack of all trades, master of none" phenomena in our soldiers, a major obstacle to achieving higher levels of professionalism.

The ever-growing diversity of systems led the SAF to consistently rethink our training system. We have differentiated between appointment specific and system specific training for the individual soldier. Over the years, concepts such as combat system specialisation (appointment specific training), type qualification training programs (equipment /system specific training) and the latest combat technical (CT) cross training schemes were introduced to cope with the ever increasing operational and technical knowledge demands that accompany newer systems.

## **The Impact of Information Technology (IT)**

Computers were developed to collect, store, process, communicate and present information (data). The rapid development of Information Technology (IT) in recent years resulted in ever-sophisticated computer systems that are becoming faster, smaller and more reliable. As a result, the rate and nature of computerisation in the SAF has increased in practically all fields of operations. Sophisticated computers have been integrated in our C3I systems, combat systems and in every office and workplace. Many of our previously menial and repetitive tasks have been automated with the help of computers. In this sense, the use of Information Technology has changed our proven methods and challenged old traditions. Information as a valuable strategic resource is becoming more influential in the military in the information age just as manpower and capital have been so far.

Prime Minister, Mr Goh Chok Tong<sup>2</sup> mentioned that in order to stay ahead of the competition, Singapore must aim to have a knowledge-based economy; be a global services hub; and have strategic multinational-local corporation partnership and a skilful workforce. On the development of the knowledge economy as a key global trend which Singapore must prepare for, he noted that the new basis for wealth creation would be knowledge and intellectual capital, rather than traditional capital and labour. The role of IT plays a crucial role to achieving these aims. The government had introduced Singapore One and the IT2000 vision, which envisaged Singapore as an intelligent, wired and on-line city that would fulfil the key objectives that were mentioned earlier. The government has invested in extensive infrastructure development like the island wide broad-band cabling works connecting all homes in our housing estates to the high speed telecommunications backbone commonly referred to as the *information highway*.

IT had been introduced to and integrated in the curriculum in all our schools and academic institutions. With the growing prevalence of personal computers in homes and with more and more people having access to the Internet, information technology is common place if not intrusive. It has begun to shape our lifestyles in the way we communicate, work, do business or even shop. On this background, the SAF through national service has inherited a generation of IT exposed soldiers from society who will undoubtedly exert their influence in the military.

The resistance to change does exist in the SAF, as in all organisations. Therefore, as the extent of computerisation in the SAF continues to grow, the need to re-train or upgrade the knowledge of existing in-service personnel becomes important. We have addressed that, and upgrading courses and personal development courses have been developed of which IT training programs constitute a significant proportion. The bottom line is that we have grown to rely more and more on computer networks for the flow of essential information. Such dependence produces vulnerabilities as more of our military infrastructure becomes automated and inter-linked. Any attempt to exploit the vulnerabilities and our efforts to safeguard our classified military information have consequently drawn us to the concept of information warfare.

## **Intelligence**

The competition for information is not a new concept. It is as old as human conflict and as General Fogleman<sup>3</sup>, Chief of Staff USAF put it, "... virtually a defining characteristic of humanity". Nations, corporations, and individuals each seek to increase and protect their own store of information while trying to limit and penetrate an adversary's. At the grand strategy level, nations seek to acquire, exploit, and protect information in support of their objectives. This exploitation and protection can occur in the economic, political, or military arenas. Knowledge of the adversary's information is a means to enhance our own capabilities, degrade or counteract enemy capabilities, and protect our own assets, including our own

information."<sup>3</sup> Information about the enemy in war in the form of intelligence had been an important factor between victory and defeats in almost any war. The spectacular development of information technologies in this information age is transforming all military operations by providing commanders with information unprecedented in quantity and quality. General Fogleman added,

"The commander with the advantage in observing the battlespace, analysing events, and distributing information possesses a powerful, if not decisive, lever over the adversary. Quality information is the counter to the fog of war. Surveillance and reconnaissance are the principle powers of observation."

Dr. Myron Cramer<sup>4</sup>, Principle Research Scientist at the Georgia Tech Research Institute described information warfare as constituting of five elements, namely

- **Information collection.** The SAF just like any other organisation needs a variety of information to support its operations. These needs include planning of activities, executing of plans, monitoring progress and reporting of results. Information collection includes the entry points for information from both internal and external sources. The use of advanced telecommunications and information technologies have helped us to gather real time data from the field while increasing quantity and quality for analysis.
- **Information protection.** With this increased dependency on computers, we have adopted a cautious approach to the use of IT in the military. Information protection has become a top priority as we have identified right from the start that the biggest challenge that IT has brought about is the issue of COMPUSEC or computer security. Extensive and deliberate measures and tests were taken and conducted in the design and construction of computer networks.
- **Information denial.** All possible storage mediums and all telecommunications devices were strictly monitored and controlled. Such stringent protective measures constitute our basic policy of information denial. Information management. Increased computational power with more sophisticated custom designed software in computers have brought mainframe level capability to the desktop enabling us to manage our information.
- **Information transport.** Various information systems developed by external agencies like the Systems and Computer Organisation (SCO) and the National Computer Board (NCB) are validated internally. A good example of such a system is our Logistic Management System (LMIS) which is a real time centrally stored database of logistics information that has improved productivity by increasing the speed of processing logistical requests, servicing and accounting.

## Shaping Our Organisation Structure and Culture

The SAF, like any military, is more than a collection of people and technologies. The internal composite formations are highly structured, hierarchical, interdependent, and highly complex. Major changes in the nature and quality of weapons, communication and control systems have long-term and transformational effects that are difficult to understand. They are unlikely to be fully tested until irreversibly committed in combat. Our commitment to the use of technology is backed by such innate consciousness of the magnitude of the potential impact and forces us to consistently rethink and update our existing organisational structures, operation, training and logistic doctrines to ensure their relevancy and viability.

To highlight a few examples, the introduction and the increased reliance on the Global Positioning Systems (GPS) and the Electronic Chart Systems (ECDIS) for example can result in a subtle erosion of navigation fundamentals in the Navy if our training system is not structured to balance the need between imparting fundamental and specialised knowledge.<sup>5</sup> The introduction of our advanced simulators for a myriad of military equipment ranging from tanks, to ships, to aircraft has valued added and changed our approach to training. Technology has also made certain field positions redundant, unmanned airborne vehicles, remotely piloted vehicles, sophisticated C3I and data communications and data link will make physical presence on the field unnecessary. As another example, advances in telecommunications have resulted in easier remote communications via the use of hand-phones and wireless modems etc. The size of such gadgets has also been reduced dramatically over the past few years. Such commercial innovations will make a mockery of<sup>6</sup>

existing concepts<sup>6</sup> of Operational and Communications Security if our system is not robust enough to adapt to such changes.

Information technology on the other hand has increased the pace of formalisation in the SAF. Formalisation refers to the degree to which written military doctrines, policies, rules, procedures, job descriptions, and other documents specify what actions are (or are not) to be taken under a given set of circumstances. The use of computers has speed up our process of documentation and made our information management more efficient. Many of our military formations are already ISO certified with more in the process of doing so. Too much formalisation however can stifle an organisation. It is perhaps inevitable that the span of control in the SAF will have to be more broad based. In other words, like most organisations that have committed themselves to information technology, the SAF's organisational structure will be more networked than hierarchical. Information in the form of visions, directions and orders will go via multiple routes through fewer command levels with increased lateral flow thereby increasing transparency and responsiveness of the SAF to changes and to meet dynamic challenges.

The use of technology especially IT on the ground has changed lifestyles. The e-mail has replaced to a large extent official typed letters by post as a fast, efficient and effective way to communicate between persons and agencies. Computers have become indispensable tools in word processing, data processing and presentations, not unlike any other organisation. Automation has resulted in more user friendly combat systems that has helped reduced training time and at the same time valued added the combat system with advance computer based features. With all this in perspective, the principle tasks of information protection can only become more difficult. Attacks on our information systems constitute a real threat. Cases of virus attack, e-mail bombs and suspected hacking into our systems are emerging as worrying new threats, which we will have to address swiftly and decisively.

## **The Shape of Things to Come**

On a larger perspective, technology will continue to advance and it will be broad based in many fields as it has always been. We are beginning to witness the use of non-traditional technologies being used for military purposes. General Colin Powell<sup>5</sup> defined it as, "War by other means, WBOM." Psychological operations (psyops), military deception, electronic warfare (EW) and economic warfare will gain greater eminence by their intrinsic association with technological sophistication. In the longer term, the possibilities and options for the military are endless and spectacular.

The moral and political debates aside, new technologies have radically altered the concept of how wars can be fought. The same political objective can be attained without the loss of lives, at minimal capital costs and with the battle-space anywhere inside cyberspace. Singapore with its world class telecommunications and IT infrastructure are potentially vulnerable in the information age. A sound and effective national defence cannot therefore be a pure military matter as other aspects of national defence in the form of psychological, social, economical and civil defence assumes greater prominence and equal importance. This has always been our 'Total Defence' Strategy.

## **Conclusion**

In this essay, the impact and consequences of technology on the military have been described vividly and many of the lessons learnt have been shared. The SAF will continue to keep pace and evolve with the advances in technology. While our principal role of being the military arm in the Total Defence of Singapore will not change, the means to fulfil our role will. Our operational, training and logistical policies and doctrines will continue to evolve with each new technology introduced as the SAF continues to stay lean, fit and relevant.

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# Advancement in Simulation Technology and its Military Application

by CPT Boh Choun Kiat

*Simulation, which had for millennia been an ancillary part of the military, has now become a primary focus and, in the systems and budgets of the 21st century, will become the single most important element in the structure and planning of military establishments worldwide, not only in terms of training but also in missions and planning.*<sup>1</sup>

*Even in the era of dramatically reduced defense spending worldwide, simulation is one of the few areas of military budgeting that has not suffered as greatly as others, largely because simulators are used more and more heavily to replace traditional training with actual equipment.<sup>2</sup> Simulation now enables military planners to prepare and train their forces for the complex engagements of the future.<sup>3</sup> Advanced simulators are used to forecast, analyze and plan potential conflicts with degrees of precision that were impossible with previous generation technologies.*

*Emerging simulation technologies will enable manufacturers of the 21st century to build military and commercial systems faster, better and at lower cost than they can today.<sup>4</sup> With the current speed of technological development, it often seems that what is considered speculative today will be in prototype tomorrow and the hot market items before week's end.*<sup>2</sup>

## THE REVOLUTION

Simulation, the ability for powerful computers to mimic actual events, is expanding in four different ways.<sup>5</sup>

- Simulation is moving away from the huge, specialized systems of the past, as the necessary computer power is embedded in ever-smaller systems, first workstations and now personal computers.<sup>3,6,7</sup>
- Simulation is available to ever-growing number of users thanks to new networking technology, 4 which the industrial experts called Distributed Integrated Simulation (DIS).<sup>8</sup>
- The role of simulation is expanding beyond its most in computer-based training into new functions such as mission rehearsal, acquisition and planning support, and decision support to the warfighter.<sup>5</sup>
- In direct response to the need for improved simulation technologies, a new generation of commercial-off-the-shelf (COTS) tools has emerged.<sup>9</sup> These new tools enable military organizations, their suppliers, and other commercial manufacturers to simulate products or tactical environments quickly, efficiently, and at low cost.

## Moves To PC

The driving force behind these changes is the realization of the oldest mantra in defense procurement: Smaller, faster, and cheaper.<sup>6</sup> As a result, simulation is moving from large supercomputers to desktop solutions; switching from RISC-based Unix systems to Pentium-based Windows PCs; changing from big budget dome displays and 6-degree motion platforms to helmet-mounted displays, virtual reality glasses and less motion; even witnessing the emergence of an entirely new concept in display 3-Dimensions (3-D).<sup>7</sup>

## New Protocol Linkage

A few years ago, experts found a method of networking all existing and future military simulators together, regardless of level of fidelity or physical location, with capability to link with live military systems training at sea, in the air and on land.<sup>10</sup> All could be brought into a synthetic environment that ultimately would involve

everyone from the lowest rank to the chairman of the Joint Chief of Staff.<sup>8</sup> The first step towards this goal is Distributed Interactive Simulation (DIS), which enables an extended network of simulation through standardized protocols.<sup>9</sup> This system, while still in its early stages of development evolved to interface live, virtual and constructive players into a common virtual environment.<sup>10</sup> In the meantime, a new concept of protocols called Advanced Distributed Simulation (ADS) has emerged; this simply shows the speed at which simulation technologies are advancing.

