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**Effective Leadership:
Contextual and Invariant Dimensions**
by BG Ng Chee Khern

**The 3rd Generation RSAF:
Managing Transformational Tensions**
*by LTC Roland Ng, MAJ Liau Eng Soon, MAJ Poh Li San,
CPT Ng Boon Ching & LTA Timothy Ang*

Enhancing Integration in Transformation
*by LTC Tan Ying Kiat, MAJ Lee Siew Hui,
MAJ Aldrin Tan & CPT Tay Shulin*

RSAF in Operations Other Than War – The Challenges
*by LTC Yeong Chee Meng, MAJ Aaron Tan
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EDITORIAL

To be more flexible and capable of meeting new and evolving threats and tasks, the Singapore Armed Forces (SAF) has embarked on the journey to build the next generation force. The strength of this force will not be based on having more platforms or cutting-edge weapon systems alone, but its capabilities will be multiplied by the ability to work as an integrated force, so that the overall fighting system is much more capable than the sum of the individual parts.

In concert with the SAF's transformation efforts, the 3rd Generation Republic of Singapore Air Force (RSAF) is envisioned to be a full-spectrum, integrated force, networked as part of the wider 3rd Generation SAF. This 3rd Generation RSAF will see its scope expanding beyond traditional competencies in air defence and air superiority, to include an increasing role in shaping the surface battles from the air and orchestrating the employment of airpower to achieve the SAF's campaign objectives. The transformation will also allow for more scalable and flexible responses to peacetime Operations Other Than War (OOTW).

The four main building blocks for the 3rd Generation RSAF are Concepts, Technology & Force Structure, Organisation and People. Leadership will be a key component of the People building block in this transformation

journey, and in this issue, we are honoured to publish the article "*Effective Leadership: Contextual and Invariant Dimensions*" by our Chief of Air Force, BG Ng Chee Khern. In the article, BG Ng shares his thoughts on effective leadership as an art, and postulates that leaders do not become effective by having fixed formulas. Drawing from his own experience, he argues that both leadership and warfighting require a judicious mixture of principles to be effective. He then describes six contextual dimensions of leadership and discusses how the application of leadership principles may change with context. In the article, BG Ng also elaborates on five invariant dimensions of leadership that are not contingent on the situation and which all worthy leaders must pay attention to.

In view of the exciting developments in the RSAF, we are delighted to publish four articles contributed by a group of RSAF Officers led by COL Tam Peng Yew, Commander of Air Force Operations Group. Offering perspectives on some of the pertinent issues associated with the RSAF's transformation efforts, and centring on the theme "*Changing Paradigms to meet Future Challenges – the RSAF Perspectives of Transformation*", the articles cover key areas such as transformational tensions, integration efforts, full-spectrum operations (focusing on OOTW), and people development.

In “*The 3rd Generation RSAF: Managing Transformational Tensions*”, the authors provide an overarching framework on the management of potential tensions that may arise from 3rd Generation RSAF transformation efforts. The article first traces the evolution of the RSAF over different generations in order to contextualise the vision and the challenges of realising the 3rd Generation RSAF as a full-spectrum and integrated force. It then elaborates on three potential key tensions that may arise, and discusses how they can be balanced to facilitate the transformation efforts.

The 3rd Generation SAF is envisaged to be a joint military that synergises the various capabilities in the air, sea and land dimensions to achieve optimum effects. The next article “*Enhancing Integration in Transformation*” highlights the imperative for achieving such a level of jointness, as well as the need for the RSAF to be an integral part of this development. It discusses the importance of greater integration in the SAF from three perspectives, examines how enhanced integration can be achieved through joint concept and capability development, and proposes solutions for the challenges arising from these new initiatives to ensure that greater integration can indeed be successfully effected.

The article “*RSAF in Operations Other Than War (OOTW) – The Challenges*” outlines the issues in the areas of OOTW that need to be addressed as the RSAF participates in more OOTW operations as part of a full-spectrum force. Through case

studies, it highlights the multitude of operational and defence relations challenges involved in such operations, and discusses activities that may need to be conducted to improve the cultural quotient of deployed personnel. It also addresses the training and knowledge management requirements that may be necessary to ensure that the RSAF is operationally responsive and effective when called upon for OOTW operations.

To enable the RSAF to transform successfully into a 3rd Generation Air Force, the article “*A Reflection on Developing the 3rd Generation RSAF Airman*” emphasises on the need for a new generation of Airmen to be developed. It postulates that while the 3rd Generation Airman will need to remain strong in type and vocational knowledge, he will also need to possess a set of new attributes. The article then discusses on how these desired competencies and attributes can be developed using a requisite framework to better prepare the 3rd Generation Airman to operate in the 3rd Generation RSAF.

In this issue, we have published articles offering some perspectives on the RSAF’s transformation efforts. As the SAF’s transformation gathers momentum, we look forward to receiving and publishing more articles on this transformation journey from you.

We hope you will enjoy this issue. Happy reading!

Editor, *POINTER*

Effective Leadership: Contextual and Invariant Dimensions

by BG Ng Chee Khern



Introduction

The subject of leadership has received wide attention across many disciplines, ranging from management, history, economics and philosophy, just to name a few. Despite the attention, what leadership really is remains elusive. Defining leadership is not easy. It can be argued that the diversity of views exists because fundamentally, effective leadership is highly contextual in nature.

Leadership is an art and not a science – in the same way as warfighting is largely an art. In leadership, as in war and in art, there are no fixed formulas

to be effective. There is only good judgement and good taste. Dogmatic application of the principles of war usually leads to disastrous outcomes; great chefs do not produce great dishes by mechanically following cookbook recipes. Leaders do not become effective by having a fixed formula of seven habits for example. Leadership requires a judicious mixture of principles to be effective. Warfighting requires a judicious mixture of principles of war to win. In both cases, the best mixture of principles depends on the context.

To Clausewitz, war is a clash of human wills. Since it is a clash of human wills, war is difficult, the permutations

of action-reaction are endless. To me, leadership is the harmonisation of wills across various stakeholders, which include oneself, one's bosses, peers and followers. Harmonisation and alignment of human wills, which is what leadership seeks to do, is similarly difficult.

Contextual Dimensions of Leadership

In this article, six dimensions of leadership will be described and discussed, along with how the application of leadership principles may change with context. The first is the dimension of leadership and management. Leadership is about defining visions, setting ambitions for the organisation, looking ahead to the future, and conceiving initiatives to adapt to changing environments. In short, it deals with an organisation's purpose and produces change that brings it forward. Management is about maintaining control, allocating resources, implementing initiatives and working efficiently. It ensures that the organisation delivers its objectives within the stipulated time and budget. Some related views are that leadership entails problem identification, while management is primarily concerned with problem solving; management works within the system, whereas leadership works on the system; and leadership is about doing the right things, while management is about doing things right.

In most situations, one will need to apply a combination of leadership and management. How much of each is needed depends on the context in which one's unit operates. In a state of transformation and change as the SAF is in today, where we are in the process

of transiting into a vastly different force structure, leadership should be more emphasised. This is because of the need for creativity, imagination and 'thinking out of the box' to generate new ideas that will allow a breakthrough beyond current thinking borders. On the other hand, when the organisation is at a stage of consolidation and focusing on the safe operationalisation of new platforms and capabilities, as the RSAF was in the 1990s till a few years ago, management will take on greater significance. In this situation, one should avoid creating a state of flux and more rightly place his focus on achieving taskings safely and effectively, as was the case in the 1990s.

Secondly, the leadership and command dimension will be discussed. While the distinction between leadership and management has been given some attention in the SAF, or at least the RSAF, the distinction between leadership and command has not been given the same focus. One of the key constructs of leadership is 'leading by example' or 'leading from the front'. Leadership is largely about influence – influencing others by providing purpose, direction, inspiration and motivation. It involves persuading people to willingly endure hardships and undertake dangers that if left to themselves they would do their utmost to avoid. However, to command requires one to do more and also less than to lead and influence. Commanders are also expected to decide and exercise judgement, and in many ways, to perform a higher-order creative managerial function that seeks to direct and coordinate the effective use of military force. In real life, there is often no clearly right or wrong way of doing things, and more than one good reason usually exist to drive the conclusion in different directions. That is why judgement is needed: it is the

ability to think of many matters at once, in their interdependence, their related importance, and their consequences. In essence, command is an exercise of judgement to make the right decisions. High commanders may not exercise much leadership in the sense of directly influencing many others. This is the change over history noted by Keegan in his book *Mask of Command* between command in the modern era compared to command in the heroic ages, such as during the time of Alexander the Great, where the distinction between being a leader and being a commander was next to non-existent.

How much command and leadership is needed is again contextual. This article contends that at the tactical levels of the platoon and company for example, one would require more leadership than command. This is because at the junior levels, there is considerably less scope for decision-making, and more often than not, officers at these levels are mainly responsible for motivating people to achieve already specified objectives. However, as one moves from the tactical to the strategic level, the physical presence required to influence others is steadily reduced. As such, once he reaches the levels of the Division, Formation or Fleet for example, a bigger proportion of command over leadership will have to be exercised. While leadership and influence remain relevant, their part vis-à-vis command and decision-making will be significantly diminished. In fact, it may be that senior commanders who spend too much time on leadership and not enough on thinking and exercising judgement may well be doing so at the expense of the bigger strategic picture.

The third dimension is that of the intellect and the moral. Moral here refers to character, not morality. It is the

character qualities of a person and not the intellectual or physical qualities. This is what Napoleon meant when he said, “the moral is to the physical as three is to one”. Leadership is far more than just being clever and knowing what has to be done. It entails the moral and personality aspects of ethics, moral and physical courage, and daring and caring to do things. It is the willingness to overcome inertia and prevail against all obstacles, antagonists and doubters. It rests on the mentality and conviction that ultimately, all problems can be tackled and solved.