## **A New Strategy**

Despite all other advances that normally would have held center stage, perhaps the most commanding is the advent of true interaction 3-D displays.<sup>11</sup> A growing number of 3-D tabletop displays have emerged.<sup>12</sup> The displays are remarkably simple and can provide a 3-D version of anything that an ordinary computer monitor can display.<sup>13</sup> System designers can use such systems for extremely realistic 3-D displays for mission planning and rehearsal purposes.<sup>14</sup> Users can create the scenario and see friendly and enemy forces and movements as they happen in a real-time helicopter view of a live battlefield, using data from ground, air and satellite sensors.<sup>15</sup> Military leaders could also use these systems to study enemy tactics to a degree never before possible.<sup>16</sup> Such a capability could help improve training methods and tactics development for battlefield commanders, and permit far greater realism in mission planning and rehearsal.

## **The COTS Revolution**

The new push for simulation has included a greater emphasis on commercial-off-the-shelf (COTS) components, which reduce acquisition and maintenance costs, promote system commonality and interoperability, and ease technology insertion.<sup>17</sup> COTS items have proven their ability to reduce the time and expense necessary to bring a simulation project to completion.<sup>18</sup> COTS systems help lower overall simulation and training costs by applying economical commercially developed technologies to a broad spectrum of military challenges.<sup>19</sup> While system hardware must still meet military standards, the software and basic system architecture can be derived and customized from existing and very cost effective commercial products.

"The main advantage is that you do not pay for technology development.<sup>20</sup> Bill Gates has done that for you".<sup>21</sup>

## **EXPANDING MILITARY MISSION**

As defense budgets shrink, world leaders recognize the military value and economic advantages of advanced simulation technologies.<sup>22</sup> The more successful militaries will enter the future battlefield with more sophisticated weapons, transportation, communications, and command and control technologies.<sup>23</sup> Military leaders must adjust quickly to ever-changing combat technology, yet reduce the time, cost, and risk of bringing these sophisticated new systems online.<sup>24</sup> The age of simulation has arrived.<sup>25</sup> And as budgetary and competitive pressures mount, planners are seeking virtual technologies that are more powerful, more flexible and far less expensive than the hand-coded heavy software of the past.

Computer simulation is one of the most potent and cost effective means to plan and train military forces, and deploys to meet an expanding range of mission assignments.<sup>26</sup> The first and most obvious use of this still developing technology, training, remains a primary mission for military simulators worldwide.<sup>27</sup> Due to complex and rapidly changing battlefield technology, as well as the need to gain readiness from tight training budgets, computer simulators routinely help train personnel to use new and existing weapons.

A logical extension of simulators is analysis to help plan future battlefield scenarios, evaluate weapon systems and test military decision-making.<sup>28</sup> Leaders learnt that by digitizing their forces and field experiences for simulations not only enriched their real-time knowledge of how a battle unfolded, but also helped train soldiers to fight more quickly, safely and effectively.<sup>29</sup> And leaders can only develop, test, train for, improve, coordinate, verify and implement all of this new technical complexities through

simulations. In some instances, the same displays and techniques that will make those simulations applicable at all levels of command, control, and engagement will also go into the real-world battlefield to help distill clarity from information chaos.<sup>16</sup>

Since today's simulators offer detailed models that users can test in realistic combat conditions, they can also help evaluate proposals for new or upgraded military systems through design, prototyping and testing. Engineers could fully design a system based on the same specifications that would be used by a manufacturer, then place it in a combat situation against known and suspected weapons and countermeasures. As the simulation progresses, the new weapon's capabilities and shortcomings could be assessed and adjusted as necessary. Engineers would thus have a fully 'field' tested and verified system in the simulator, thus significantly reducing the test and evaluation process. Besides, the user community would know its full capabilities and even start training its troop without having committed for procurement. This would significantly reduce procurement time, cost and training from the design phase to eventual deployment of the system.<sup>17</sup>

## THE BENEFITS OF SIMULATION

Simulation offers a number of advantages over some other forms of training such as classroom lectures, system drills or even field exercises. One of the most important is cost. Modern simulators are high-fidelity devices, which are able to accurately replicate all aspects of an operation. It follows that it is more cost effective to provide training to teach a pilot how to engage enemy aircraft with various missiles in a flight simulator, than it is to let him loose in an actual aircraft with a full load of missiles, after classroom training. Using simulators in training also reduces the maintenance cost on the real equipment. Cost can also be saved in terms of the networked simulators being able to link together simulators, which may be thousands of miles apart. Hence, joint exercises can then take place between forces, which do not need to leave their premises.

The second element to stem from the use of simulation is the ability for the instructor to control and monitor the student. This also saves costs but it can also increase training transfer effectiveness and shorten the training cycle. The student will be able to achieve expected level of competence before actually having hands-on the real thing. This gives the student and instructor the level of confidence that the student will be able to do it right from the very first time. A validation exercise done by the South African Army showed that students going through the gunnery training simulator achieved 30% to 40% quicker reaction time and 14% better first hit results than those who did not use the simulator.<sup>18</sup>

The third aspect of using simulation is its ability to cope with environmental limitations. Databases can be created which replicate non-local environments, which might be encountered on future deployment. Units and individuals can train at their home base without the need to travel to other areas located many miles away. This also allows units to undertake mission rehearsal exercises whereby in war, actual combat missions can be pre-fought.

The final benefit associated with simulation is concerned with safety. By improving the levels of training before allowing individuals to use actual equipment can only improve safety. This safety factor applies to the individual undergoing training, those around him on the exercise and finally, the safety of the actual equipment.

## MILITARY APPLICATIONS

To consider the simulation technologies in more depth demands us to look at some specific applications. The military training process may be viewed as a four-tier process. These four tiers to which the computer has added so much over the years are:

- individual training
- crew training

- Unit Training and finally Command-and-Tactics Training.

## Individual Training

One of the most popular mediums for individual training is Computer Based Training (CBT). This type of training is delivered on a desk-top computer, CBT provides a fully interactive environment which the student uses the computer to hear audio, observe dynamic graphics and watch video. CBT offers the ability to test the student at the end of each session and then records his results on a central file server. It is this server that the instructor can monitor each student's progress. Studies in the USA at the Illinois have shown that CBT is approximately 70% more effective than a conventional instructor. Its major benefit is its ability to interact with the student and simulate wide ranges of scenarios.

The use of flight simulators to train pilots how to fly their aircraft can be traced back to the beginning of flight itself. During the first decade of this century, the French engineers took a wine barrel and cut it in half laterally to make a cockpit. Mounted on the upturned bottom half, and then placed on a turntable, assistants could move the cockpit in accordance with the pilot's control inputs on the joystick. A crude approach but a very successful one. Over the past decade or so, commercial pressures and the continued growth in processing power allied to general simulation technologies have shaped military flight simulation. The modern flight simulator fully reflects the complexity of the aircraft that it is replicating. Sophisticated technologies have been brought together to provide a fidelity that is difficult to separate from the real aircraft.

## Crew Training

Crew training sees individuals brought together to operate as a team. A classic example of this type of training device would be the small arms trainer. Although good for marksmanship training, this narrow field of view did little for tactics but here too, increasing processing power came to the rescue; as well as the conventional marksmanship training aspect which teaches a soldier how to shoot, modern devices are also used to teach squad, fire team and section tactics as well as how to respond to a specific combat situation.

Today modern small arms trainer normally features a wide-angle screen onto which background and target images are projected. The number of backgrounds and targets are only limited by the storage space on the host computer. Any number of trainees could be linked to such a simulator. Each position is then linked to the instructor's operating station and from here, the instructor can observe the firer's aim picture and the fall of shot. These small arms simulators can accommodate different weapon types from pistols to anti-armor weapons. This allows section fire and movement drills to be carried out. Nearly all the key phases of battle may be simulated using the simulator, and that makes it an ideal system for preparing troops in actual situations and tactics development.

## Unit Training And Above

Historically, such training was undertaken in a large classroom where unit commanders and staff officers sat around a large map/model board. Units and sub-units were represented by models which were moved around the board by assistants. Enemy forces were also represented by models, were orchestrated by the enemy force cell in another room. This type of approach can only provide a limited environment in which to train.

The modern command and tactics trainers bear little resemblance to the system mentioned above. They make use of large computer networks and actual vehicle simulators, which are all linked into the main host computer. Depending on the type of trainer, it is possible for commanders to be in simulated command vehicles that fully replicate the vehicles they would use in operations. In addition, other simulated vehicles have crews who drive through the gaming database making the training far more realistic. Enemy forces can again be manned vehicles or what are known as computer-generated forces, whose actions are randomly determined by a computer or by another commander.

Technology, particularly in field of networking simulators, has led to the development of such trainers. Using Distributed Interactive Simulation protocols to link an unlimited number of stations such as vehicles, aircraft, command centres and observes, to allow all arms training to take place simultaneously.

## CONCLUSION

On the battlefield of the approaching century where intelligent new weapons systems will project lethal force with ever-increasing precision and efficiency, the technology of simulation will be the decisive factor that tips the balance between victory and defeat. Advances in military simulation is changing not only the way tomorrow's military personnel will train, but also nearly everything else that influences their military and civilian lives. Simulation may appear to be an expensive business but when all the factors are taken into account, it often proves to be the most efficient way of providing training and tactics development. Looking into the future, as the power of the micro processor grows, so will the capabilities of simulation. The future is clear; it's definitely digital.

Today, there is very little that cannot be simulated. Why is simulation so popular? The simple reasons are that simulation provides cost savings, protects the environment and assists in enhancing the realism of training. With such benefits, modern military commanders are embracing simulation with unparalleled. From individual training, through crew training to staff and formation training, simulation is now a fully accepted facet of training in modern military force.

*"In time of shrinking budgets, the temptation will always exist to reduce training expenditures because the tangible value of saving dollars is difficult to measure - difficult, that is, until a force inadequately prepared for the realities of combat is again sent into harm's way. The price paid for unpreparedness will not be in dollars, but in blood and sacrifice."*

- Gen. (Retired) Creighton Abrams<sup>19</sup>

*former Army Chief of Staff*

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# Yamashita and the Assault on Singapore: Was Yamashita's Success a Bluff that Worked or the Culmination of Calculated Risk Taking?

by LTA (NS) Toh Boon Ho

The Japanese victory in Singapore was unprecedented in its scale and magnitude.<sup>1</sup> In fact, the victory was so total that Winston Churchill billed it as "the worst disaster and largest capitulation in British history".<sup>1</sup> Yet, Lieutenant-General Yamashita Tomoyuki, who orchestrated his victory, claimed in a post-war admission that his victory was a bluff that worked by the narrowest of margins.<sup>2</sup> This notion flew in the face of his opponents, notably the British commander, Lieutenant-General A.E. Percival, who insisted that the Japanese won through sheer numerical superiority on the ground, in the air and on the seas.<sup>3</sup> Coupled to this view were excellent combat tactics employed by the Japanese with battle-hardened and experienced troops, which made victory a predictable result.<sup>2</sup> How do we reconcile these two contrasting and contradictory assessments?<sup>4</sup> It is the intention of this paper to evaluate the basis of these two conflicting theses and highlight the inadequacies of each as a credible explanation for the Japanese victory in Singapore.<sup>5</sup> The paper will then argue that the Japanese victory was more that just a bluff that worked, but the result of bold generalship that invariably had to respond to the frictions of war and ultimately depended on calculated risk-taking that paid dividends.