However, effective leadership is achieved not by focusing solely on the intellect or the moral. Rather, it comes with balancing intellect with the different aspects of the moral. A leader who is daring but stupid spells disaster; a leader who is clever but cowardly will be worthless; a leader who is daring but immoral is depraved; and a leader who is brave but irresolute will not prevail. In the SAF, while the role of intellect weighs strongly in our human resource practices, our ranking officers may not always be the most intelligent, as the organisation takes an equally serious view of our whole character. The SAF Officer’s motto *To Lead, To Excel and To Overcome* is not just a catchy phrase. It is the moral that this article speaks of.



The SAF Officer’s motto To Lead, To Excel and To Overcome is the moral that this article speaks of.

Fourthly, the dimension of command and staff competencies. Let me explain this by sharing my own experience. People have asked me about the difference between my present appointment as the Chief of Air Force, and my previous appointment as Director JOPD and concurrently the Chief of Staff (Air Staff). My answer has been that as DJOPD and COS(AS), even though I had a strong role in many of the recommendations submitted to CDF and CAF from the staff departments, they have to “carry” the decisions more than I do. However, as the Chief of Air Force now, if policies implemented do not turn out as expected, I would be the one who have to face up to everyone affected in the RSAF, and answer for any failures to my bosses, my organisation and my people. The point is that leadership consists of a combination of command and staff competencies. The staff component is to think and recommend, while the command component is to decide, and bear the burden and consequences of the decision.

Ideally, a leader should be a strong commander and also have strong staff abilities. However, one can be a great leader without being a strong commander or have good staff or intellectual abilities. Some of us would have read the story of the Three Kingdoms, and we would know that Liu Bei was neither a very wise commander, nor a courageous warrior. Yet he was revered not only by the people of his time but also many generations after him. He was a leader who managed to attract the best commanders and the wisest counsellors to him. Counsellors such as Zhuge Liang and Pang Tong, commanders such as Guan Yu and

Zhang Fei, do his bidding. The point is, as if things are not complex enough, this article postulates that to be an effective leader, one does not always have to be the most talented person. Talented people will readily come as long as one is charismatic and shows that he recognises and appreciates talent.

The fifth contextual dimension of leadership is the upward, sideward and downward responsibilities. To illustrate, as the Chief of Air Force, I constantly engage my superiors in MINDEF HQ and CDF, informing them of my intentions, and seeking their consensus and directions. Sideward, I engage Joint Staff and the other Services, tabling papers at their meetings to inform them of Air Force developments, and building relationships through formal and less formal means. For instance, I have invited some senior officers from Joint Staff and the other Services to fly on the F16 to better understand the capabilities of the Air Force. Downward, I spend hours engaging Air Force personnel at all levels, holding a series of cascade briefings, dialogue sessions and squadron visits. While one may need to spend substantial time and effort to fulfil these responsibilities, I believe that it is necessary, as effective leaders manage not only superiors and peers, but also their subordinates.



Dialogue sessions & cascade briefings are ways of engaging personnel at all levels.

There is no magic ratio, however. One will need to find in his own situation the balance required across the three facets of responsibilities. For example, if one's unit is new or in a state of change, he should look upwards more to seek directions and agreement with his intended approach. If one is involved in developments that will affect the units or people around him, he should look sideward to ensure that he would not walk in isolation. If one is moving from a stage of conceptualisation to implementation, he should focus downward to secure the buy-in and support he needs from the people working under him. Ultimately, there will be many other considerations, and it is for one to decide what the right balance would be.

The sixth and final dimension of contextual leadership is none other than leadership style. This focuses on one's behaviour towards his subordinates. There are many ways of delineating leadership style, and one of the most widely used is the transactional and transformational models. The transactional model is largely the carrot-and-stick approach, and it prescribes the need for leaders to combine active-checking functions like those of a policeman, with passive-standby functions like those of a fireman. The transformational model hinges largely on the empowerment of subordinates through charismatic influence and intellectual stimulation by the leader. At the risk of stating the obvious, there is no one correct style. Transactional styles tend to be useful when there is no room for error or when the staff is not sufficiently competent, while transformational styles are more suited to inspire shared higher purpose and long-term commitment. As a leader, one will have to interact

with the situation to decide the most effective style to adopt for any given circumstance.

To recap, six dimensions of leadership that are contextual in nature have been covered. They are namely leadership and management, leadership and command, intellect and character, command and staff competencies, superior, peer and subordinate management, and lastly leadership style. The article will now move on to what I personally believe are the *sine qua non* or invariant dimensions of leadership – five particular fundamentals that are not contingent on the situation and that one must do at all times.

Invariant Dimensions of Leadership

The first fundamental is team-building. Team-building is the process of fostering trust amongst one's followers, building relationships with them, and influencing them through one's actions and behaviours rather than through formal authority. Treat people with respect and dignity, give meaning to what they are doing, and make a difference to their lives. There is an analogy that sums up this point quite nicely: good leaders are like the best conductors – they go beyond the notes to reach the magic in the players.



Team-building: the process of fostering trust, building relationships, and influencing one's followers through his actions and behaviours.

Secondly, coach and groom the next generation to bring out the best in them. Aim to develop leaders and not followers. Do not constrain people's potential simply because of the fear that they may outshine you. You will be amazed by how much they can do for you if you create the right environment for them to contribute. Look at your own experience. Many of you would remember that how well you did depended largely on how much your boss allowed you to contribute, how much he welcomed your contributions. Hence, how well your subordinates in turn do depends to a large extent on the environment you set for them. A senior SAF officer once made a remark that can be used in this context. He said that if you cannot make yourself useful, you should at least get out of the way. If you sometimes run out of good ideas, do not be afraid to let your subordinates flourish and take initiative. Give them your support and encouragement and they may pleasantly surprise you with how much they are capable of.

My personal preference towards coaching and grooming has been to adopt an inclusive approach that gives people the right-to-know, rather than stay exclusive based on the need-to-know. When giving directions and making decisions, explain the rationale so that the basis of your decisions are understood. I believe that one of the best ways to coach and groom people is to open up your thoughts to them. Some of you would have been involved in dialogue sessions with me or received long discursive emails and letters from me. You would know that in these sessions, emails and letters, I am usually candid and open with my thoughts.

While my efforts to share are time-consuming, I think they are necessary because of the coaching and grooming that is achieved through them.

Thirdly, it is important for one to maintain a high level of vigour and rigour, both intellectually and emotionally. One of the impetus behind the keep-SAF-young policy is to ensure that our leadership remains vigorous and dynamic. Being vigorous means that one keeps up his energy and enthusiasm levels, while being rigorous means that one pays close attention to the things he needs to do and strive for excellence and the best standards. Leadership is a tiring task, not helped by the sheer pace and tempo of things in the SAF. One must be prepared for situations where the drive to get things done can come only from within oneself.

Fourthly, good leaders stay optimistic and keep hopes alive. One may not realise it, but any feeling of negativity in him will easily be passed on to his people on the ground. In the face of adversity, one needs to maintain his composure, stay on top of the situation and not allow his emotions to get the better of him. To use the words of Napoleon again, "a leader is a dealer in hope". Subordinates will always look to their leader when the chips are down and when they need to find reasons to keep going.

The fifth fundamental is to demand standards and ensure proper follow-through. Demanding standards means that one does not let people get away with superficial or easy answers. It requires probing into things and not

simply going through the motion. The other aspect is the need to ensure proper follow-through. One significant trait, which distinguishes the military from the civilian sector, is that when an instruction is passed, we will always ensure that it is followed through. It is sometimes tempting to focus on the problems with the easier solutions because it takes too much to overcome the harder ones. However, in any venture of significance, the difficulties involved will be vast, people will have to be persuaded, their heartaches conquered and uncertainties mastered. Leadership is not only about taking them to where they want to go; more importantly, it is also about taking them to where they don't want to go but ought to go.

I have many other thoughts but I think these are sufficient for now. They are of course non-exhaustive, but in my opinion, the more significant ones.

Conclusion

Leadership is an arduous task. There is no scientific law or universal causal relationship that will allow

one to simply invoke a principle and everything falls in place. That will be too easy and it will devalue the whole notion of leadership. Instead, one will need to interact with the situation and decide on the relative weightage of the principles required in the given context. Besides the contextual dimensions, I have also described some of the more invariant dimensions that I believe all worthy leaders must pay attention to. I hope you have found my thoughts useful and refreshing.

Afternote

Leadership Styles across Cultures

One further observation on the contextual dimension of leadership is that because Chinese and Western conceptions of warfare are different, this may have resulted in styles of leadership that are dissimilar. The Western conception of warfare reflects Clausewitz's thinking, where war is a means to an end. It advocates meeting strength with strength, using maximum force and fighting a decisive battle, with the objective of imposing one's will on the enemy. On the other hand,



Clausewitz's thinking and Sun Tsu's ideas: Western and Chinese conceptions of warfare are different, this may have resulted in different styles of leadership.

the Chinese conception takes after Sun Tzu's ideas, where war is a necessary evil that has to be managed when it occurs. Chinese warfare emphasises the art of asymmetry and the use of minimum force, and the objective is to undermine the enemy's will more than to impose one's will. Different approaches should result in styles of leadership that vary across Western and Chinese leaders.

From the historical point of view, it may also be significant that Western wars were mostly fought to annihilate the enemy, or at least to the point that they succumbed to the invader's will. In contrast, Chinese wars tended to be 'civil wars', whose aims could be ideological

rather than physical. The enemy need not always be physically destroyed, and could often be persuaded to switch sides. It is thus arguable that the history of Western and Chinese warfare could have engendered the development of very different leadership styles. Western military commanders have looked at Chinese or more generally Oriental leaders as devious, even cowardly. Conversely, Chinese and Oriental leaders have looked at Western military leaders as unsubtle, even foolhardy and brutal. 🇸🇬

*This article is a reproduction of a speech by **BG Ng Chee Khern**, Chief of Air Force, at the Singapore Command and Staff College's Distinguished Speakers Programme on 19 January 2007.*



BG Ng Chee Khern assumed his current appointment as Chief of Air Force on 24 March 2006. A qualified F-16 and F-5 fighter pilot, he has served as Director of Joint Operations and Planning Directorate, Chief of Staff (Air Staff) and Commander of Tengah Air Base. BG Ng is a President's Scholar and SAF Overseas Scholar. He graduated with a Bachelor of Arts Degree in Philosophy, Politics and Economics, and a Master of Arts Degree from University of Oxford, U.K., and attained a Master in Public Administration from Harvard University, USA. BG Ng has also attended the prestigious Air Command and Staff College in the USA. For his significant contributions to Singapore and the SAF, BG Ng was awarded the Public Administration Medal (Gold)(Military) in 2005.