The thesis that Yamashita's victory was a close call that could easily have gone the other way was reflected in the following admission :

*My attack on Singapore was a bluff, a bluff that worked. I had 30,000 men and was outnumbered by more than three to one. I knew that if I had to fight long for Singapore I would be beaten. That is why the surrender had to be at once. I was very frightened all the time that the British would discover our numerical weakness and lack of supplies and force me into disastrous street fighting.*<sup>4</sup>

This bluff thesis first appeared in J.D Potter's *The Life and Death of a Japanese General* published in 1962.<sup>5</sup> In it, Potter claimed that for the assault on Singapore, Yamashita's forces were short of ammunition that each soldier had only a hundred rounds each.<sup>6</sup> In addition, his food supply situation was so acute that "in long battle he was almost certain to be defeated, for even his tow-bowls-a-rice troops would be reduced to a near-starvation level."<sup>6</sup>

The smoking gun was further augmented by the tantalising revelation of Major Kunitake Teruhito's memoirs published in Japanese in 1973 and quoted in Louise Allen's 1977 book, *Singapore 1941-42*.<sup>7</sup> In it, Kunitake wrote of "the extreme fatigue of the Japanese troops [on 15 February] and the feeling that the Japanese might be on the brink of *surrender*."<sup>7</sup> This view was reinforced by various post-war scholarly accounts.<sup>8</sup> C.M. Turnbull in her *A History of Singapore 1819-1975* published in 1977, claims that "Percival never realised the close margin between defeat and salvation."<sup>8</sup> She then asserted that Wavell made the claim that had Singapore held out for another month than it did, sufficient reinforcements would have arrived to drive back the Japanese.<sup>9</sup> Turnbull went on to state that "Yamashita and Tsuji considered that if the British had held on for three more days the Japanese would have been forced to call off their attack."<sup>9</sup>

Furthermore, the critical artillery ammunition was rapidly dwindling.<sup>10</sup> Tsuji Masanobu, the Chief of Operations and Planning Staff, 25th Army was of the opinion that "the success or failure in the attack on Singapore depended on the preparations made to get adequate supplies of ammunition to the front line in time for the attack."<sup>11</sup> It would seem then that the Japanese decision to totally rely on captured British food supplies<sup>12</sup> and their failure to stockpile adequate reserves of artillery ammunition were now manifesting themselves in the possibility of a major Japanese setback, if not possible defeat, in the battle for Singapore.<sup>13</sup>



The above observations are however misleading and misrepresent the actual events.<sup>14</sup> A 'bluff' is a deliberate deception intended to create the impression of a stronger position than one actually has.<sup>15</sup> No doubt Yamashita's critical shortage in artillery ammunition was masked by his decision to keep up the crescendo of artillery bombardment against the British positions in the battle for Singapore, which seemed to indicate the inexhaustible supply of shells available in the Japanese camp.<sup>14</sup> Even though artillery support was crucial, the Japanese had proved in their successful infantry assault on Bukit Timah that, armed with speed and surprise, an infantry attack unaided by artillery could very well succeed with acceptable losses.<sup>15</sup> At the same time, Yamashita did not intentionally inflate the number of troops under his command.<sup>16</sup> The inflated figure of Japanese forces attributed by British sources was largely due to the failure of British intelligence to grasp the actual enemy numbers ranged against them. More importantly, it was Percival's continued belief that the Japanese had thrown in five or even six of their most experienced divisions against his overstretched, exhausted and numerically inferior forces.<sup>16</sup> The employment of such numbers would also accord with his pre-war appreciation of a Japanese attack on Malaya and Singapore.<sup>17</sup> Thus, Percival was conditioned by his perceptions of what the Japanese would do if he *himself* was in their position, and not what the Japanese were *actually* doing or assessing Japanese actions on their own merits.<sup>18</sup> In this manner, Percival was evaluating Japanese actions through mirror imaging, with grave consequences.<sup>18</sup>

The scale of the stubborn British resistance also surprised the Japanese.<sup>19</sup> So did the intensity of their artillery bombardments as the battle dragged on just as the Japanese thought their enemy was at its last gasp.<sup>20</sup> Yamashita has expected the British to surrender after losing Malaya.<sup>21</sup> He then felt certain that Percival would surrender after losing the vital logistic dumps on Bukit Timah.<sup>22</sup> Hence, his offer of terms to Percival on 11 February.<sup>21</sup> Yet, British resistance persisted.<sup>23</sup> Had the British continued the stubborn resistance displayed in the last two days of fighting by engaging in street fighting for the city, it would have become necessary for Yamashita to await further ammunition supplies and perhaps even request troop reinforcements to launch the final assault on the city itself.<sup>22</sup> In addition, contrary to Potter's assertion that Japanese food supplies were dangerously low, this aspect of logistics was well-provided for after the capture of the vital British supply dumps at Bukit Timah on the 10th/11th February.<sup>24</sup> The real problem was Yamashita's lack of manpower for any possible street fighting in the city and the continued resilience of the British capacity for resistance that far exceeded Japanese expectations.<sup>25</sup> Thus, the bluff in the context of Yamashita's post-war admission was his ability to exact a British surrender with the forces he possessed *without* recourse to additional reinforcements to effect such a surrender.<sup>23</sup> Had Yamashita required reinforcements and additional supplies, he would most certainly have received them.<sup>24</sup> Southern Army had sent its Chief of Staff, Lieutenant-General Tsukada Osamu to Yamashita's headquarters on 23 January with voluminous notes on how to capture Singapore, which, invariably, infuriated Yamashita.<sup>25</sup> But such detailed concern highlighted the importance of Singapore in Japanese plans.<sup>26</sup> Higher command would certainly not refuse Yamashita's request if he so demanded.<sup>27</sup> The final capitulation of the British defences were never in doubt at this stage of the fight.<sup>28</sup> The only contention was the *timing* of the capitulation.<sup>29</sup> Therefore, Yamashita's post-war admission had been grossly misrepresented out of context.

In addressing Percival's failure to exercise the opportunity of salvation by taking advantage of Japanese logistic and manpower shortages<sup>26</sup>, one must bear in mind the real constraints he faced, and not expect him to do the impossible.<sup>30</sup> What the aforementioned writer - Potter, Turnbull and Kunitake - failed to understand was the very real problem Percival and his senior subordinates faced in exercising *any* form of control over the defenders.<sup>31</sup> Malaya Command was literally *disintegrating* under Percival.<sup>32</sup> The straggling and desertion problem was becoming too serious to ignore.<sup>27</sup> These problems undermined the fighting efficiency of the forces remaining in the line which was barely holding up with the numbers remaining.<sup>33</sup> Thus, even if the opportunity for salvation availed itself, Percival simply lacked the forces to launch an effective counterattack, especially when he faced problems finding the required numbers to man the defence perimeter.<sup>28</sup> In addition, Singapore was totally invested by the 14 February with the commencement of the Japanese assault on Sumatra.<sup>34</sup> From this point on, no ground, air or sea reinforcement of the beleaguered garrison could possibly get through.<sup>29</sup> Thus, the argument that Percival could have reversed his fate given the problems confronting the Japanese simply does not stand up to scrutiny.

The bankruptcy of the "bluff" thesis highlights the need for a better explanation to account for Yamashita's victory in Singapore.<sup>35</sup> What this paper proposes is the "calculated risks" thesis.<sup>30</sup> Throughout the campaign for Malaya and Singapore, Yamashita made conscious decisions based on calculated risks where it

mattered most.<sup>30</sup> These decisions were mostly borne out by their successful outcome.<sup>31</sup> For the battle of Singapore, this paper proposes four such decisions.

The first decision was the dedication of all rail transport for the carriage of artillery ammunition critically needed for the siege of Singapore.<sup>32</sup> This decision was taken at the expense of transporting food supplies.<sup>31</sup> Yet, this was not a foolhardy decision for Yamashita had taken the calculated risk that he could secure enough supplies from captured enemy rations to feed his entire army.<sup>32</sup> The conduct of his opponents had yet to disappoint him since retreating Commonwealth forces had the tendency to abandon large quantities of supplies in their hasty retreat southwards.<sup>33</sup> It was a well-taken risk for Yamashita had barely enough artillery shells for assaulting the final British defence perimeter on 15 February.<sup>33</sup>

The next calculated risk was the decision to take Bukit Timah on 10/11 February in an infantry assault without artillery support.<sup>34</sup> Rather than wait for the required number of artillery pieces to be floated across while the Causeway was being repaired, Yamashita decided to exploit the momentum of the assault by adopting the maxim of "hit them hard, hit them fast."<sup>35</sup> His rationale was to keep the Commonwealth defenders off-balance and deny them any form of respite to re-form and re-organise for the next dig in.<sup>36</sup> Through this bold calculation, Yamashita gained the crucial Bukit Timah heights and the important British supply dumps, which alleviated his food supply woes.

The third calculated risk was the assessment that Percival would not endanger the civilian population by subjecting them to the horrors of street fighting which would place Yamashita's numerical inferiority at a major disadvantage.<sup>35</sup> Percival had exhibited this trait in the Malayan campaign when he successively gave up Penang, Ipoh and more importantly, Kuala Lumpur without making a stand.<sup>37</sup> Kuala Lumpur was a major transportation hub that could act as a funnel to canalise the enemy and force it to fight a set-piece battle.<sup>38</sup> It was also a major base area for III Corps and the Royal Air Force (RAF), housing considerable military stores.<sup>39</sup> Yet, Percival had decided to give up without a fight after the Slim River disaster.<sup>36</sup> In effect, Percival was turning Kuala Lumpur into an 'open' city.<sup>40</sup> It was hoped that Percival would do the same in Singapore City.<sup>41</sup> To augment the chances of a British surrender, Yamashita decided to offer surrender terms after the successful capture of Bukit Timah, which dominated the city and where the bulk of the British supply depots were concentrated.<sup>37</sup> This occurred on 11 February.<sup>42</sup> The wording of the terms appealed to Percival's humanitarian nature.<sup>43</sup> Yamashita advised that

*... resistance is futile and merely increases the danger to the million civilian inhabitants without good reason, exposing them to infliction of pain by fire and sword .. If ... you continue resistance ... it will be difficult to bear with patience from a humanitarian point of view, and inevitably we must continue an intense attack against Singapore.*<sup>38</sup>

In other words, Yamashita was warning Percival of a potential sacking<sup>39</sup> of Singapore unless resistance ceased immediately.<sup>44</sup> Yamashita then kept up the pace of bombardment despite his critical shell shortage to impress upon Percival the futility of continued resistance.

While Yamashita held out the hope that Percival would surrender Singapore City without resorting to street fighting, he concurrently prepared plans for the last calculated risks, which constituted an all-out night attack by tanks and infantry scheduled for 15th February.<sup>40</sup> This was a gamble to utilise all the last remaining resources in his possession to force a British surrender.<sup>45</sup> Should this gamble fail and the Commonwealth defenders resort to bitter street fighting, Yamashita would be forced to call up additional ammunition supplies and even reinforcements to extinguish the last remnants of Commonwealth resistance.<sup>46</sup> Yet, Yamashita was counting on the shock delivered by his tanks and the pulverising artillery bombardment of his last remaining shell supply on the defenders to punch through the defence perimeter and pour right through the breach.<sup>47</sup> Yamashita was clearly counting on the shock value to so disorganise the defenders that they had no chance to re-form and establish a new defence perimeter within the city itself.<sup>48</sup> Yamashita would have placed considerable faith in his infantry to exploit the shock of the attack, infiltrate the defences to get behind the defence perimeter within the city.<sup>49</sup> In all likelihood, the<sup>50</sup> attack would have been successful had it taken place.<sup>51</sup> Major Cyril Wild, GSO II, III Indian Corps, concurred with the view that "had the attack gone in that night it would have broken clean through to the sea, splitting the garrison in tow."<sup>41</sup> Thus, Yamashita's bold decisions were borne out by their successful outcomes.<sup>52</sup>

In conclusion, the notion that Percival could have entirely reversed the situation had he known of the dire logistical and manpower situation of the Japanese through a strong counterattack with his numerical superiority has been disproved. The disintegration of Malaya Command and the abundant support readily available to a determined Yamashita to prosecute the campaign to its final conclusion made surrender the only realistic option available to Percival. What mattered most was that Yamashita took calculated risks and won out in the end. The decisions he took were not reckless gambles. He evaluated his chances carefully before undertaking them. Thus, the Japanese victory was a just reward of calculated risk-taking. Luck, it seemed, had favoured the bold.<sup>42</sup>

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1. **W. S. Churchill, *The Hinge of Fate* (London : Cassell, 1951), p. 81.**

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3. **A.E. Percival, *The War in Malaya* (London : Eyre & Spottiswoode, 1949), pp. 294-306.**

4. **Potter, *Life and Death*, p. 80.**

5. **Ibid., pp. 85, 88-89; M. H. Murfett, J.N. Miksic, B.P. Farrell & M.S. Chiang, *Between Two Oceans : A Military History of Singapore From First Settlement to Final British Withdrawal* (Singapore : Oxford University Press, 1999), pp. 341-342, 360.**

6. **Potter, *Life and Death*, p.77.**

7. **Emphasis mine. See Louise Allen, *Singapore 1941-1942* (London : Davis-Poynter Ltd ., 1977), p.174.**

8. **C. M. Turnbull, *A History of Singapore 1819-1975* (Kuala Lumpur : Oxford University Press, 1977) , p. 187.**

9. **Ibid. Regrettably, no references were indicated to show that the views were directly attributed to the three principles concerned. Both Allen and Turnbull left the above interpretations unchanged in revised editions of their books. See Allen, *Singapore 1941-1942* (London : Frank Cass & Co. Ltd., 1993), p. 174 and Turnbull, *A History of Singapore 1819-1988*, Second Edition (Singapore : Oxford University Press, 1989), p. 183.**

10. **US Army Center of Military History, Japanese Monograph no. 54, *Malaya Operations Record November 1941- March 1942*, p. 104; Tsuji Masanobu, *Japan's Greatest Victory, Britain's Worst Defeat* (Staplehurst : Spellmount Limited, 1997), pp. 212-213; Farrell, et al., *Between Two Oceans*, pp. 235, 341.**

11. **Tsuji, *Japan's Greatest Victory*, p. 154.**

12. **Ibid., p. 153.**

13. **Potter, *Life and Death*, pp. 79-80.**

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15. **Tsuji, *Japan's Greatest Victory*, pp.203-205.**

16. **Letter from Percival to General Douglas MacArthur, 1 October 1948, Percival Papers, Box 22, File 43; Percival, *War in Malaya*, p. 271; Potter, *Life and Death*, p. 89; Farrell, et al., *Between Two Oceans*, pp. 218, 228-29.**

17. **Ong Chit Chung, *Operation Matador : Britain's War Plans against the Japanese 1918-1941* (Singapore : Times Academic Press, 1997), pp. 70-71.**

18. **Farrell et al., *Between Two Oceans*, p. 343.**

19.Ibid., p. 236.

20.Ibid., p. 341.

21.Ibid., p. 216; Allen, *Singapore 1941-1942*, pp. 187-188.

22.Farrell, et al., *Between Two Oceans*, p. 342; Tsuji, *Japan's Greatest Victory*, p. 213. Stunned by the stubborn resistance, Tsuji was preparing a new contingency plan to engage in possible street fighting for the city's capture.

23.Farrell, et al., *Between Two Oceans*, p. 343.

24.Ibid., p. 342.

25.A. Swinsom, *Defeat in Malaya : The Fall of Singapore* (London : Macdonald & Co., 1970), p. 126.

26.Turnbull, *History of Singapore*, p. 187.

27.Farrell, et al., *Between Two Oceans*, pp. 230,344,359; C. Kinvig, *Scapegoat : General Percival of Singapore*(London : Brassey's1996), p. 210.

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29.S. W. Kirby, *The War Against Japan Volume I : The Loss of Singapore* (London : HMSO, 1957), P. 468.

30.Farrell, et at., *Between Two Oceans*, p. 343.

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32.Tsuji, *Japan's Greatest Victory*, p.154.

33.Ibid., p. 213; Potter, *Life and Deaths*, p. 85.

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36.Kirby, *War Against Japan*, p. 289.

37.Tsuji, *Japan's Greatest Victory*, p. 205.

38.Emphasis mine. Ibid., pp. 205-206.

39.Major C.H.D. Wild, Note on the Capitulation of Singapore, paragraph 21, 30 November 1945, Health Papers, Box p441, File LMH4; John Smyth, *Percival and the Tragedy of Singapore* (London : Macdonald & Co. Ltd., 1971), pp. 238-239; Farrell, et al., *Between Two Oceans*, p. 235; Kinvig, *Scapegoat*, p. 219.

40.Potter, *Life and Death*, p. 89; Farrell, et al., *Between Two Oceans*, pp. 342-343.

41.Wild, Note on the Capitulation of Singapore, paragraph 21, 30 November 1945; Allen, *Singapore 1941-1942*, p. 184; Farrell, et al., *Between Two Oceans*, p. 343.

42.Farrell, et al., *Between Two Oceans*, p. 175.

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# Geopolitics: The Need to Reconceptualise State Sovereignty and Security

*by LTA Seet Uei Lim*

In October of 1989, the Berlin Wall, in dramatic fashion, tumbled and crumbled.<sup>00</sup> With it the winds of change swept through Europe and most parts of the world, bringing an end to nearly half a century of tenuous near nuclear holocaust period<sup>0</sup> between two superpowers.<sup>00</sup> This end to bi-polarity contributed to the blurring of the internal and external distinctions of state functions, due in part to the lifting of ideological barriers, the lessening of overt external military threats, the opening up of previously closed command economies, combined with a new emphasis on sub-regional development and an intensification of intra-regional trade linkages, competition for resources, and growing inward investments.<sup>1</sup>

The evolution of the international political system coincided with significant geopolitical developments, such as:

- increasing global-scale interdependence in economic, monetary, technological, military, and ecological spheres (ie, new transboundary systems and dynamics symptomatic of an emerging though still incipient, global civilisation);
- the increasing capacity of humans to intervene in and alter Earth's life-sustaining processes (ie, new dynamics in human-Earth relations);
- the increasing capacity of present generations to jeopardise future life (ie, new dynamics in intergenerational relations); and new scientific paradigms and new knowledge about the way the Earth functions".<sup>200</sup> As such, some scholars have argued that there is a need to rethink state sovereignty and security at the end of the twentieth century.

The aim of this essay is to examine how these changes have necessitated the re-conceptualisation of statehood, sovereignty and security.<sup>0</sup> In so doing, these concepts will first be defined in order to set the parameters for discussion.

A state is a legal-political entity, which functions as the primary player in international relations. To qualify for statehood, the following criteria should be met:<sup>3</sup>

- a particular defined territory;
- a permanent resident population;
- a constituted effective government;
- formal and real independence;
- sovereignty;
- recognition by other states in the international system of states;
- the expectation of permanence;
- the capacity to enter into relations with other states;
- a state apparatus; a circulation system;
- an organised economy;
- various 'fictional parts' of states, such as the official residences of foreign diplomatic envoys".<sup>3</sup>

In geopolitical terms, perhaps the most critical quality of statehood is territory.<sup>00</sup> Although territory alone does not constitute statehood, statehood is first and foremost tied to territory.<sup>40</sup> For instance, many nationalist movements in Southeast Asia during the era of de-colonisation rallied national sentiments by evoking images of blood-ties to the land, to mobilise mass support against the European imperialists and alien immigrants (Chinese and Indians).<sup>00</sup>

However, territory alone does not complete the picture. Sovereignty as a legal presumption elevates mere territories to the status of statehood by empowering it with the right to exercise the functions of a state to the exclusion of others, and conferring upon it the recognition and acceptance of other states in the international political system. The above definition of sovereignty implies "competency to control the territory and its contents and also relationships with other states through the totality of powers that state, under international law, have and may use".<sup>5</sup> For example, it is the quality of sovereignty that distinguishes states from nations. As in the case of the Palestinians, though significant portions of territories are occupied in the West Bank and Gaza Strip, it nonetheless is not accorded the recognition of statehood because its nationhood is subsumed under the sovereignty of Israel.

The above example of the Palestinian-Israeli conflict highlight an important aspect of statehood, namely, internal and external forces may challenge sovereignty. This point addresses the concept of state security. The term security is ubiquitous, as evident in how governments usually proclaim national security as the highest stated value of their state's existence, if not its essential *raison d'être*.<sup>6</sup> Consequently, the term security is inherently ambiguous and openly contested, since its meaning is flexible and the object of many competing claims and attempts at definition. As such, security may be broadly defined as "a series of widely held desires to be free from threat".<sup>7</sup>

In attempting to define security, a geopolitical paradigm to aid conceptualising the term may be construed in the form of specifying an internal community in antithesis to an external threat. This is so because security is not an entirely objective matter of military force calculation or economic analysis, but also substantially about creating the political identity of the domestic community. Precisely in the process of creating external threats, a domestic 'self' is constructed in terms of security.<sup>8</sup>

Having defined the three concepts of statehood, sovereignty and security, attention will now be turned to the present debate calling for the re-conceptualisation of these concepts. In an age when Cold War zero-sum calculations have been laid to rest, and a sigh of relief heaved as the global community ushers in a "New World Order" of peace, co-operation and harmony, scholars have shifted their attention from Realist obsession with power politics to "softer" global political issues. The discussion will now focus on two "softer issues" - globalisation and the environment - and the bearing these phenomena have on prompting scholars to rethink state security and sovereignty. First, the discussion will centre on the re-conceptualisation of the term state security.

One reason for this volte-face is the emergence of globalisation. Globalisation may be broadly defined as the economic, political and cultural forces connecting and linking states in a web of interdependence. "As globalisation 'shrinks the political world', states and societies are becoming more tightly enmeshed in transnational networks and interactions. It was suggested that globalisation is reducing the state's capacity for effective action; that there are growing disjunctures between the ideology of independent, sovereign statehood and the actual practices of contemporary states and of politics more widely defined".<sup>9</sup>

For instance, it was pointed out that it is now increasingly difficult to find one fixed viewpoint or perspective from which to make sense of territorial sovereignty and distinguish between 'foreign' and 'domestic' affairs.<sup>10</sup> At present, this is reflected in the Asian currency crisis where the financial and political institutional weaknesses of a few (Thailand and Indonesia) have severely affected an entire region (East and Southeast Asia).

This phenomenon of globalisation has severe implications on the concept of state security. Borrowing again the preceding example, Singapore's economic security no longer depends on the viability of the home market alone, rather the concept has broadened to include the economic security of her neighbours and trade partners.<sup>11</sup>

Today, not just economic, but also conventional military security needs re-thinking. "In the nuclear age, with the possibility of major nuclear war ever present, it is clear that states are incapable of guaranteeing their citizens' safety".<sup>11</sup> This is especially true with the emergence of rogue states such as Iraq under the dictatorship of Saddam Hussein, who have weapons of mass destruction enough to wipe out the entire

human race, but lack institutional checks on his ambitions.<sup>10</sup> Arms proliferation is another post-Cold War problem, given the rise of 'black markets' and peripatetic arms dealers who are not accountable to national governments.<sup>11</sup> As such, "focusing on the mutual vulnerabilities of contemporary societies in the face of extended technological - and not just nuclear - warfare, the idea of common security challenged states to abandon the assumption that unilateral military measures offered the possibility of assuring national security".<sup>12</sup>

Thus, scholars have argued for the need to think in terms of global security, as opposed to state security, referring to matters that are at least in theory of common interest to all humanity.<sup>13</sup> Evidence of this already in the making includes International Organisations and regimes such as the World Trade Organisation, the Nuclear Non-proliferation Treaty and the recent United Nations efforts at banning landmines.

Another aspect of security to be re-thought in response to globalisation, is security in a stronger sense of communal or group identity (ethnic, religious, regional and national) .<sup>14</sup> This has arisen largely as a reaction to the increased speed of change, combined with economic problems, which has resulted in social tensions and insecurity; examples include the former Warsaw Pact members, Yugoslavia, and the former Soviet republics.

Having discussed globalisation as an impetus to re-conceptualising security, the spotlight now turns on the environment.<sup>15</sup> For the first time the human species at large is vulnerable.<sup>16</sup> We are now faced with a security problem of a new magnitude: how to secure all humanity against an as yet undefined and little understood threat to our existence - one we ourselves have started but may not be able to stop if we do not change our activities in time.<sup>15</sup> One need not look very far to grasp the gravity of the above statement.<sup>17</sup> Last year's haze is a case in point.<sup>18</sup> Forest fires in Sumatra not only affected neighbouring islands within its immediate radius, winds actually carried the smog as far north as Manila. In fact, one of the worst hit areas was the Klang valley in Malaysia. Thus, ecological security is a regional, if not global, concern because Mother Nature is no respecter of territorial boundaries.

"Re-thinking security along these lines requires a refusal of the metaphysics of domination and control.<sup>19</sup> Even more than in the case of military matters, neither economics nor ecological security can ultimately be ensured by violence, nor can they be ensured by the unilateral actions of a single state.<sup>20</sup> Instead they require international co-operation and a participatory politics".<sup>21</sup> To a certain extent, governments have heeded this cry for re-conceptualising security.<sup>22</sup> Witness the 1987 Montreal Protocol on *Substance that Deplete the Ozone Layer*, and the on-going efforts now at reducing CFC production to 50% of 1986 levels by the end of the century, and the myriad United Nations Environment Programme (UNEP) endeavours.

The above discussion on security has tremendous implications on the concept of statehood.<sup>23</sup> This is because radically re-thinking security inevitably has to deal with the role of states since the conventional discourse of security is all about states as the providers of security<sup>24</sup> . In dealing with the role of states, one cannot escape the question of sovereignty.<sup>25</sup> Thus the discussion now focuses on the need to re-conceptualise state sovereignty.