The 3rd Generation RSAF: Managing Transformational Tensions

by LTC Roland Ng, MAJ Liau Eng Soon, MAJ Poh Li San,
CPT Ng Boon Ching & LTA Timothy Ang



Introduction

The transformation to the 3rd Generation RSAF is an exciting time for the organisation. It is a time of fundamental re-evaluation and change from first principles. The coming years will usher in a particularly critical transitional period as the organisation embarks on concrete steps towards realising the 3rd Generation RSAF. The transformational tensions that will inevitably arise during this period of inter-generational transition should be properly managed in order that the transformation process can proceed unimpeded. This article explores the evolution of the RSAF over different

generations since its inception in order to contextualise the current 3rd Generation transformation effort. It then identifies the key tensions that will arise from the current inter-generational transition, and discusses possible ideas and initiatives to manage these tensions as we evolve to the 3rd Generation RSAF.

Making Inter-Generational Transitions

Organisations need to evolve continuously to overcome the prevailing set of pressures imposed on them from internal organisational forces and the external environment. However, the

pace of an organisation's evolution is not necessarily uniform. In fact, the myriad transitions that take place along this continuous evolutionary process may vary greatly in scale, from minor adjustments to far-reaching organisational transformations. The current transition that the RSAF is embarking on is especially crucial because it is a major transformation that entails a generational shift in the whole organisation. As this article shall later elaborate, a transition of such magnitude imposes enormous stresses, or tensions, on the organisation. These tensions need to be properly managed in order that the transition may be accomplished seamlessly.

Inter-generational transitions are not new to the RSAF. Even over its relatively short history, the RSAF can be said to have undergone significant cross-generational transformations. These have occurred when the excellence achieved in current competencies became inadequate to accommodate emerging challenges or exploit new opportunities. A process of fundamental renewal would then be necessitated to ensure that the organisation remained vital, relevant and refreshed. An examination of the evolution of the RSAF will illustrate the process of inter-generational transition with greater clarity, and should also provide useful insights into the impetus and challenges in the current transition to the 3rd Generation RSAF.

The 1st Generation RSAF, which can be roughly dated from 1968 to 1985, was primarily directed by the need to establish a credible air defence capability. This necessitated the birth of

the Air Force in September 1968 with the formation of the Singapore Air Defence Command (this officially became the RSAF in 1975). The following decade saw the RSAF operationalising existing British platforms like the Hunter aircraft and Bloodhound missiles, and assimilating more advanced platforms like the A-4s, till air defence vocational and functional competencies were firmly established. However, by the early 1980s, a good air defence capability was by itself increasingly inadequate to provide support for operations with the developing Army and Navy. Furthermore, the SAF began considering the requirement for new capabilities in the light of changing developments in the strategic environment, and in the region in the late 1970s. These internal and external pressures paved the way for a cross-generational transition to the 2nd Generation RSAF.

If the 1st Generation RSAF was concerned with building up air defence, the 2nd Generation RSAF focused on establishing air superiority so as to secure the airspace for the Army and Navy to operate unimpeded. This 2nd cycle of growth can be said to have lasted from about 1985 till recent years, with the operationalisation of new platforms like the F-5s, E-2Cs, and later the F-16s, and the organisational re-configuration of the RSAF according to Airbases with more clearly separated Command and Staff functions. By the late 1990s, the RSAF's vocational and functional competencies and ops readiness had achieved a level of excellence well recognised by advanced air forces around the world. However, the early 2000s, especially after 9/11, saw the rise of a new threat environment

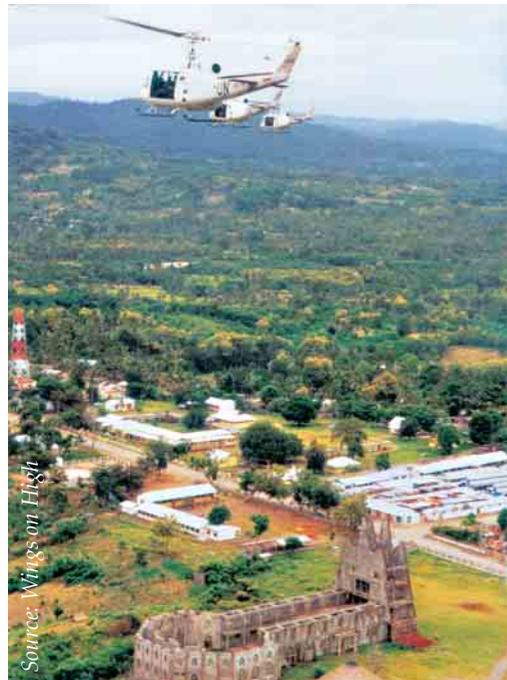
characterised by asymmetrical threats and LICs (Low Intensity Conflicts). This has since necessitated a process of self-renewal in the RSAF, motivated by the recognition that the organisation needs to transform in order to effectively tackle the security challenges ahead. Therefore, over the last few years, the RSAF has been engaging in a process of consolidation and a host of system reviews in order to facilitate the next cross-generational transition, or the transformation, to a 3rd Generation fighting force.

Transiting to the 3rd Generation RSAF

Going forward, the 3rd Generation RSAF is expected to move beyond air defence and air superiority to become a full-spectrum integrated force, capable of dominating the ground and sea from the air. Although wars are traditionally won on the ground, they need not be won from the ground alone. Operations Enduring Freedom and Iraqi Freedom, for example, were wars that were won on the ground, but in large part also from the air. Airborne precision weapons and UAVs clearly played a decisive role in decimating the Taliban and Iraqi ground forces. In order to harness the potential of these 3rd Generation cross-domain capabilities to shape surface battles, the RSAF needs to achieve enhanced integration across functions (ops-int-log, plans-control-execution) and Services (air-land-sea), and more broadly, to engage in integrated warfighting with the other Services and Joint.

However, conventional “hot” wars form only one part, albeit a key part, of an increasingly diverse range of

threats emerging from today’s global security environment. There will be a growing need for the RSAF to conduct operations across the whole peace-to-war continuum, ranging from Operations Other Than War (OOTW) like Peace Support Operations (PSO), Humanitarian Assistance and Disaster Relief (HADR) and counter-terrorism, to LICs and HICs. This will require the RSAF to be an effective full-spectrum force capable of being calibrated to the requirements of different campaigns.



Source: Wings on High
RSAF’s UH-1Hs (in UN colours) supported UNMISET in Timor Leste from 15 Nov 02 to 22 Oct 03.

Additionally, the needs and potential of a new generation of people in the RSAF provides the impetus for developing 3rd Generation RSAF people. The RSAF will need to capitalise on the improving educational profile of its current and prospective employees by maximising their potential, and in so doing, meet their heightened job

expectations and feed their passion for a military career. Moreover, the RSAF will require better trained and more technologically-savvy people who are able to operate advanced cross-domain warfighting systems, execute complex ops concepts and thrive in task-oriented and integrated organisational structures. Only with 3rd Generation personnel can the RSAF properly fulfil the heavy demands imposed on it by the need to undertake integrated and full-spectrum operations.

Managing the Transformational Tensions

It is evident that the RSAF is now at a critical juncture of its development as it transforms across generations. The key challenge of this period lies in the need to manage the transformational tensions arising from this inter-generational transition. These tensions are unavoidable not simply because of the sheer magnitude of the transition taking place, but also because of the differential rates at which different parts of the organisation are developing and transforming. Understanding these tensions will help the RSAF to better manage the potential conflicts in priorities, which could emerge under such circumstances, and thus ensure that the transformation towards the 3rd Generation RSAF is safe and successful.

The first tension, which is between progress and consolidation, refers to ensuring that the relevant 2nd Generation competencies are not being eroded in the course of transformation. This

would be detrimental to the RSAF's ability to conduct complex operations across the peace-to-war spectrum. In particular, even as the RSAF is operationally prepared to respond swiftly and decisively for peacetime operations such as HADR, as it did with Ops Flying Eagle (OFE) in 2004, this should not erode its competencies to conduct operations in open conflict. Also, harnessing new concepts and technologies cannot be done at the expense of safety. It is important that these fundamentals are maintained to serve as a sound-footing from which new innovative ventures can be launched.

The second tension, between risks and yields, occurs most during the exploration of new ideas and concepts, when it is unclear whether the risks taken will commensurate with the desired outcomes reaped, especially given the uncertainty that surrounds these activities. This tension is most visible in the exploration of the use of new and complex cross-domain systems, as well as attempts of greater and better integration both within the RSAF and with the wider SAF. While these cutting-edge developments have the potential to yield tremendous benefits to the war-fighting abilities of the RSAF and wider SAF, they are also undertakings that carry a higher level of risks than endeavours on beaten path. The RSAF must therefore effectively calibrate the risks it undertakes as it pushes these new boundaries.

The third tension, between learning and “un-learning”, affects the vital flows of information supporting the

whole transformation effort. This tension is manifested most clearly in the ‘people’ dimension of the RSAF. At present, different people may be at different stages of the 3rd Generation learning curve, or at different stages of “un-learning” 2nd Generation mindsets that have been outmoded. New task-oriented and cross-functional work processes, for example, may clash with existing type-centric and univocational mindsets. A sound system of knowledge acquisition, management and exploitation is needed to enable learning and un-learning to proceed simultaneously, and more generally, to redress the differential levels of knowledge and understanding among RSAF personnel. Without this, neither the balance between consolidation and progress nor the calibration of risks can be achieved. All in all, it is important that the three tensions are viewed and treated holistically, considering that any one tension, if not properly managed, can potentially derail the entire transition from the 2nd to the 3rd Generation RSAF.

In sum, the management of the three tensions can be represented as follows:

- Rapid progress needs to be made, but not at the expense of consolidating foundational competencies;
- Desired yields need to be maximised while potential accompanying risks need to be minimised;
- Learning and un-learning needs to take place simultaneously, in a non-conflicting and effective manner.

Balancing Act I – Managing the Tension between Progress and Consolidation

One of the main challenges posed by the transition from the 2nd to the 3rd Generation is the need to ensure that rapid progress towards the 3rd Generation RSAF does not take place at the expense of retaining the excellence achieved in 2nd Generation competencies, or vice versa. There is no doubt that making rapid progress in new ventures is critical to realising the 3rd Generation vision. As the organisation forges ahead with transformation, the journey will be lined with opportunities to implement new ideas and initiatives. Underestimating and under-investing in new, potentially high pay-off ideas can cost us the chance to secure best-case future scenarios, or worse, result in future failure. A classic illustration is the colossal misjudgement by Kenneth H. Olsen, who, as the President of Digital Equipment Corporation, announced in 1977 that “there is no reason for any individual to have a computer in their home”.¹

However, as the RSAF keeps its options open to innovation, it is important that fundamental competencies are continually strengthened, as they form the foundation from which new ventures can be launched. A good example from the commercial arena is the Federal Express Corporation’s (FedEx) launch of its overnight-delivery service. By consolidating its strong foundational competencies in providing door-to-door mail-and-package delivery service, and

applying them in a new context, FedEx's strategy opened up a new market that forced the industry incumbents like United Parcel Service (UPS) to play catch-up.² Therefore, retaining and consolidating strong fundamentals in the RSAF is vital in providing foundational stability for the organisation as it makes inroads into new and potentially turbulent frontiers.

In this regard, the RSAF has in the past few years conducted a number of key reviews to consolidate our fundamentals. For instance, following the series of aircraft incidents and accidents that occurred after the 7.5-year period of zero accidents, the RSAF subjected itself to a rigorous regime of internal and external reviews at both the unit/formation level and the HQ level. This exercise proved valuable in furnishing the RSAF with a clearer picture of its strengths and deficiencies in the arenas of safety and operational readiness, and the operational standards that had to be emphasised in order to take the RSAF to a new level of operational excellence.

In the areas of force structuring and capability development, a similarly rigorous review has been conducted to get the fundamentals right for

transforming the RSAF. In order to create capacity for the realisation of new airpower employment concepts, the RSAF recognised the need to trade legacy capabilities with newer and more advanced ones. Hard decisions were taken to draw-down older platforms, such as the A-4s, while at the same time introducing new capabilities, such as the F-15SGs, in a phased and calibrated manner. As a result, over the past few years, the RSAF has improved its capabilities and enlarged its capacity to transform into a 3rd Generation Air Force.

As is apparent, such system reviews are vital for managing the tension between rapid progress and consolidation. They allow the organisation to map out its foundational baseline and to properly calibrate its progress. This will ensure that as the RSAF maximises emerging 3rd Generation opportunities, it also continues to consolidate and strengthen the 1st and 2nd Generation fundamentals that have enabled it to become a first-class Air Force. In view of this, it will be useful to conduct system reviews periodically, particularly at key transition phases along the 3rd Generation journey.



RSAF's fighter aircraft – Past and Present

Balancing Act II – Managing the Tension between Risks and Yields

In the course of the transition from the 2nd to the 3rd Generation, the RSAF will have to introduce a host of new initiatives to enable the 2nd Generation components of the organisation to progress to the 3rd Generation, as well as to further advance those elements that have entered the 3rd Generation domain. In implementing these initiatives, it is crucial that the expectation of yields is balanced by an awareness of the possible risks.

However, the relationship between risks and yields is not as straightforward as one might initially assume. This is because the RSAF, like many large organizations, is what we may refer to as a complex system, which makes it susceptible to the so-called ‘Butterfly Effect’³: a butterfly flaps its wings in Tokyo, and sets in motion events that lead to tornadoes in California. Of course, this must be understood in conjunction with its converse: another butterfly flaps its wings, and nothing of meteorological consequence happens.⁴ From this, it is evident that the various parts which constitute a complex system interact in a non-linear fashion.⁵ So a small perturbation in a complex system may lead to unimaginably large consequences analogous to the ‘butterfly effect’. Conversely, a ‘big bang’ input may turn out to have little noticeable effects.

In practice, the unpredictable relationship between risks and yields can have serious implications on decision-making within the complex

system. An over-concern with the possibility of a ‘butterfly effect’ can lead to decision paralysis; while a “just do it” approach, on the other hand, may cause us to place misinformed big bets on initiatives that result in write-offs. To balance the tension between risks and yields, the RSAF needs to better understand the interactions of the various demand centres when new initiatives are introduced, so that changes can be effected in a more calibrated and integrated manner.

In this regard, experimentation, which arises from the Latin word ‘experiri’ (meaning ‘to try’), is vital. The RSAF should leverage on experimentation to ensure that the effects of intended changes are comprehensively and thoroughly examined in manageable slices before introducing them into the mainstream.⁶ As a process, experimentation progressively creates knowledge pertaining to new concepts or current issues through exploring various possibilities and options. This in turn allows operators and decision-makers to spirally and collaboratively deliberate, decide and effect the changes in a manner that delivers the desired outcomes while mitigating the possible risks involved.

To this end, the RSAF has established dedicated agencies to develop concepts and validate them in virtual environments. For example, these agencies have been working with the SAF Centre of Experimentation (SCME) to explore network-centric concepts. Such efforts have enabled the RSAF to understand from first principles the workings of new ideas, which in turn minimises the risks of unintended

effects from changes. They have also provided a cost-effective way for the RSAF to test ideas, identify potential military benefits and the conditions under which the benefits can be reaped, before we commit more resources to further examine ideas in the physical domain.



Source: Pioneer

A CH-47D with a Pegasus howitzer underslung during Ex. Wallaby 05.

The RSAF can also leverage on field experimentation to further explore new concepts and capabilities. Ex. Wallaby 05, the largest air-land integration exercise conducted in Australia by the SAF in 2005, was a good demonstration of how this can be achieved. In one experiment, RSAF Searcher drones were employed to use their cameras and sensors to hunt down and track the simulated enemy. Video images captured by the Searchers, through experimental systems, then helped artillery gunners

shell enemy positions with precision and gave tank commanders timely warnings of enemy movement. At around the same period, the RSAF also participated in Ex. Forging Sabre in Continental USA. In the exercise, experimentation was also conducted on the integration of RSAF systems, including the AH-64D Longbow attack helicopters, CH-47D Chinook helicopters, the UAVs and F-16 C/Ds, with the Army artillery systems and commandos as one integrated force.



Source: Wings on High

Ex. Wallaby 05, the largest air-land integration exercise conducted by the SAF in 2005.

Such experiments are invaluable processes for the RSAF to test out new ideas, understand the complexities and intricacies of new operations, as well as uncover important issues pertaining to operational effectiveness and safety. As the RSAF ventures into cutting edge 3rd Generation domains such as Integrated Strike and Network-Centric Warfare, it is vital that systematic experimentation is carried out in order that these new initiatives can be expeditiously implemented to achieve the desired yields with minimum risks.

Balancing Act III – Managing the Tension between Learning and ‘Un-learning’

The process of inter-generational transition calls for a great deal of simultaneous learning and “un-learning”, given that an organisation undergoing such change is straddling two generations of development. The processes of learning and un-learning can come into tension because the attention and resources devoted to one process can easily result in neglect of the other. At worse, this results in old mindsets co-habiting with and inhibiting the growth of new concepts or capabilities. To manage this tension, it is imperative that the RSAF develops the capacity to simultaneously negotiate the many learning and un-learning curves that will come with the transformational process.

One way of achieving this is by harnessing effective knowledge-management tools to facilitate the learning and un-learning processes. In this regard, the experience of the U.S. Army’s Opposing Force (commonly known as OPFOR) offers many useful insights. OPFOR is a 2,500-member brigade whose job is to help prepare soldiers for combat. It constantly confronts the Blue Forces (BLUFORS) in a variety of mock campaigns under a wide range of conditions. Although OPFOR is always smaller and less well-equipped than its opponents, it almost always wins.⁷

OPFOR’s consistent success is attributable in a large part to the way it effectively utilises the After Action

Review (AAR). Many organisations conduct elaborate AARs, but all too often still end up repeating the same kinds of mistakes, because they misperceive the AAR as a meeting, a report or a post-mortem of past failure.⁸ Understanding AARs as such will cause the organisation to concentrate too much on the un-learning process at the expense of learning. Past mistakes may be identified, but future performance would not be enhanced. In contrast, OPFOR sees AARs as part of a cycle that starts before and continues throughout each campaign against BLUFOR.⁹ Central to this idea is the fact that the cycle must not only correct things; it should also correct thinking. OPFOR conducts multiple AAR iterations at the earliest possible opportunity after the issue arises, so that capacity can be created for simultaneously un-learning, learning and applying in a progressive manner, and solutions can be tested and refined along the way. By OPFOR’s definition, a lesson is not considered ‘learned’ until it is successfully applied and validated.

The concept of continuous learning and un-learning as a knowledge management tool is not new. Many advanced armed forces have developed their own systems and processes to achieve this, of which OPFOR’s AAR is but one highly successful example. The RSAF has a well-established knowledge-management system, in the form of the Safety Information System (SIS), to rapidly and effectively document, share and implement lessons on safety at a systems level. Extending the SIS concept and experience, similar systems could be developed for the war-

fighters and force developers to rapidly document, share and implement lessons learnt through training, operations and capability developments. This will expand the RSAF's capacity to learn and un-learn concurrently across the wide array of technological, operational and organisational changes that will be introduced as part of 3rd Generation transformation. In this way, the RSAF will be able to reap the benefits of the U.S. Army's OPFOR experience at a larger scale but potentially at a lower cost.

Another way of developing the capacity to learn and un-learn simultaneously is to widen the participation base for information gathering and sharing. This can be effectively achieved through sharing, learning and applying lessons among peer working groups such as a 'Community of Practice' (CoP)¹⁰, which can augment the more formal functional and task-organised groupings in the RSAF. This idea has already been adopted in RSAF Formations and Airbases over the past few years. Working groups, including selected members from other Formations, Services and fields of expertise, have been set up to develop, experiment and implement selected ops concepts, capabilities and initiatives as part of 3rd Generation RSAF transformation. The cross-functional collaboration has been invaluable in facilitating an integrated perspective towards the sharing of new concepts and tactics, un-learning out-moded mindsets, and aligning disparate concepts to a common vision and end-state.