"Today, though absolute state sovereignty has proven to be a persistent myth, it is beginning to be challenged, especially in the face of several new realities"<sup>26</sup> is mentioned at the outset of this paper.<sup>27</sup> These new realities have awakened us to the realisation that we live in a world where national boundaries are like permeable membranes through which there is a flow of life between our own existence and that of the rest of the world's.<sup>28</sup> As such, "sovereignty needs to be re-conceptualised within a total-systems context as a dynamic process involving multi-spatial, multi-temporal, multi-species, and multi-systems interactions".<sup>29</sup>

In the case of globalisation, economic production and finance, as well as trade, are now increasingly organised and integrated on a transnational or global basis. As a result, these changes have undoubtedly weakened the control which states can exercise over activities within their territories.<sup>30</sup> This phenomenon may give rise to two sources weakening state sovereignty.



The first is a challenge to sovereignty from "above".<sup>21</sup> A case in point is the ailing economies of the Philippines, Thailand and Indonesia.<sup>22</sup> These economies have lost their sovereignty not only to the merciless forces of global currency markets and speculators, but also to the International Monetary Fund and the World Bank, which have literally forced these economies to swallow the bitter pill of rescue prescription.<sup>23</sup> This example highlights the crucial point that due to global inter-linkages, states are no longer capable of bailing themselves out of crisis, but are dependent on others for basic survival.

The second challenge to sovereignty is from "below".<sup>24</sup> Due to economic liberalisation and privatisation, the central institutions of the state may experience a relative loss of power to regions, cities and localities, and they may be bypassed altogether as local authorities forge their own international links.<sup>25</sup> Conversely, states frequently negotiate with multi-national corporations, as opposed to the respective sovereign state, as in the case of Prime Minister Mahathir Mohammed and Bill Gates on the construction of an informational super-corridor connecting the entire peninsular.

Ecological security poses another challenge to state sovereignty.<sup>26</sup> Firstly, "the Earth does not recognise sovereignty as we now know it. Existing concepts and systems of state sovereignty are incongruent, even antithetical, to the prerequisites for global ecological security".<sup>27</sup> For instance, the terrible destruction wrought by the *El Nino* effect on the west coasts of South America proves that the annihilating anger of nature refuses to confine itself to defined borders found on maps.

Secondly, environmental security requires at the very least, actions that will lead to some pooling of national sovereignties.<sup>28</sup> Examples of this have been mentioned earlier, but the point to note is, in the process of pooling national sovereignties, states necessarily have to sacrifice their prerogative right of autonomy, to the pedestal of global ecological security.

A corollary to this discussion of ecological security threatening state sovereignty is the fact that in the "absence of governmental leadership commensurate to the global scale of today's crises, people's movements have begun to assert leadership and to act across national borders on behalf of ecological security."<sup>29</sup> In doing so they have begun to form an invisible global policy that pays less and less attention to philosophies and declarations of state sovereignty".<sup>30</sup> One example of this is the Greenpeace movement and its powerful lobby power across the globe on a plethora of issues concerning the environment.<sup>31</sup> An example of its success was its opposition to the French nuclear testing in the Pacific atolls.

In short, in the process of transboundary initiatives and co-operations on issues of common concern, these non-governmental organisations have implicitly redefined sovereignty as shared responsibility for the fate of humans and of the Earth.<sup>32</sup>

Having laid out the arguments for the need to re-conceptualise statehood, sovereignty and security, one must be careful not to go to the extreme of asserting that we have already lost our sovereignty, and that the death of the state as a legal-political entity is imminent.<sup>33</sup> In fact, in some ways, the modern nation-state, with its sovereignty defined by familiar territorial boundaries, seem as firmly rooted as ever.<sup>34</sup> For instance, tax collectors are stopped at the border, immigrants are stopped at the same border and transnational linkages can still be arbitrarily snapped off by wide state powers.<sup>35</sup>

In the face of globalisation, although the concept of state security has somewhat altered, and that state sovereignty may have been encroached, states nonetheless continue to have new and crucial roles.<sup>36</sup> "With recurring crises, there is still covert protectionism and 'managed' rather than genuinely 'free' trade in many instances".<sup>37</sup> This is evident in the perpetual trade dispute between Japan and the United States over supposed unfair trade practices.<sup>38</sup> This example further alludes to the fact that states still view security in the traditional Realist, albeit altered, views of zero-sum calculations.

Moreover, although local authorities may have comparatively greater autonomy today, they nonetheless still operate within strictly defined and centrally imposed limits, and if serious conflicts of interest arise, the central authorities generally have the upper hand.<sup>39</sup> For instance, "most people accept the state's claims

to have a monopoly on the legitimate use of institutionalised lethal force.<sup>00</sup> Others who use armed force are "terrorists", and this is recognised by other states in international law".<sup>30</sup>

To conclude, at the end of the twentieth century, there are real geopolitical changes that have effected the need to re-conceptualise the concepts of statehood, sovereignty and security.<sup>00</sup> However, one must adopt a balanced view of these developments, and be slow to predict the obsolescence of state security or the demise of state sovereignty.<sup>00</sup> It is hoped that this discussion would provide a fresh perspective to rethink traditional paradigms, as an uncertain and nebulous future awaits.

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# Joint Vision 2010 : The Concept of Future Warfighting for the US Armed Forces and its Relevance to the SAF

by LTA Tay Gek Peng

*"Vision without action is merely a dream. Action without vision just passes the time. Vision with action can change the world."*

-Joel Arthur Barker

*In 1995, the United States Commission on Roles and Missions of the Armed Forces reported that during Operation Desert Storm, although each of the Services individually exhibited superb military capabilities, they were not operating well enough together as a joint fighting force.<sup>1</sup> The commission believed that this happened because there was no common vision to guide every Service in developing its capabilities and training its forces.<sup>2</sup> The commission went on to recommend that the Chairman of the United States Joint Chiefs of Staff (CJCS) should propose "a future joint warfighting vision to help guide Service force development efforts".<sup>1</sup>*

*CJCS, General John M. Shalikashvili, concurred with the recommendation and initiated the effort to formulate a vision for future joint operations.<sup>2</sup> In July 1996, this vision was eventually issued as **Joint Vision 2010** (JV 2010) with this message from General Shalikashvili:*

*"The nature of modern warfare demands that we fight as a joint team.<sup>3</sup> This was important yesterday, it is essential today, and it will be even more imperative tomorrow.<sup>4</sup> Joint Vision 2010 provides an operationally based template for the evolution of the Armed Forces for a challenging and uncertain future.<sup>5</sup> It must become a benchmark for Service and Unified Command visions".<sup>3</sup>*

*JV 2010 is the conceptual template for the US Armed Forces to channel human resources and leverage technological advances to achieve higher level of effectiveness in future joint operations. It aims to achieve dominance across the full range of military operations through the application of new operational concepts.<sup>6</sup> It provides a common direction for the Services in the US Armed Forces, Federal agencies, defence organisations and military-related industries to develop their unique capabilities within an integrated framework as they prepare to meet the future.<sup>4</sup>*

*The objective of this paper is to introduce the concepts of JV 2010 and discuss its relevance to the SAF.<sup>7</sup> The synopsis of JV 2010 aims to provide sufficient overview to this conceptual framework.<sup>8</sup> JV 2010 identifies "key enablers"<sup>5</sup> that will help develop new operational concepts as the central approach to future joint operations.<sup>9</sup> The main theme of discussion centres on the "key enablers" and how they may help to realise the new operational concepts.<sup>10</sup> It concludes with a discussion on how the vision can be put into action.*

## Joint Vision 2010

To achieve its objective, JV 2010 first identifies the factors expected to continue and the changes to be anticipated in future strategic environment.<sup>11</sup> Factors expected to remain constant include American goals and interests, as well as the missions, tasks and strategic concepts.<sup>12</sup> JV 2010 also recognises the crucial importance of maintaining the current high quality of its Armed Forces as the key to success in future operations.

Dynamic changes anticipated include growing importance of integration, not only among the Services but also within a multinational force, nature of America's potential adversaries, advancing technology, and

increasing significance of information superiority.<sup>6</sup> Among these dynamic changes, JV 2010 identifies technological innovation and information superiority as the two "key enablers" to its objective.<sup>7</sup>

With these two "key enablers" as its basis, JV 2010 goes on to develop four new operational concepts to provide the Services with a common operational framework.<sup>8</sup> They are:

- dominant manoeuvre
- precision engagement
- full dimensional protection, and
- focused logistics.

Each of these new operational concepts is not developed to work on its own, but to reinforce the others in order to achieve synergy on the battlefield.<sup>9</sup> With this synergy, JV 2010 hopes that the US Armed Forces will dominate any adversary and control any situation in any operation across the full range of military operations. This *Full Spectrum Dominance* is what JV 2010 aims to achieve for the US Armed Forces in the 21st century. 6

The importance of operating effectively and efficiently as an integrated force, as highlighted in JV 2010, has long been recognised in the SAF.<sup>10</sup> Chief of Defence Force, LT-GEN Bey Soo Khiang, re-emphasised its continual importance in his speech at the inauguration of the Tri-Service Staff Course<sup>7</sup> in October 1998 when he stated that this "will be the premise on which the SAF will operate".<sup>8</sup>

JV 2010, however, is not only a military strategy or doctrine. <sup>9</sup> It is a joint vision to guide each Service to harness the two identified "key enablers" and enhance its future operations, based on the four prescribed operational concepts, so that it can complement the others to achieve a common objective of the US Armed Forces.<sup>10</sup> This is the first time that the US Armed Forces has a joint vision.<sup>11</sup> It may provide an interesting insight for the SAF, especially when it plans for the concepts of future joint operations.<sup>12</sup> The two "key enablers" will be discussed next.

## TECHNOLOGICAL INNOVATION

JV 2010 presented technological innovation as one of the two "key enablers" that the US Armed Forces must integrate with innovative thinking in order to gain new joint operational capabilities.<sup>13</sup> For the SAF, the importance of harnessing technology effectively and efficiently as a force multiplier to compensate for its small size and limited resources has been constantly reiterated by its<sup>14</sup> leaders.<sup>11</sup>

JV 2010 focuses on four key technological areas

- long-range precision capability,
- smart weapon systems,
- low-observable/masking technologies, and
- information technologies.<sup>15</sup>

The following sections provide a brief introduction of the four technologies and the implications of their advances to future joint operations.<sup>16</sup>

Singapore may not have the resources to be a leader in the creation of the above defence technologies.<sup>17</sup> However, as Deputy Prime Minister and Minister of Defence, Dr Tony Tan Keng Yam, pointed out, it can be a leader in the application and integration of these technologies to our military operations.<sup>12</sup> Furthermore, history has provided numerous examples to highlight that it is the way people apply technology in their operational concepts and doctrine that proves more crucial in the battlefield than having the technology itself.<sup>13</sup> Hence, possible military applications of the four technologies and local efforts in developing or applying them are also discussed.

## Long-Range Precision Capability

Technological advances are expected to continue the trend towards improved precision. The potential of precision weapon systems had been well demonstrated during Operation Desert Storm. Examples include the guided bombs used for strategic bombings and the interceptions of the Iraqi Scud missiles by the US Patriot missiles. Global positioning systems, high-energy research, electromagnetic technology, and enhanced stand-off capabilities are expected to provide further accuracy and an even wider range of delivery options.<sup>14</sup> Such improvements will result in high survivability and increased combat power available from dispersed locations for use against specific objectives.

Having the edge in long-range precision capability will prove to be a force multiplier for the SAF. Increased precision will reduce the number of ammunition and sorties required to achieve the same objectives. This will be translated to reduction in manpower and storage space for operating, maintaining and storing these weapons. Added with long-range capability, survivability will be increased because warheads can be launched further away from enemy's defence lines. Reconnaissance activities can also be carried out at a safer distance, thus enhancing survivability too. Finally, this can also mean enhanced air surveillance and defence capability. An example is the recent deployment of the FPS-117, a modern 3-dimensional, long-range radar with high precision detection capabilities. It replaced the ITT RS 320 as the main radar used by the RSAF for the surveillance of Singapore's airspace.<sup>15</sup>

## Smart Weapon Systems

The future will also see a wider range of potential weapons effects, from less lethal to hard target kill, from sensor to directed energy weapons. Continuous leaps in computer storage capacity, advances in computer architecture and greater automation will allow microprocessors to be integrated into existing weapons, making them more intelligent. These weapon systems will be expected to analyse the environment and real-time battle situation, search likely target areas, detect and analyse targets, make attack decisions, select and dispense ammunitions, and report results.<sup>16</sup>

A recent local technological breakthrough that may lead to smarter weapons is DSO National Laboratories' development of the *Airborne Compute Engine* (ACE). ACE, is a super computer; the size of two slices of bread, for signal processing application under harsh and confined environments of airborne platforms. With a computing power of four 300 MHz Pentium II PCs, ACE can enhance the capability of SAF in many of its weapon systems.<sup>17</sup> For example, it might become a pilot's "electronic navigator" and increase a pilot's situation awareness of the battlefield. It might also be able to diagnose defects in the aircraft, take corrective actions, if any, during operations, and help maintainers troubleshoot the fault, thus reducing repair lead-time on ground.