A similar CoP approach can be explored in other developmental areas of the RSAF, especially during this critical period of inter-generational change. A promising initiative in the RSAF is the recently launched CoP@RSAF, which aims to provide a one-stop, informal on-line forum for Commanding Officers (COs) and Officers Commanding (OCs) to exchange ideas, information and knowledge with their respective peer groups. Such exchanges are likely to provide more opportunities for accelerating the capacity and speed of learning and un-learning, as well as applying best practices quickly and effectively. These initiatives should be progressively extended to more peers, type and functional groups within the RSAF, as well as the wider SAF.

Conclusion

Dealing with transition is an organisational fact of life. However, a transition can only be effectively managed if accompanying challenges are properly identified and tackled. This applies especially to the RSAF, which is at present undergoing a historic, and no doubt challenging, cross-generational transformation from a 2nd Generation to a 3rd Generation Air Force. This article has outlined the three main transformational tensions that confront the RSAF as it straddles the 2nd and 3rd Generation, and the broad measures required to deal effectively with these tensions. ☺

Endnotes

¹ Courtney et al (1997), p4.

² Ibid., p20.

³ Lorenz (1993), pp181 – 184. The origins of this much-used catch-phrase can be traced back to meteorologist Edward Lorenz who first analyzed the effect in a 1963 paper for the New York Academy of Sciences.

⁴ Lewin (1999), pp10 – 11.

⁵ A linear system is one that obeys the principles of superposition, i.e. the whole is the sum of its parts. Non-linear systems are those that disobey proportionality or additivity. They may produce disproportionately large outputs from disproportionately small inputs, or vice versa. They may also involve synergistic interactions in which the whole is not equal to the sum of the parts. Examples of non-linear phenomena include weather, biological evolution and the damping effect of atmosphere on a swinging pendulum. Beyerchen (1992/3), pp62 – 66.

⁶ Alberts et al (ed. 2002), p19.

⁷ Darling et al (July / Aug 2005), p1.

⁸ Ibid., p2.

⁹ Ibid., pp4 – 7.

¹⁰ A ‘Community of Practice’ can be defined as ‘a group of people informally bound together by shared expertise and passion for a joint enterprise’. Examples are engineers engaged in deep-water drilling, consultants who specialised in strategic marketing, or frontline managers in charge of cheque processing at a large commercial bank. Wenger et al (2000), pp2 – 3.



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Enhancing Integration in Transformation

*by LTC Tan Ying Kiat, MAJ Lee Siew Hui,
MAJ Aldrin Tan & CPT Tay Shulin*



Introduction

The increasingly complex and dynamic strategic environment we face today, where the challenges of war and terrorism will require the 3rd Generation SAF to be able to respond flexibly and appropriately, requires the building up of capabilities not just for conventional defences, but also for peacekeeping and Humanitarian Assistance and Disaster Relief operations. The 3rd Generation SAF will also need to be leaner and more potent, employing innovative concepts and solutions to exploit our scarce resources, and to leverage on key technologies in IKC2, advanced weaponry and UAVs.

For the RSAF, the confluence of new operating concepts, emerging technologies in IKC2, advanced weaponry and UAVs, people and training development and organisational restructuring, will allow the RSAF to force structure and make the most of our scarce resources, and be able to operate as an integrated force for full-spectrum operations. Given the relative maturity of the RSAF core competencies in air defence and air superiority, the 3rd Generation RSAF will focus on maximising the potential of airpower to influence surface battles and better exploit cross-domain capabilities, as part of the overall 3rd Generation SAF campaign. Hence, we will need

to enhance our integration efforts, when the RSAF conceptualises, force-structures, organises and operates with the other Services.

The Journey Thus Far

When the Ministry of Interior and Defence was initially formed in 1965, it was organised into five functional divisions, namely General Staff, Manpower, Logistics, Intelligence and Home Affairs. Subsequently, an integrated command of air, land and sea elements under the Director of General Staff was established, so that these capabilities can be used flexibly during operations, and manpower overheads in similar functions reduced. At that point in time, the Air and Sea Commands were relatively small and still in the midst of building up a credible force structure. However, in the early 1970s, the integrated defence structure had practical problems because there was a limited level of operational experience within the staff officers in the various Divisions, leading to a relatively slower pace of capability development of the land, air and sea orbat. This triggered the need for the separate formation of the RSAF and RSN by 1975, where Air Staff and Naval Staff were formed to drive operations and planning in their respective Services. General Staff continued to focus on Army matters, and inter-service co-ordination were largely made through General Staff given its relative seniority among the three. In the early 1980s, various Joint Committees were created, to facilitate joint operations planning, intelligence and plans. In Mar 1983,

Joint Staff, headed by Director Joint Operations and Planning Directorate was created to co-ordinate the services in the areas of operational planning, operational readiness and control, plans management, as well as doctrine and training. These functions were subsequently consolidated into three main departments – Joint Operations Department, Joint Plans Department, and Joint Communications and Electronic Department in 1986 to strengthen their roles in these areas. Joint Manpower Department and Joint Logistics Department were subsequently also formed under the ambit of Joint Staff. With the development of new concepts and capabilities for the 3rd Generation SAF, Joint Plans was further expanded to include the SAF Transformation Office and renamed as the Joint Plans and Transformation Department.

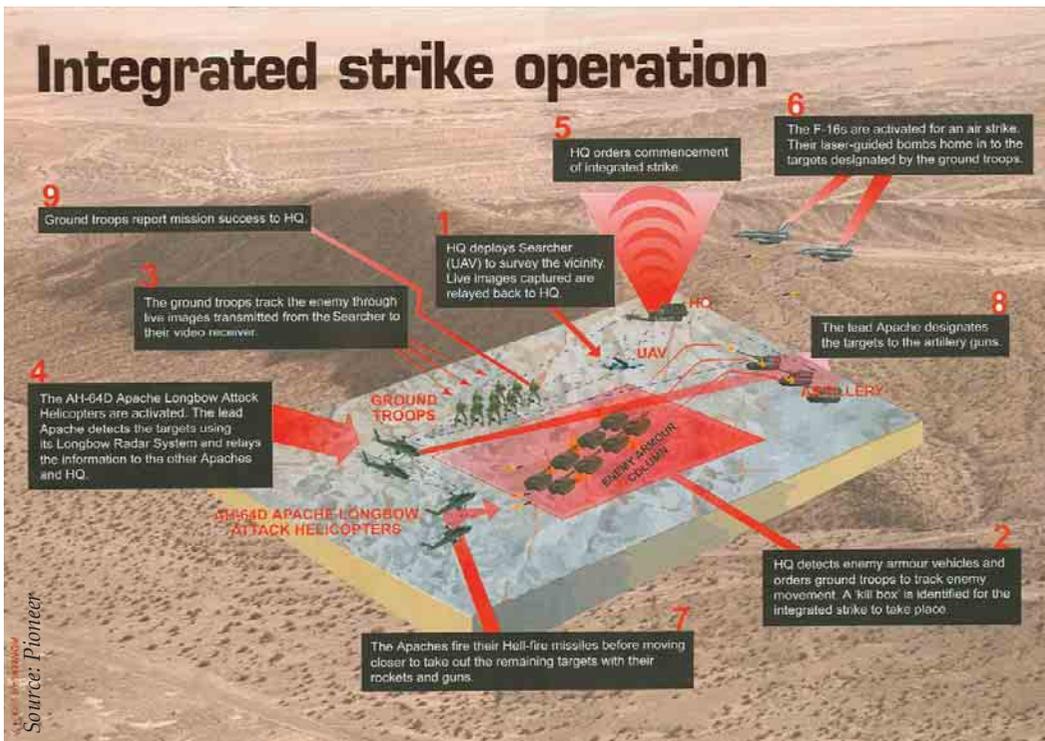
In terms of aircraft and weapon systems, these were rapidly introduced into our force structure from 1967. Airbase Commands and full staff departments were formed in the 1980s, and the RSAF grew from a mainly training formation to a more operationally ready Air Force, that was able to responsively launch operations when needed. By 1985, the air orbat included the Hunters, A-4s, and F5s, SPs, UHs and several air defence and ops control squadrons. Today, the RSAF has matured from building a credible orbat to establishing system-level competence. From 1985 to 2005, the RSAF concentrated on improving quality rather than quantity. We elevated our competence from the platform to the system. The RSAF flies routinely with

and against the best Air Forces in the world. Today, when professional and tactical skills are relatively mature, it is timely to look at our ability to orchestrate airpower, so that we are better able to swing airpower to influence surface battles, and strengthen cross-domain and cross-functional integration. The 3rd Generation RSAF will need to be a full-spectrum, integrated force, capable of delivering a wide range of military and policy options to our decision-makers. Joint operations, such as Operation Flying Eagle in Aceh, and Joint exercises, such as Forging Sabre in CONUS, are reflective of the level of integration that has been achieved so far, and are indicative of the integratedness that is required in the future. In order to meet future operational and strategic demands, the RSAF must be able to

exploit new technologies and forces to overcome traditional airpower constraints; develop new operating concepts to fully optimise and exploit new capabilities and technologies; create new organisations to efficiently execute concepts in concert with the rest of SAF, and also implement new human resource and training programmes to groom people for the added requirements of their job.

Why Integrate?

Proliferation of Cross-Domain Capabilities. Emerging technologies have led to the development of sophisticated platforms that can be employed in several different domains. This enables the conceptualisation of operational strategies that can leverage on the advantages of the different



Joint exercises, such as Forging Sabre, are reflective of the level of integration that has been achieved so far.

environmental characteristics to exploit the use of such systems. Exploiting the use of different environmental domains can allow us to overcome traditional challenges in operating within our current operational space. For example, UAV platforms are increasingly being used in both strike and ISTAR collection roles. Multi-role fighters are also increasingly being used to influence surface operations, where airpower can be brought to bear to shape ground or maritime battles supported by a highly responsive kill-cycle and stand-off capability. The proliferation of such cross-domain capabilities will drive an increasing need to consider its design and employment not just from a single-domain perspective, but to maximise its use in different operating environments.

Integrated Warfighting by a Networked Force. By creating and executing plans which maximise the unique capabilities of each of the Services, integration can result in a synergistic force of significantly greater combat power than if each service had been employed individually against the same enemy. The 3rd Generation SAF will need to fight as an integrated and networked force, in order to maximise the use of various capability options within its orbit to their maximum potential, and not just sub-optimising within a single domain or operational objective. Optimising at the task level will encourage operational concepts and capabilities that cross traditional stove-pipes in singular domain and functional areas, thus expanding the number of options available for different operational models and end-states.

Limited Resources. With limited manpower and budgetary resource, the 3rd Generation SAF and RSAF will need to make the most of its available budgetary and manpower capacity. It will not be prudent to force structure capabilities that in aggregate, will destroy an intended target many times over. Hence, a system-level task-oriented perspective will allow us to integrate suitable capabilities and operational processes so that at the SAF-level, these key objectives can be achieved with a more prudent use of resources.

What to integrate and How we may do it?

Integration across structural lines, concept and capability development, as well as more professional community building will involve the building of closer linkages and work-flows spanning the different environmental domains of land, sea and air, and across service and functional lines. With the formulation of new operating concepts and the delivery of key capabilities, the 3rd Generation RSAF has also fundamentally reviewed its organisational structure, so that suitable structures are built to exploit these concepts and capabilities, to build a warfighting system that is networked and integrated, and able to respond to the full-spectrum of operational needs both in peacetime and conventional war.

- a. **Concept and Capability Development.** The RSAF has a strong base in building several 3rd Generation capabilities, such as IKC2 and unmanned warfare. Moving forward, it will be important to adopt a holistic and integrated perspective for operational

concept formulation and capability development at the SAF level, so that the force structuring and subsequent employment of these capabilities can be optimised at the system-level with due consideration from the different domain and functional areas. Adopting such a system-level approach will maximise the potential of all our inherent capabilities, tapping on the strengths that each specific domain and functional group will bring, as well as building natural redundancies within the entire warfighting system to address the natural vulnerabilities and challenges inherent in each particular capability area. For example, in peacetime operations such as HADR and PSO, the introduction of Joint Task Forces with ground forces, naval and air elements for projection and lift reflects the multi-faceted nature of the more complex operations that the SAF and the RSAF will increasingly need to respond to. To realise these concepts, it is also necessary to integrate our training as well, both at the type-level to ensure that core competencies and professional standards are maintained, as well as at the task-level, as part of the overall efforts to raise, train and sustain key integrated capabilities.



A Super Puma helicopter landing on a LST during the tsunami relief efforts

- b. **Structural.** Organisational restructuring is another key element to consider as part of the move for greater integration. Under the RSAF's previous structure, the four airbases exist as separate entities, each with its own complement of aircraft, logistics set-up and support squadrons, like air traffic control and airfield defence. This structure of the airbase made each one self-sufficient, but it also meant duplicated overheads. In addition, when new capabilities and systems are delivered and new operational concepts formulated, suitable structures must be designed, together with the on-going people development efforts, to support the new force development and force employment responsibilities. To this end, as part of its 3rd Generation transformation, the RSAF has embarked on a fundamental restructuring drive, in order to enhance integration, ensure dedicated focus at every level, strengthen force employment and development, and design a more seamless transition to war. New Commands will be set up, that will be geared towards a strong task focus in different functional areas. A greater level of integration with the Army, Navy and Joint Staff will also be established, with embedded personnel and suitable work processes to incorporate the relevant expertise in the areas of force development and force employment in these specific task areas. Dedicated focus will also need to be accorded at every level, so that the strategic, operational and tactical levels of integrated force development will

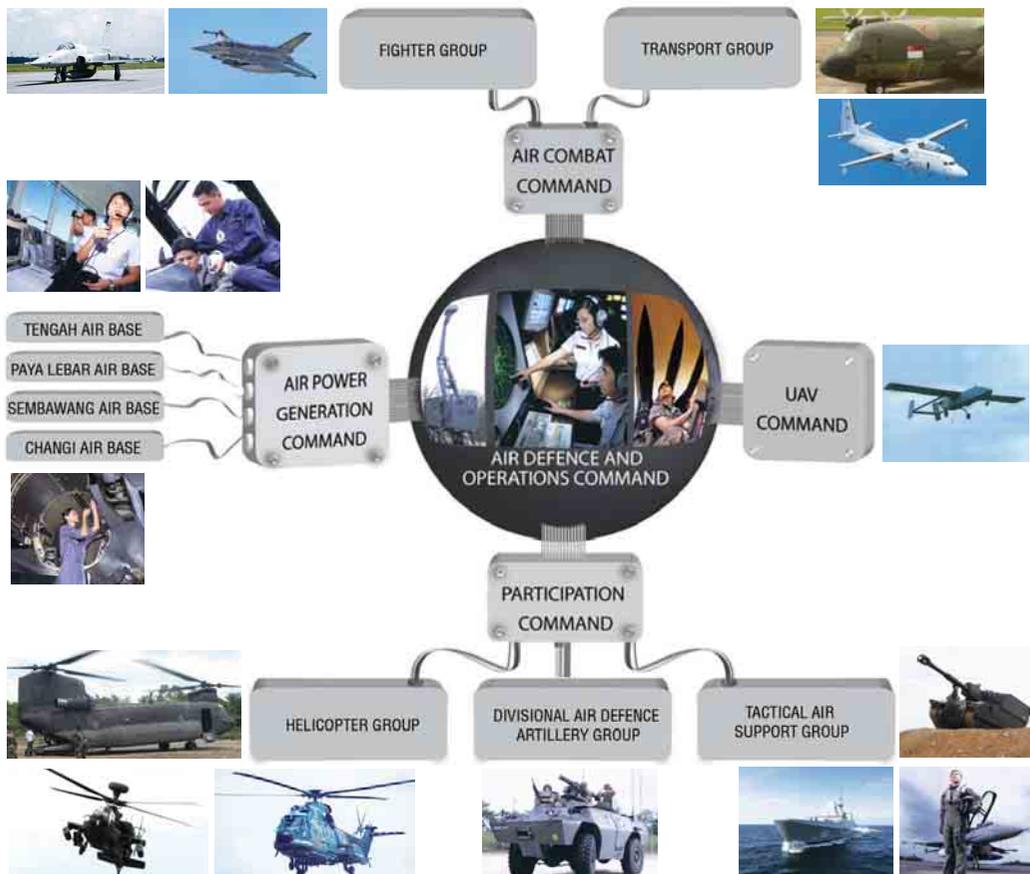
be addressed and aligned. Parallel reporting chains may also need to be established to enable a more networked organisation.

- c. **Building Communities.** With the greater emphasis on integrated structure and capability development, we also need to cement our fundamentals and core skills. Type-based groups are still important to ensure competent and safe operations. At the same time, we must expand our working communities to be more task-oriented, bringing people from different domains and functional

areas into a common task-community (e.g. in participation operations). This can be achieved by having a joint culture, which is crucial but as yet an incomplete building block in elevating service thinking to the level of joint warfare.

Main Challenges

Joint integration is largely centered on interactions between people, systems and information and firmly based on joint rather than service doctrine. The journey towards integration will involve fundamental changes that will significantly change the way we operate.



The organisational restructuring of the RSAF will enhance the level of integration, and maximise the development and use of airpower for the SAF.

- a. **Accountability in a Matrix Organisation.** The first challenge is in enabling a working matrix structure and acclimatising to working in a more dynamic environment to achieve a level of integration that is more substantive than cosmetic. Along with the deepening of integration is the need for dual, or maybe even multiple reporting in task-oriented commands. This may bring about less clear lines of responsibility and accountability due to multiple reporting lines. Specific joint standards and periodic training as a joint entity is a useful way to help the RSAF make a seamless transition through the integration journey. Such a “train-as-we-fight” principle will facilitate more effective transition from peace to war as well.
- b. **Building New Communities.** The second challenge stems from a new task-focus that is set to drive new developments and forge new bonds in different communities. We cannot afford to remain entrenched in service or type-based cultures but instead migrate to a more task-oriented one. We would need to build a peacetime structure that is organised along missions and tasks, rather than types and specialisation. Service mindsets would need to change to foster better working relationships, trust and understanding in integrated operations. This challenge may be addressed by creating more opportunities for interaction and training to understand the different working cultures and concept of operations. These could be done through participation in Joint exercises and encouraging continual proactive engagement among the services through courses, as well as cross-postings.
- c. **Strengthening our Task Focus.** The new task-focus emphasis brings about the third challenge to integration. The RSAF’s approach to operations as an integrated force will mean that warfighting will increasingly involve a collaborative and task-oriented approach from all the three services. The RSAF must thus integrate the various type vocations and platforms with sharper task-focus, so as to achieve operational-level objectives more effectively. The set up of the new task-oriented Commands will serve this purpose. However, even as the emphasis shifts from Type to Task, there is a need to ensure that type competencies are not compromised and this will also be addressed by the type-within-task structure of the new Commands.
- d. **Anchoring Core Fundamentals.** The fourth challenge is in vigorously managing joint integration in a way that our people continue to retain fundamental core competencies at each level of operations. Only with such anchoring of core skills would the pursuit of cross-functional and cross-domain developments, through integrated system-level and operational-level capabilities like IKC2, be effectively implemented. As we integrate, it is pertinent that technical proficiency and operational readiness are not diluted in the process. A strong grounding in fundamentals will be a critical

component in ensuring that the RSAF continue to function and operate safely and effectively in an integrated, complex and dynamic operating environment. To this end, we would need to equip and strengthen the attributes, skills and knowledge of our people to anchor their fundamentals in this journey of transformation.