## Low Observable/Masking Technologies

Advances in low observable technology and the ability to mask friendly forces are expected to continue as an important tool in military operations. Active radio frequency and next-generation passive infrared stealth capability may replace signature reduction techniques to enhance the ability to engage adversaries anywhere in the battlespace and improve the vehicle survivability.<sup>18</sup> Micro-miniaturisation will also promote signature reduction and greatly increase the capabilities available for individuals and small units.<sup>19</sup>

The ability of the SAF weapon systems to passively and actively manage or reduce their signatures is an important force multiplier too. It will strengthen its ability to accomplish surprise, reduce overall force requirements in many operations, and makes its forces less detectable. Low observable technologies have been applied to increasing number of SAF's weapon systems, from the large naval vessels to the small UAVs.

In this area, the SAF also seeks to tap the expertise of technologically advanced countries. The Singapore Defence Technology Distinguished Fellowship (SDTDF) is one of the means. In April 1998, the SDTDF was conferred upon retired Royal Swedish Navy officer RADM (Ret) Torbjorn Hultman, for his role in sharing Sweden's knowledge and expertise in advanced naval ship technologies with the RSN.

## Information and Systems Integration

JV 2010 expects future commanders to be provided with accurate and timely information and thus improve their ability to see, prioritise, assign, and assess information. It also foresees better performance of platforms, weapons, sensors, and people through fusion of intelligence from an integration of sensors, platforms, command organisations, and logistic support centres. Advances in computer processing, precise global positioning, and telecommunications will provide the capability to determine accurate locations of friendly and enemy forces, as well as to collect, process, and distribute relevant data to thousands of locations.

In Singapore, we are able to witness the ability of taxi operators to determine the locations of their own fleet of taxis and distribute relevant data to them. Likewise, the SAF commander will also receive relevant information like strength, location and level of ammunitions of friendly forces from all three Services. Furthermore, with data fusion from integrated sensors, intelligence on enemy forces can be collected and distributed to commanders. By harnessing these potentially available capabilities, the SAF commander will gain better situation awareness, and yield more accurate assessments in less time.

Current applications of information technology in SAF are numerous. MINDEF's island-wide office automation infrastructure; on-line computerised inventory management system where all store items are bar-coded; Automated Recall & Mobilisation System (ARMS); Logistics Management Information Systems (LMIS); Diagnostic Expert System Tool (DEST); and the sophisticated Command, Control, Communication and Intelligent (C3&I) systems jointly developed by CSO, SCO and DSO National Laboratories are just some examples. However, the challenge lies in information and system integration. This is certainly one important technological area that the SAF would like to continuously develop to enhance its operations as one integrated force.

Innovative application of information and system integration is the key to information superiority, the second of the two "key enablers". Information superiority will be discussed in the following sections.

## Information Superiority

"Know the enemy and know yourself; in a hundred battles you will never be in peril." This timeless piece of wisdom from Sun Tzu is about information superiority. JV 2010 defines information superiority, the second of the two "key enablers", as "the capability to collect, process, and disseminate an uninterrupted flow of information while exploiting or denying an adversary's ability to do the same." Information superiority has been an extremely important factor in the battlefields since ancient periods. This fact will not change in 2010. What will differ though, is broadened access to information and improvement in the speed and accuracy of collecting, processing and disseminating data brought about by advances in information-specific technologies.

The following sections describe how JV 2010 foresees information superiority will be achieved in 2010, based on the anticipated changes to the three components of information superiority - **information systems, relevant information, and information operations**. The importance of information superiority to the defence of Singapore cannot be understated. Its relevance to the SAF is also discussed.

## Information Systems

Information systems are the infrastructures and functions for collecting, processing, analysing, archiving, and disseminating information. Advances in technology have given rise to the potential of instant and

world-wide information exchange. This potential can be used to develop a battlespace information system that can provide the forces with timely and accurate information. This information will include audio, imagery, video, digitised mapping and command and control material.

With such an information system, future SAF commanders will most probably be able to receive accurate and timely intelligence about enemy locations and activities; networked data bases relating to the operations area and adversary capabilities; accurate, real-time friendly location and combat status; and a common "picture" of the battlespace.

Many of these information-specific technologies have already been well researched or developed by the DSO National Laboratories and its local and overseas collaborating partners. The synthetic aperture radar technology, radar signal processing, map processing system and unmanned aerial vehicles are some examples. Furthermore, the vision of IT2000, which aims to turn Singapore into an "Intelligent Island" with an advanced nation-wide information infrastructure in the early 21st century, will also propel any local development of similar defence information systems.

## **Relevant Information**

Relevant information is the full range of necessary information about friendly forces, the adversary, the operations area, and anything else that affects operational decision making. With such a battlespace information system that JV 2010 aims to develop, one expects information to reach an unprecedented level of timeliness, accuracy, relevance, usability, completeness, and brevity. The user will be able to choose what is needed to fulfil his specific requirements and see information that has already been processed, fused, analysed and filtered for that specific requirement.

An increased level of information technology means more information. However, the key word here is 'relevant'. Too much information can overload the user. The challenge to the SAF is to determine how much information is sufficient, how 'processed' the information should be, and what type of access to give to each level of decision makers. This will ensure information given to the user is optimised to allow more effective planning and execution of military operations.

## **Information Operations**

Information operations (IO) involve actions taken to defend one's own information and information systems (defensive IO) and to affect adversary information and information systems (offensive IO). Both defensive and offensive IOs will be required to achieve information superiority. Its contribution to a nation's defence in the future will be even more crucial as the importance of information superiority increases. IO can be conducted in both wartime and peacetime. Defensive IO is as important during peacetime as it is during wartime. It is evident that MINDEF takes defensive IO seriously even during peacetime. MSD's role in maintaining tight security measures will continue to play an important part in MINDEF's defensive IO.

Having looked at the two 'key enablers', the four new operational concepts will be discussed next.

## **NEW OPERATIONAL CONCEPTS**

The two 'key enablers' provide the basis for the development of the four new operational concepts. Each of the operational concepts, and the roles of technological innovation and superior information in making it possible, will be examined in the following sections.

### **Dominant Manoeuvre**

'Dominant manoeuvre' is "the multidimensional application of information, engagement, and mobility capabilities to position and employ widely dispersed joint air, land, sea, and space forces to accomplish the



assigned operational tasks".<sup>21</sup> It will allow the joint forces to gain a decisive advantage by controlling all dimensions of the battlespace. To achieve dominant manoeuvre, there must be shared information, interoperable equipment and high mobility among the Services and coalition members.

To achieve dominant manoeuvre for the SAF, all three services must operate together as one force, each understanding its roles in relation to the others. Common systems and standards must be used. Sensors, communications, and precision weapons will be integrated to realise a joint target engagement system. The joint and service commanders must have the full picture of the forces from all three services so that they can make better decisions over the employment of the joint target engagement system.

Shared information is an important requirement too. UAVs provide the capability to engage in battlefield surveillance and reconnaissance for all three services at a lower manpower cost, a capability that the SAF has long recognised.

## Precision Engagement

Precision engagement will enable joint forces from extended range to locate the objective or target, provide responsive command and control, generate the desired effect, assess the level of success, and retain the flexibility to re-engage with precision when required. JV 2010's direction is for precision engagement to build on current delivery accuracy and low observable technologies. It will use a wide variety of means, including very accurate aerial deliveries or air drops, discriminate weapon strikes, and precise, all-weather stand-off capability.

Local developments in synthetic aperture radar, signal processing and airborne computer engine technologies may enable smarter weapons to be guided by a joint surveillance and target acquisition radar. When all these systems are integrated with a battlefield information system, the effect of precision engagement will be achievable.

## Full-Dimensional Protection

The primary prerequisite for full-dimensional protection is to control the battlespace to ensure that friendly forces can maintain freedom of action during deployment, manoeuvre and engagement, while providing multi-layered defences for friendly forces and facilities.

Information superiority is identified as the technological leverage for full-dimensional protection in providing multi-dimensional awareness and assessment, as well as identification of all forces in the battlespace. Information warfare is required to support this effort by protecting the information systems and processes, while denying an adversary similar capabilities.

The SAF employs a multi-layered air defence policy that begins with the E-2C early warning airborne radar system down to the *Mistral* short-range air defence system. As part of our total defence concept, the Navy works closely with the Maritime and Port Authority, the Police Coast Guard and other maritime agencies to provide a comprehensive defence of Singapore's waters.<sup>22</sup> Singapore's full-dimensional protection also involves the protection of civilians.

In recent years, Lands and Estates Organisation (LEO) has also built up its expertise and capabilities in protective technologies, including SAF and HDB structures that are able to withstand explosive impacts. In fact, NATO noted that Singapore was the only nation that had actually done recent work related to the response of multi-storey buildings.<sup>23</sup> To accelerate local research and development (R&D) in protective technologies, LEO set up two research centres for protective technology jointly with the National University of Singapore and Nanyang Technological University in September 1998. The research centres will undertake advanced R&D projects such as protective structures, explosive storage safety, mechanical and electrical survival system, and camouflage and concealment.<sup>24</sup>

## Focused Logistics

To optimise each of the three preceding concepts, logistics must be responsive, flexible, and precise. Focused logistics will be the fusion of information, logistics, and transportation technologies to provide rapid crisis response, to track and shift assets even while enroute, and to deliver tailored logistics packages directly at the strategic, operational, and tactical level of operations.

Dominant manoeuvre, for example, requires joint forces of the future to be more mobile, versatile, and deployable from anywhere in the world. Hence, logistics must be able to support that requirement. This will be a challenge to the SAF, especially with its overseas detachment programmes in France, the United States and Australia, just to name a few.

In this field, the SAF has been working jointly and integrating with the civilian sector to reduce its manpower problems and to take advantage of advanced business practices, commercial economies, and global networks. One example is the commercialisation of some logistics and maintenance activities. While this works well during peacetime, there must be proper plans to ensure that logistics support do not become bottlenecked in future joint operations.

## Conclusion

The concepts of JV 2010, from its definition, objective, the two identified "key enablers", to the four prescribed new operational concepts, are introduced in this paper. The relevance of the two "key enablers" and the new operational concepts to the SAF is also discussed. Singapore's strategy to stay close to the leading edge technologies and move ahead in applying them to our weapon systems has given and will continue to provide the SAF with the cutting edge in the region.

JV 2010 provides a brief description of the implementation process as well. Six critical elements required to transform the operational concepts into joint capabilities are examined. They are:

- Dedicated, High Quality People,
- Innovative Leadership,
- Joint Doctrine,
- Joint Education and Training,
- Agile Organisations,
- Enhanced Material.

The new concepts will undergo an iterative assessment process by means of modelling, simulations, exercises, wargames, and seminars. This assessment process will result in refinement of the concepts and provide the basis for service leaders to determine necessary changes. The changes will be implemented through existing planning processes, doctrine development, and training and education systems. This is the process that JV 2010 prescribes in order for the vision to coalesce into new capabilities that will allow the US military to achieve Full Spectrum Dominance.

Since SAF aims to operate as an integrated armed force, it would not be surprising to know that it already has a joint vision of its own. This joint vision must form the backbone of the three services' visions. Every commander's place in this vision must be made known clearly to him. Such operational concepts must go through an iterative process of testing, assessment and refinement. The best experimental ground to test the concepts is joint military exercises, for it is the men, by whom the concepts will be implemented, who eventually make the difference in the battle. It will be much less costly to make any mistakes during these exercises than to realise them only too late in war. Thus, the importance of realistic joint military exercises cannot be overlooked. In short, a vision can only be as successful as its implementation.

## ENDNOTES

1 *Report of the Commission on Roles and Missions of the Armed Forces "Directions for Defense"*, 24 May 1995, 2-2.

2 Office of the Joint Chiefs of Staff, *Comments on Commission on Roles and Missions of the Armed Forces "Directions for Defense"*, 27 February 1995, Recommendation 2002, 3-2.

3 This message by the CJCS, was quoted in the forward of *Joint Vision 2010*, July 1996. A softcopy of *Joint Vision 2010* can be downloaded from <http://www.jwfc.js.mil/pages/FS/links.htm>.

4 Office of Joint Chiefs of Staff, *Joint Vision 2010*, July 1996, 1.

5 Joint Warfighting Centre, *Concept for Future Joint Operations - Expanding Joint Vision 2010*, May 1997, 87. A softcopy of *Concept for Future Joint Operations* can be downloaded from <http://www.jwfc.js.mil/pages/FS/links.htm>.

6 Joint Warfighting Centre, *Concept for Future Joint Operations - Expanding Joint Vision 2010*, May 1997, 90.

7 The Tri-Service Staff Course is only one example of the SAF's acknowledgement of an integrated armed force as the key factor for victory in modern warfare. With its inauguration, SAFTI Military Institute became the first military centre in the world with a truly tri-service officer training system at all levels.

8 The speech by CDF at the inauguration of the Tri-Service Staff Course on 6 October 1998 can be found at MINDEF Internet Web Service, <http://www.mindef.gov.sg/midpa/whatsnew/year98/October/6oct04.htm>.

9 At a briefing for members of the American Institute of Aeronautics and Astronautics (AIAA), Air Force Major General David A. Sawyer, Director for operational plans and interoperability in the Office of the Joint Chiefs of Staff, stressed that, "this is not a military strategy nor doctrine to predict force structure. This is a vision, the chairman's conceptual template for the future."

10 In the February 1997 issue of *Government Executive Magazine*, the article "Joint Vision 2010 Still Focusing" by Katherine McIntire Peters quoted Brigadier-General Robert Dees, Vice Director for operational plans and interoperability in the Office of the Joint Chiefs of Staff : "This is a paradigm shift. Never before have we had a joint vision."

11 One recent mention of the importance of technology as a force multiplier in the SAF can be found in the 1998 SAF Day Message, MINDEF Internet Web Service, <http://www.mindef.gov.sg/midpa/whatsnew/year98/Nov/04nov02.htm>. Another example is in the speech by Dr Tony Tan Keng Yam, Deputy Prime Minister and Minister of Defence, at the 1998 Defence Technology Prize / Defence Technology Training Awards Presentation Ceremony on 4 Nov 1998, MINDEF Internet Web Service, <http://www.mindef.gov.sg/midpa/whatsnew/year98/Nov/04nov02.htm>.

12 Speech by Dr Tony Tan Keng Yam, Deputy Prime Minister and Minister of Defence, at the 1998 Defence Technology Prize / Defence Technology Training Awards Presentation Ceremony on 4 Nov 1998, MINDEF Internet Web Service, <http://www.mindef.gov.sg/midpa/whatsnew/year98/Nov/04nov02.htm>.

13 CJCS, General Henry H. Shelton, highlighted two such historical examples in his speech at the General B. Erskine Distinguished Lecture Series on 23 February 1998. One of them is the defeat of the technologically and numerically superior Allies by the Germans at the beginning of World War II. His speech was published in the Fall 1998 issue of Full Spectrum, an on-line journal of Joint Vision 2010, at <http://www.jwfc.js.mil/PAGES/FS2/art1.htm>.

14 Office of Joint Chiefs of Staff, *Joint Vision 2010*, July 1996, 11.

**15** MINDEF Public Affairs, "Enhanced National Air Defence Capability", *MINDEF Singapore - News Releases*, 13 July 1998, <http://www.mindef.gov.sg/midpa/whatsnew/year98/July/13jul01.htm>.

**16** Joint Warfighting Centre, *Concept for Future Joint Operations - Expanding Joint Vision 2010*, May 1997, 26.

**17** "Building Up the SAF with the Best in Science and Technology", *Pioneer*, January 1999, 6.

**18** Joint Warfighting Centre, *Concept for Future Joint Operations - Expanding Joint Vision 2010*, May 1997, 25.

**19** Office of the Joint Chiefs of Staff, *Joint Vision 2010*, 1996, 13.

**20** Office of the Joint Chiefs of Staff, *Joint Vision 2010*, 1996, 16.

**21** Joint Vision 2010 recognizes space as the 4th dimension of defense. In fact, in his speech for the Air Force Association Annual Symposium on 18 October 1996, General Howell M. Estes III, Commander-in-Chief of United States Space Command and Commander of Air Force Space Command, emphasized that "it must be made clear that space is becoming, or some would say, space has become the 4th medium in which the military operates in the protection of our national security interests".

**22** Speech by Dr Tony Tan Keng Yam, Deputy Prime Minister and Minister of Defence, at the commissioning ceremony of RSN patrol vessels, RSS Freedom and RSS Independence, on 22 August 1998.

**23** MINDEF Public Affairs, "Military and HDB Structures Able to Withstand Explosive Impact", *MINDEF Singapore - News Releases*, 8 October 1998, <http://www.mindef.gov.sg/idpa/whatsnew/year98/October/08oct01.htm>.

**24** Speech by Mr Peter Ho, Permanent Secretary (Defence Development), at the signing ceremony for the MOU on the establishment of Protective Technology Centres on 29 September 1998.

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# Technological Capabilities of Our Defence Industries

by 2LT Eugene Yeo

*The first thing an independent state must have is a defence force.*

- Dr Goh Keng Swee

*Dr Goh Keng Swee made the above observation briefly after Singapore separated from Malaysia in August 1965. He recalled telling Mr Lee Kuan Yew, "You are a Prime Minister but you don't have any army." True enough, the army that Singapore did possess- all of two battalions- was two-thirds Malaysian and British. Southeast Asia was then among the most unstable regions in the world, and many questioned the viability of a small nation like Singapore possessing an armed force.<sup>1</sup>*

*Fortuitously, the decision to establish the Singapore Armed Forces was made quickly. However, being small, both in physical geography and population, a standing army was impossible. Instead Singapore adopted a citizen's army doctrine and an attitude towards external defence that could be compared to being a "poisonous shrimp", that there was the need to develop a fighting capability to the level of making Singapore sufficiently unpalatable for any aggressor to take a bite out of her. Limited by size and manpower, Singapore thus embarked on a policy of complementary use of technology to gain the edge in any battle.<sup>2</sup>*

*The importance of superior military technology leads to an exploration into the concept of technological capability. Technological capability is essentially a measurement of ability and capacity. It begins as the capacity to make the right choice of technology acquisition at a level appropriate to our circumstances. Most technology transfer actually takes place between developed nations. In developed countries, related products and processes exist, adaptable facilities are available, technical expertise is employable and a market is present or easily developed. Developing nations hunger for the same form of technology that is used in technologically advanced countries. However, in order for the technology to be properly utilised in recipient countries, the technology has to be selected, modified and developed for local conditions.<sup>3</sup>*

*Technological capability is also the capacity to assimilate the acquired technology into our local circumstances and utilise it accordingly. Hence, both long-range and short-range strategy should be considered by developing nations in the imports of technology. Through careful analysis of the feasibility of the technology transfer, it can be determined if the technology should be accepted or rejected. The technology may be deemed inappropriate for the country due to inefficient use of scarce resources. Hence, the capacity to dissect the knowledge aspect of the transferred technology through initial component-wise production of the product, followed by producing the entire product, is an important facet of technological capability. Finally, through innovations and enhancements to the transferred technology, the local industry may manufacture products of better quality and/or develop better methods of production, or superior means of application of the indigenous technology. This has positive externalities to the local technology base, both in software (people skills, knowledge and design) as well as hardware (machinery, process and product manufacture), and in turn enhances the technological capability of the industry. This capacity to create innovated products from transferred technology is the last but not least critical facet of technological capability, as it serves to renew the technological cycle. Products of higher technology can be imported as the capability increases.*

*In this paper, I shall discuss the rationale behind the emphasis placed on military technology transfer and technological capability in Singapore's defence force. This is followed by a quick look at the components of technological capability. As our defence industries are an embodiment of our technological capability, I will explore military technology with respect to our defence industries. I will show how military technological capability in the acquisition, assimilation and eventual generation of new indigenous technology in Singapore is demonstrated.*

## Why the Importance of Defence Technology?

Before one expounds on the relationship of technological capability with our defence force, one has to dwell on the vulnerabilities that led to the importance placed on defence technology. Technology is broadly defined to include both hardware (embodied in equipment, turn-key plants, instruments etc) and disembodied technology and human capital (technical services, technical data and design, human resources and managerial expertise. In November 1984, BG Lee Hsien Loong, then Political Secretary of Defence, said that the problems confronting small states were laid out.<sup>40</sup> Small states, like Singapore, have no strategic depth, no safe areas in which they can withdraw to nurture their strength and launch counter attacks. Hence, the capture of a city in Singapore's context would translate into the capture of Singapore itself.<sup>41</sup> This limitation results in a need to quickly and decisively push back the enemy. In addition, Singapore being the only island-state in Southeast Asia and its proximity to neighbouring territorial waters has relegated it to the status of a land-locked state with no economic zone that requires surveillance and protection. Surrounded by sea, Singapore is thus vulnerable to seaward attacks. Consequently, the Navy and Air Force have to upgrade technologically to better combat the enemy. As it is, sophisticated technology, like our E-2C Hawk-eyes, an effective *Aircraft Early Warning System* and our long range FH2000 field howitzers and Mistral missiles provide a wide defence envelope.<sup>42</sup> Our limited population of roughly 3 million, our only natural resource, poses a serious constraint in the build-up of a defence force, and prevents the establishment of a large standing army.

In the same speech, BG Lee stated that small nations must expect to be outnumbered militarily. It was not only a matter of troop strength but also mobilizable strength. They cannot field enormous armies nor can they easily replace forces lost in battle. They cannot command the output of a large industrial economy, or out-produce their enemies in war materials and thus win by attrition. Technology, the force multiplier, is the edge required to ensure success.

The last factor in assessing Singapore's perception of its strategic environment is the historical memories that contribute to its sense of vulnerability, and which has not been forgotten. A good example is "*Konfrontasi*," which had strongly influenced the government's perception of the external threat from our immediate neighbours to the north and south. Apart from the immediate concerns of the nation, external threats also increased Singapore's challenges. The Vietnamese occupation of Cambodia backed by Soviet power added to the external threats perceived by Singapore and led it to identify more closely with Thai security interests. Similarly, the consolidation of the Soviet-Vietnamese alliance and its spin-offs had increased Singapore's sense of vulnerability.

In view of the limitations of size, manpower and threats provided by our locality and enhanced by historical memories, Singapore had little choice but to depend on sophisticated technology to build up a credible armed force. This translated into an enthusiastic development of the defence industry in Singapore, emphasis in the training of defence staff, indigenous development of weapons and weapon systems and upgrading of current weapon systems.

## Framework of Technological Capability

In examining the concept of technological capability in Singapore with respect to the acquisition, development and application of military technology, I will view the defence industries from a commercial perspective, that of firms that are vulnerable to market forces. The rationale behind this is that the defence industries were established as commercial operations, not as ordnance departments within MINDEF and are also required to turn a profit. In this respect, the defence companies are treated no differently from other government-owned enterprises in Singapore - they either succeed or sink on the basis of their commercial viability. The insistence on profitability helps to keep defence costs within acceptable levels. No nation can survive if it allows its military expenditure to drive it to bankruptcy. Thus, the strategic value of the defence industries is based on this concept of commercialisation and profitability.

Without much further ado, let me define technological capability in the broadest conceptual framework.<sup>50</sup> I will adopt Lall's (1992) framework of national technological capabilities (NTC) and relate it crudely and

directly to technological capability as described above. Lall describes capabilities as being grouped under three broad headings: physical investment, human capital and technological effort.

## **Physical Investment**

In other words, physical investment is a "basic" capability, in that plant and equipment are clearly necessary for industry to exist, but it is the appropriateness and efficiency with which capital is utilised that is of greater interest. Without sufficient or correct physical resources, the inflow of foreign technology will result in negative effects on local technological efforts, as the ability to assimilate the technology is greatly diminished.

In the case of Singapore, without the proper physical equipment and tools, the defence industry would not be able to satisfy military needs, much less assimilate foreign technology.<sup>5</sup> An example would be the production of cartridges to be filled with ammunition.<sup>6</sup> An advisor to Dr Goh Keng Swee on the creation of a defence industry for Singapore, Sir Larry Hartnett recognised that the high humidity of the tropics would hinder production.<sup>7</sup> Tropical humidity dampens the ammunition being filled into cartridges.<sup>8</sup> In order to construct a dry room for filling operations, he visited the cold rooms in the British Naval Base and decided that this was the solution.<sup>9</sup> Thus, the physical investment, cold room housing was the appropriate capital that was required for assimilation of the technology to produce cartridges in-house.

Human capital is used broadly to include skills generated by formal education and training, and those created by on-the-job training and experience of technological activity and the legacy of inherited skills, attitudes and abilities. This comprises a broad spectrum of production; design and research work with firms, backed up by a technological infrastructure that provides information, standards and basic scientific knowledge.