Conclusion

The SAF's integration effort aims to fully exploit the potential of the various Services through integrating CONOPS and capabilities. By adopting new operational strategies and renewing its process of organizational restructuring, force structuring, training and people development, the RSAF seeks to become an integrated force that contributes to this goal, one that is capable of

decisively shaping the air, land and sea campaigns. These changes to the RSAF are fundamental, and will significantly change the way we work. Concepts and capability development will assume a more integrated and system approach. This will be accompanied by structural changes to more effectively conduct integrated operations. Our people will need to be acclimatised to work in a more dynamic environment, and be comfortable with multiple reporting channels and matrix structures. A clearer understanding of the new task-focus would also be necessary to drive new developments and forge new bonds in different communities. Our core fundamentals, however, must continue to be strongly anchored while all these are done to ensure that safety and operational readiness are maintained. 



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RSAF in Operations Other Than War – The Challenges

by LTC Yeong Chee Meng, MAJ Aaron Tan
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Introduction

Apart from building up conventional capabilities, to fight and win wars, the developments in the security landscape have necessitated RSAF to progress towards a full-spectrum integrated force. Besides war fighting operations, which continue to remain the key focus of RSAF's training and development, the RSAF would also need to be able to conduct Operations Other Than War (OOTW). These OOTW ranged from Humanitarian Assistance and Disaster Relief (HADR) operations to Peace Support Operations (PSO). As Singapore contributes as a responsible member

of the region and the international community, it is also confronted with challenges in such OOTW operations.

Due to its constraints of limited airspace, the RSAF has long set up overseas detachments and participated in multilateral exercises in various parts of the world. These detachments and exercises span from locations as near as Thailand to as far as the USA, and they range in duration from short one month long detachments to permanent ones over a period of five years or more. Although the primary purpose of these detachments and exercises is to cater

for the training needs of the RSAF, as well as to learn from our partners, they have nevertheless provided the RSAF with valuable opportunities to build up defence relations and interact with the local governments and communities. All of these have helped to hone our cross-cultural skills, which is a valuable asset when conducting OOTW operations overseas. Notwithstanding this, several challenges still need to be managed.

The Increasing Demand for the RSAF in OOTW

The primary role of the RSAF is to deter war and, if that fails, to secure a swift and decisive victory as an integral part of the SAF. However, as a responsible member of the international community, Singapore (and the SAF) has in its more recent history been involved in more instances of OOTW. Some significant examples include the PSO missions in Timor Leste, missions in support of the reconstruction efforts in Iraq, Operation Flying Eagle (OFE) after the Tsunami in 2004, and relief efforts related to Hurricane Katrina. These missions are important as they save lives and preserve international peace and stability. This trend of greater involvement of the military in OOTW is also not unique to the SAF. The demand for national armed forces to support PSOs and HADRs across the world has increased in scope, complexity and frequency.

While the core business of armed forces is in the area of warfighting, in view of these demands, it is important for the SAF and RSAF to be ready for OOTW when called upon to do so. From the standpoint of operational readiness, such operations also provide opportunities for the SAF to exercise

our logistic and operational elements to plan, orchestrate, co-ordinate and execute tri-service operations on a real-time basis, while dealing with the public media. Being able to execute such tasks effectively is important to the professionalism of SAF and instils confidence of the SAF into Singaporeans.

Given the nature of OOTW, air power is often the likely first responder because of its inherent advantages in the areas of speed, reach and flexibility. Unmatched speed and reach combine to equip Air Power with the critical responsiveness to respond quickly to changing situations at far distances. This advantage in reach and responsiveness is further enhanced by superior mobility on the scene. Indeed, it is recognised that simply reaching the disaster area quickest is insufficient, and air platforms prevail in offering a myriad of transportation options that can be tailored to suit a variety of roles, ranging from ferrying of personnel, to evacuation, to Search-and-Rescue (SAR) and to expedient delivery of supplies, such as food and medicine, often over difficult terrain.

We will first look at two case studies of OOTW to identify the challenges facing the RSAF before discussing possible options to address them.

HADR Case Study: RSAF's Participation after the Boxing Day Tsunami

On 26 Dec 04, the region around the Indian Ocean was shaken by one of the worst earthquakes and subsequent tsunamis in history. Aceh in Indonesia, Phuket in Thailand, Penang in Malaysia,

Sri Lanka and India were all hit by the effects of the tsunami. As many as a quarter of a million lives were lost. Although Singapore was spared the fallout from the disaster, units in the SAF were activated to contribute to the aid efforts.

The RSAF's C-130 transport aircraft was the first to respond, arriving in Medan, Indonesia on 28 Dec with emergency relief supplies. Within a week, the SAF had despatched 12 helicopters to both Thailand and Indonesia. In the following few weeks, the RSAF's Chinook and Super Puma helicopters, together with C-130, Fokker 50 and KC-135 transport aircraft, flew a total of 690 missions carrying more than 600,000 kilograms of cargo and ferrying some 4,000 people.

Besides the deployment of SAF's aircraft and LSTs, a Mobile Air Traffic Control tower was also deployed to Banda Aceh's Sultan Iskandar Muda Airport. This helped to alleviate congestion due to the heavy air traffic that confronted the local airport. The RSAF also provided air traffic controllers to help manage the hectic airspace situation.

The key challenge of the HADR operation was to provide the needed aid and relief to locals and the government when and where it was required. To this end, the familiarity with the TNI, which was built up over many years, played a big part in facilitating the smooth and effective execution of the HADR efforts. Through the conduct of these intense operations, even stronger bonds of co-operation and friendship were formed between the SAF and the

TNI on one hand, and between the two nations on the other. Much respect and trust were also established between the SAF and the locals who received the much needed aid.

Other challenges were also encountered in the course of the conduct of these missions. While skill sets developed in peacetime training could be applied to the actual operations, the conduct of these operations in an unfamiliar territory, following the devastation by the tsunami, required the crew to be nimble and adaptive, in situations such as the preparation of the helicopter landing sites. Another example of innovation was in the decongestion of the use of the congested airspace, whereby our air planners, working with our TNI counterparts, recommended that helicopters flying south from Banda Aceh to Meulaboh fly over the sea at even altitudes while helicopters making the return trip were to fly overland at odd heights. Yet another challenge was the conduct of operations in the environment of the UN, Non-Governmental Organisations (NGOs) and the civilian population, to achieve a non-military objective. This required our crew to be culturally sensitive and understand the dynamics of such an international and non-military setting.

PSO Case Study: RSAF's Participation in Timor Leste

The RSAF conducted the first helicopter detachment in support of UN missions in 1993 under the mission of United Nations Transitional Administration in Cambodia (UNTAC) in support of the Cambodian elections.

Four Super Puma helicopters and sixty-five servicemen were deployed to Cambodia for one month in May 1993. The detachment provided transport for the election officials, ballot boxes and medical casualties and also conducted aerial policing for UNTAC.



RSAF's Super Puma helicopters (in UN colours) supporting UNTAC from May to Jun 1993.

More recently, RSAF supported the UN mission in Timor Leste with a detachment of four UH-1H helicopters under UNMISSET. Following the 30 Aug 99 “popular consultation” in which the East Timorese voted for independence from Indonesia, the situation in East Timor (now called Timor Leste) deteriorated very quickly with a significant increase in militia activities. This prompted the UN to authorise the Australian-led International Force in Timor Leste (INTERFET), which transited to the United Nations Transitional Administration in East Timor (UNTAET) in Oct 1999 and its successor mission, the UN Mission of Support in Timor Leste (UNMISSET),

in May 2002. In Oct 2002, an RSAF detachment of four UH-1H helicopters was deployed to provide UNMISSET with an air lift capability for one year.

Similar to the case of OFE, the conduct of operations in a pseudo – civilian setting to achieve peaceful objectives posed some challenges and required some adjustments in the training for such operations. RSAF personnel had to understand the way the various foreign forces and non-military agencies operate, and the operational and cultural differences among them. The detachments also had to learn to adapt to the local operating environment. Additionally, the lines of command and control in PSOs may be dynamic to cater to the operational needs in-theatre. A case in point was that the helicopter detachment, which was situated in Suai, supported missions directed by both the parent Sector Control, and also the Peacekeeping Force (PKF) HQ situated in the capital Dili. Commanders had to be aware of the needs and be able to meet the various requirements of both the Sector Control and PKF HQ. A good understanding of the myriad of organisations participating in such missions and command/control issues is important to ensure mission effectiveness.

Tackling the Operational Challenges of OOTW

Managing conventional training and OOTW

Through participation in PSO and HADR operations, our personnel were able to interact with personnel from other countries and learn about different cultures and operating environments. At

the political level, it allowed Singapore to contribute in the international arena and widened our policy space in the region and beyond.

Having considered the key observations from both PSO and HADR operations, and against the backdrop of the increase in OOTW operational demands, it is important that the RSAF build upon these lessons learnt to better equip itself for future missions of such nature. While the RSAF's primary mission is to deter, fight and win wars, there is also a need to be prepared for OOTW. To enhance effectiveness in OOTW, the RSAF would need to strengthen our ability to address the operational and defence relations challenges associated with OOTW.

Given the finite resources¹ available to the RSAF, there is a need to manage between OOTW and conventional operations. This challenge may become a regular feature of RSAF operations, as OOTW becomes a part of the full-spectrum of operations that the 3rd Generation RSAF will be expected to fulfill. Although some may observe that the build up of our operational capabilities could be used to undertake OOTW operations and the conduct of OOTW could contribute to operational readiness, there are fundamental differences between the two and it should be acknowledged that training cannot be fully commonalised. For example, the missions flown in OOTW are typically limited to a few types (for heli HADR, this includes troop lift and underslung ops), which is only a portion of the entire spectrum of conventional operational capability. There is a need

to maintain close oversight on the level of training proficiency to avoid dilution in overall competencies.

Reviewing Organisational Structure

In view of the challenges of maintaining operational readiness through conventional training, as well as participating in OOTW, there is a need to ensure proper focus in both these areas. In addition, the recent OOTW operations showed that command and control of the deployed units is vital. Linkages between the deployed units and the backend support are absolutely crucial for safe and effective operations. Hence, an integrated high readiness operational entity would be useful to provide better planning-control-execution synergy especially in the case of OOTW missions. The newly formed Air Defence and Operations Command (ADOC) will serve these functions. During OOTW, the command and control structure under a Joint Task Force concept may be different from the wartime structure that our people are used to. Hence, they must be clear and familiar with the different structures so that the OODA loop remains tight.