Although the firms or the government can have a certain amount of control in the level of skills developed in human resource, much of the actual learning takes place on-the-job. For example, the creation of the Ordnance Development and Engineering (ODE) in 1973 required human capital in the creation of a design engineering team for indigenous weapons development.

## **Technological Effort**

The final component to technological capability relates to technological effort, which combines trained labour and physical capital to assimilate and improve upon the relevant technology, which will result in spill-over to domestic defence industries, and improve the technological capability of the military. Hence, the cycle continues.

Technological effort plays an instrumental role in the indigenous creation of new technology. Even if the appropriate physical resources and expertise were available, if a conscious effort to blend both factors to assimilate and create new technology was not present, then progress cannot be made. The framework presented serves to compartmentalise the concept of technological capability. However, in most cases, the lines separating one factor from another is thin if not transparent. The framework may be applied to the examples of technological capability in our defence industries that follow.

## **Importance of Technological Capability**

Most developing states begin the cycle of development from the initial import of defence materials from the developed countries, followed by the establishment of facilities for the maintenance and repair of imported arms and systems. Licenses are then negotiated for the domestic assembly of either a component of the whole weapons system or its sub-system. More sophisticated elements continue to be imported, though the simple components are locally manufactured. Through time and experience, the local industries accumulate enough knowledge to produce the entire system under license. Finally, the entire weapons system can be locally manufactured.<sup>6</sup>

Military technological capability dictates Singapore's choice of technology to be adopted, and its success in adapting the technology for local needs and refining the technology that equal or better the original. For example, Chartered Industries of Singapore (CIS) spent the early years entirely licence-manufacturing and subcontracting for foreign ordnance manufacturers. After fulfilling the SAF backlog of M-16 rifles, Colt Industries disallowed CIS to produce these rifles for export, other than for an 8-year limited production period. Thus, CIS started producing the SAR 80-assault rifle. However, the SAF would only accept 20,000 of them, and the design was outdated in the international market. Finally, CIS produced the Ultimex 100 Section Assault Weapon, an indigenous design that was extremely popular at important defence industry exhibitions. Technological capability was demonstrated by the capacity to assimilate the knowledge gained from manufacturing the M-16s and SAR 80s, and having the infrastructure and ability to eventually create a local design which far exceeded its original capabilities.<sup>7</sup>

In summary, the greater the military technological capability of Singapore, the shorter and steeper will be the learning curve with regards to the acquisition and utilisation of new technology. Singapore will also be more successful and efficient in assimilating the new technology and generating new indigenous technology and ideally, the transferred technology and/or indigenous technology will be better applied.

## **Technological Capability of our Defence Industries**

Defence industries in Singapore are the physical entities that source for and ultimately become a source of military technology, be it a licensed or local product. In other words, technological capability is embodied in the defence industries. The fourteen years from 1967 to 1980 saw the formation of the twelve core defence industries, including Singapore Food Industries and Unicorn International, the marketing arm that was to spearhead overseas defence sales.<sup>8</sup> The motivations for developing countries to invest in local defence industries are varied. One of the principal motivations, especially in the light of reduced availability of military assistance programs and hence the need to pay for expensive arms purchase is to reduce defence spending through domestic production. This also saves on foreign exchange. Technological spill-over to other facets of technology may lead to benefits to the civilian industry. Jobs and employment for professionals and industrial growth to support the defence industries are further benefits. The need to achieve self-sufficiency to reduce dependency on foreign suppliers, to avoid political strings attached as well as to pre-empt potential conflict that may occur is another motivating factor. For middle or regional powers in the developing world, a credible defence industry can also be an advantage in the swing of regional power.

In the 1986 Stockholm International Peace Research Institute (SIPRI)'s publication, *Arms Production in the Third World*, Michael Brzoska and Thomas Ohlson acknowledged that "Singapore's arms industry is the most diversified and capable in ASEAN."<sup>9</sup> As a matter of fact, Singapore has developed a highly advanced and integrated defence industrial complex.<sup>10</sup> Arms production was primarily a monopoly of the Western and Eastern blocs, due to their economic and technological potential. There is a trend, however, in the number of developing countries in the world who produce arms to meet both domestic requirements and export demands. Beginning with about four arms producers in the developing world in 1950 there exists today about 30 to 40 states among the developing nations that are involved in defence production. Singapore Technologies (ST) were initially set up to support the SAF against a backdrop of potentially destabilising developments in Southeast Asia in the late 1960s. Chartered Industries of Singapore (CIS) helped to equip the SAF but eventually went on to spawn Chartered Semiconductor Manufacturing (CSM). Singapore Shipbuilding and Engineering (SSE) now known as Singapore Technologies Shipbuilding & Engineering (ST Shipbuilding) came next in 1968. Ultimately, SSE played a major role in the building of missile corvettes for the Republic of Navy. Singapore Electronic and Engineering Ltd (SEEL), now known as ST Electronic and Engineering (ST E&E), was formed in 1969 and in 1971, Singapore Automotive Engineering (SAE), now known as Singapore Technologies Automotive (ST Auto) was formed to maintain SAF vehicles and tanks. Ordnance Development and Engineering (ODE) (precision engineering and production of medium calibre weapons), Allied Ordnance of Singapore (AOD) (marketing and manufacture of Bofors 40mm and 57mm guns), Singapore Food Industries (SFI) (to supply food to the SAF) and SAF Enterprises or SAFE (to sell basic durable items like watches and TVs to SAF personnel).<sup>10</sup>

CIS had to compete with imports and was competitive due to innovations Larry Hartnett introduced in ammunition production, and because of Singapore's low cost wages. The increase in the number of



technicians and engineers turned out by our universities and polytechnics, in response to the growing demand for these types of employees, worked in favour of the rapid growth of the local defence industry. CIS formed the core of the government's industrial effort, and the sale of weapons and ammunition to the Singapore government forms a decreasing proportion of its total sales even though total arms sales increased considerably over the years. What really promoted industrial development in Singapore, was the increase in the number of technical personnel. The nurturing of the country's pool of technical personnel became a priority, and soon the supply of products paralleled the increase in supply of manpower. With a zero base of expertise, CIS adopted the principle that every licensed production contract must include technology transfer and the appropriate training packages. CIS realised that in order to be able to develop defence products, it must initially evolve its technological capability from scratch.

Applying Lall's framework, CIS simultaneously built up her machinery and infrastructure to accommodate the transferred technology growth, as well as improve on the software side of technology- the skills and knowledge acquired from training packages. For starters, CIS adopted two core values, which have been adhered to this day.<sup>11</sup> All operations were to be technology driven and all products were to be of an uncompromising quality. CIS spent the early years entirely license-manufacturing and subcontracting for foreign ordnance manufacturer, to improve her software side of technological capability. In addition to the wide array of ammunition, there were also the production and assembly of fuses, and the assembly and parts manufacture of M-16 rifles and grenade launchers. But CIS never had any intention of remaining only a license-manufacturer or subcontractor. Slowly but surely, the proportion of subassemblies increased, with the objective of eventually achieving indigenous design and production capability. Therefore we can note a quick increase in the defence technological capability of CIS.

Another example of how technological capability was developed and eventually aiding further developments in technology is that of SAMCO.<sup>12</sup> Singapore Aerospace Maintenance Company (SAMCO), now known as ST Aerospace Engineering, was involved in the re-furbishment of the 60 mothballed ex-US Navy's A-4 Skyhawk fighter-bombers in 1979. This gave Singapore's fledgling aerospace industry the kind of experience that money could not buy. This was the enormous jump in technological capability. When the RSAF decided to replace its *Alouette* helicopters with *Bell Hueys*, SAMCO took the opportunity to develop its rotary wing capabilities, further extending RSAF's range of operations. Another milestone was reached as the RSAF lamented the poor engine power of the *Curtiss Wright* J-65 engine and that spare parts for the engine were difficult to obtain. Hence, the RSAF suffered frequent problems of not being able to utilise the *Skyhawks*. Mindef decided to upgrade the *Skyhawks* with General Electric's F404-GE-100D non-afterburning jet engines. Extensive changes to the airframe were made to accept the more powerful engine and air intakes were modified. The programme proved extremely successful. The sea-level climb rate of the *Skyhawks* increased from 8,000 feet per minute to 18,500 feet. The upgrade improved the plane's take-off weight and its payload capacity. This demonstrates how technological capability was developed by plunging headfirst into re-building and re-furbishing the old *Skyhawks*, and consequently gaining the experience necessary to upgrade the power requirements and defence performance of the planes.

## **A Further Example the Defence Science Organisation**

In his speech at the 1998 Defence Technology Prize and Defence Technology Training Awards Presentation Ceremony, Dr Tony Tan, Deputy Prime Minister and Minister for Defence opined that the rapid advances in technology have resulted in the development of weapon systems that are many times more effective than their predecessors. Forces equipped with such systems have done battle with numerically superior forces and achieved decisive victories. This was demonstrated in the Falkland War in 1982 and the Allied Nations in Operation *Desert Storm* in 1991. He gave further examples of the success of the Israeli Airforce in destroying some 80 Syrian fighters with the loss of only one aircraft in the air battle over the Bekaa Valley in 1982. The MiG-25s operated by Syrian Airforce were of the same technological level as the F-16s operated by the Israeli Airforce, but the Israeli Airforce had superior electronic counter measures that blinded the radar of the Syrian MiG-25s. Thus the decision to build a high tech armed force demanded a competent technological infrastructure to facilitate the smooth acquisition and assimilation of foreign military technology, as well as to develop weapon systems that will be optimised for operation by Singapore soldiers, in the requisite areas of operation.<sup>13</sup>

The range of development projects is wide, from hardware like the BIONIX armoured fighting vehicle to the new patrol Vessels for the Navy. Integration of various sensors, communication equipment, computers and weapons have made such platforms more potent than similar weapon systems available. The new class of patrol Vessels, the first of which was launched on 18 February 1995, marked a milestone in the maturing of local technological capability. RSS *Fearless* was the first major warship to be designed and built locally to meet the Navy's operational requirements. The Defence Technology Group of MINDEF was responsible for systems integration and for supplying the command control system.

BG Lee described the key role played by Defence Science Organisation (DSO) since its setting up by Dr Goh Keng Swee in 1972 towards enhancing the SAF's technological capability and hence military might.<sup>140</sup> In the seventies, DSO provided MINDEF with scientific and technological advice, thus enabling it to make intelligent decisions on new technologies for the SAF. In the eighties, DSO improved on the advanced hardware that the SAF acquired, such as the E-2C *Hawkeye*'s.<sup>141</sup> DSO in the nineties was occupied with collaborating on substantial foreign projects, broadening the technological capability of SAF. The positive externality from accomplishing these projects is not just the indigenously developed hardware, but the improved understanding by the people involved in the new systems developed. Thus, the software part of technological capability also improves. In fact, many of the scientists and engineers, after leaving DSO, took with them valuable experience, which enabled the building up of the Defence Technology Group and the defence industries.

## Conclusions & the Future

In conclusion, technological capability is essential in the assimilation and modification of technology to fit local needs, as well as in the creation of new indigenous technology. This capability of self-renewal, the process of gaining technological capability, enables one to achieve a higher plane of technology transfer and modification, which results in further expansion of software (human talent) and hardware (physical infrastructure). This technological capability is actualised in our defence industries, namely the Singapore Technologies Group (ST) and in the software cultivation of our Defence Science Organisation (DSO). The examples given above display the growth of our defence industries, and the improvement in aptitude for providing excellent weapons and services to the SAF, through a betterment of our technological capability. In retrospect, ST began as a defence-related entity but since defence-related industries are capital-intensive and knowledge-based, they provided the technological base from which ST ventured further afield. Furthermore, as the earliest companies in ST were formed to undertake ventures in non-existing areas, ST became accustomed to creating new industries, and not merely extending existing capacities.

As they grew from strength to strength, Singapore's defence industries realised that in order to remain commercially viable, they would have to leverage their skills and move into non-defence areas. The first stage of diversification saw the defence companies utilise their core competencies to explore non-defence areas and spinout their service components into stand-alone companies. The second stage of diversification saw an extension of the group's core competencies into riskier but more profitable areas like semi-conductors.

Thus we can see that technological capability in one area, does not exclude the venturing into other areas. Hence, with further commercialisation of ST's core expertise, our defence technological capability will be augmented by external inflows of technology from the private sector.

*We must maintain and improve upon what we inherit.*

- Lee Kuan Yew

## ENDNOTES

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