Reviewing Training

In any form of operation, even OOTW, there is a need to ensure that our personnel are properly trained in executing the mission well in-theatre and able to assist the host country in a positive manner.

Two aspects of training exist – internal and external. Internal training refers to how the RSAF prepares itself for OOTW operations, as compared with normal peacetime conventional

training. While OOTW operations are not completely alien to the RSAF, there is a need to sharpen the knowledge and skills of our people in this area. While the core skills remains largely the same, our people must be knowledgeable in the application of such military capabilities in the civilian context and cognisant of the impact of such activities to civilian life. Internal seminars can transmit the experience gained from previous OOTWs to the wider RSAF audience to educate them on the conditions, improvisations and decisions that are part and parcel of OOTW. Additionally, emphasis on uncertainty training in the RSAF would also be important. Not only would it be useful to respond to changing scenarios during war, it is also necessary for effective adaptation to new environments during OOTW. Understanding the higher intent also plays a key role towards handling uncertainties and more importantly, to achieve the strategic objective of the mission. In this regard, there is a need to develop the policy instincts of our people in order to perform the role of the “strategic corporal” more effectively.

External training refers to the establishment of linkages with foreign forces and agencies. This could take the form of subscribing to overseas command and staff courses, joint courses and seminars, and participating in multi-lateral exercises, so as to enhance our understanding of their culture and the intricacies with which they operate. Additionally, external training would also involve the education of our troops with a basic appreciation of the “rules of engagement” and considerations for civilian issues. Apart from that, our troops, especially commanders, need to be sufficiently equipped to be

able to navigate through the myriad of governmental and non-governmental agencies, UN, local and international agencies, UN, local and international non-profit relief organizations, and finally local and international media. One does not acquire such knowledge and skills without exposure and training. In this regard, RSAF’s participation in multilateral PSO exercises, such as Cobra Gold series, helps to elevate our knowledge in this domain.



Working with NGOs, like the Singapore Red Cross during Operation Flying Eagle in Aceh, require exposure and training.

Enhancing Knowledge Management

Given the vast amount of knowledge required for such operations, coupled with the rapid transition of officers within the SAF, the challenge of knowledge retention will naturally arise. This aspect of knowledge management (KM) needs to be carefully managed, so as to ensure that mistakes are not repeated and there is a repository of information for the training of our people. Setting up Communities of Practice and incorporating other Organisational Learning tools and techniques are possible ways for such knowledge and lessons learnt to be retained within the organisation. This KM process has already begun with the numerous learning and KM initiatives within the SAF, the setting up of an

online knowledge portal as well as the promulgation of the OOTW Manual. These tools must allow rapid utilisation and comprehension by officers being activated for OOTW at short notice.

Our OFE experience showed that the KM system was able to progressively capture, document and then share the relevant knowledge with the relevant people at the right time. Archives of past events and knowledge/capabilities also enabled the more effective conduct of After Action Review (AAR) for improvements and rapid development and deployment of new innovative solutions.

Apart from IT initiatives, some “OOTW veterans” could also be identified to impart their real life experiences, and to leverage on their established network of contacts to enhance KM.

Capitalising on both IT systems and people, such an approach will allow the creation and retention of deep domain knowledge, as well as the accumulation and sharing of tacit and experiential knowledge of our people.

Tackling the Defence Relations Challenges of OOTW

The RSAF has thus far built up a strong and capable fighting force, well suited for its conventional military roles. In OOTW, however, our people have to contend with the sensitivities and cultures of other nations in light of the application of military capabilities in a civilian setting. There is a need to adequately equip our personnel to handle these challenges.

Understanding the local culture – High Culture Quotient Needed

Probably the greatest challenge faced by our forces operating in a foreign country is the respect for cultural sensitivities. The Air Force has numerous permanent and periodic detachments in many parts of the world. These detachments provide not only excellent training but also afford the opportunity to build up the cultural quotient of our people. Our recent success in OFE has underscored the fact that our understanding of the local Indonesian culture and ability to speak their language were key enablers of tighter interoperability. They were crucial in facilitating our effective contribution to the relief effort and in allowing us to play a useful interlocutor role between the Indonesian and other foreign agencies. Consequently, it is necessary to educate and equip our war-fighters with a higher degree of cultural quotient, especially in the cultures of our neighbours, and knowledge of the attendant sensitivities and nuances. One specific example is that the Indonesian locals preferred to see us with physical eye contact and not behind the cover of sunshades. Hence, it became an unwritten guideline during OFE not to wear sunglasses when working alongside them. Such tacit knowledge entails investing resources and effort to understand the cultural sensitivities, learn the language and foster cross-cultural friendship building.



Operating in a foreign country requires the respect for cultural sensitivities.

To this end, prior to deploying for overseas missions, our personnel need to be mindful of the cultural sensitivities in the area of operations. Where possible, culture immersion programmes should be organised and basic language training provided. To facilitate a quick response to OOTW, a core group of commanders, who are ready to go at a moment's notice, could be pre-identified and pre-training considered for them. In addition, briefings and educational booklets would be helpful to prepare the personnel and serve as quick guides in-theatre. Such materials could be prepared during peacetime, ready for dissemination when needed.

Maintaining contact through community work

In the course of our detachments in the various parts of the world, we need to build up positive and harmonious relationships with our hosts and the general public. Activities can be arranged to foster a better understanding of the RSAF and the SAF. For example, an open house or some form of visits to our detachments can provide an insight into our operations and culture. Projects to reach out to the local communities, for example volunteer services, school projects, etc., could also reinforce better understanding of both cultures and people.

Ability to work with foreign media

Media operations is one aspect of OOTW that military commanders can expect to be confronted with. Recent advances in technology have enabled the media to report "live" from many places. This increases the likelihood that our ground commanders will be expected to give periodic updates on the work being carried out. Thus, besides performing the

tasks at hand, our scope of professionalism has been expanded to include how well we communicate to the media and the public at large. Media training would be necessary to equip our commanders with the ability to work with the foreign media when the occasions arise and enhance public relations.

Taken as a whole, understanding the local culture, maintaining contact through community work, and enhancing the ability to work with the media would help to improve the cultural quotient of our deployed personnel and enhance their ability to act as good ambassadors of the country.

Conclusion

The geo-political situation of the world today suggests that conventional armed forces will be periodically called upon to participate in OOTW overseas. Singapore, and the RSAF, as a responsible member of the international community, had contributed in this regard. Through the successful conduct of OOTW, the RSAF has contributed to the strengthening of defence diplomacy by reinforcing the understanding between militaries as we worked towards a common goal. However, the challenges that may arise as a result of RSAF's participation in OOTW, would have to be properly managed to ensure that the RSAF can contribute in a manner useful to the host country. To this end, there is a need to enhance our competencies in both operational and defence relations aspects to bring about successful outcomes whenever the RSAF participates in OOTW. 

Endnote

¹ Resources include time, money, manpower, equipment, etc.



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A Reflection on Developing The 3rd Generation RSAF Airman¹

*by LTC Leow Meng Fai, MAJ Leong Chun Siu
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Introduction

The 3rd Generation RSAF will be a full-spectrum and integrated force that will decisively shape the SAF campaign. In the first two generations, people were key to the growth of the RSAF into a macro-competent first class Air Force. In the transformation into a 3rd Generation RSAF, the RSAF recognises that people remain key with people development being identified as one of the main building blocks for the RSAF's transformation. Our Airmen must develop the right competencies and attributes. They have to be prepared to harness the confluence of advanced technologies and concepts, as well as to exploit the opportunities afforded

by the new organisational structures as part of the 3rd Generation RSAF. In addition, our Airmen, anchored on the RSAF core values, must also enable and bring about the transformation through their commitment and will to surmount the challenges and keep the RSAF at the forefront of the transformation journey.

Airman in the 1st and 2nd Generation RSAF

In the 1st and 2nd Generation RSAF, people were the critical success factor for the RSAF's development. Our Airmen were trained rigorously on type or vocational competencies, and developed along specialist functional lines to enable the RSAF to successfully prosecute the

Air Defence and Air Superiority core mission imperatives. As technology was a key enabler, our Airmen were trained to be technically literate, and were adept at assimilating and operationalising the latest technology at both the platform and system levels. Through strong systems and processes, our Airmen also effectively planned and executed complex tasks safely. Building on a strong foundation of the RSAF core values, our Airmen were well equipped to successfully build up the RSAF into the lethal macro-competent first class Air Force that she is today.

Drivers for the 3rd Generation Airman

In the RSAF's transformation into a 3rd Generation Air Force, there is a need to groom a breed of professional Airmen with the right competencies and attributes to succeed in the 3rd Generation RSAF. The drivers that shape the need for a new generation of Airmen lie in concepts, technology and force structure, organisation, as well as mission.

Concepts, Technology and Force Structure, Organisation

Advances in technology like in IKC2, the introduction of advanced warfighting systems (advanced weapons, unmanned systems, etc), and the modernisation of existing ones, will enable new warfighting concepts as part of a network-centric 3rd Generation RSAF. To be effective in exploiting the new technologies, the 3rd Generation RSAF will become more closely integrated. It will leverage upon cross-domain (air-land-sea) capabilities as new technologies will

not respect traditional service domain boundaries. In addition, the bridging of the functional divides (ops-int, ops-logs) will allow operations to be conducted with timely and accurate intelligence updates, and proper understanding of logistics capabilities, for greater responsiveness and effectiveness.

As part of the transformation, the RSAF will undergo restructuring to become more task oriented through enhanced integration of force capabilities. In addition, there will be sharper delineation of force development and force employment within the reorganised structures. Dual reporting lines as part of the matrix organisational structures will feature to promote integration and help align the interactions between various functions based on common task focus.

Mission

In terms of mission, the 3rd Generation RSAF will move beyond the Air Defence and Air Superiority imperatives towards one that is a full-spectrum and integrated force. The operational strategies of Air Dominance, Dominating from the Air, Island Air Defence, Info Dominance, as well as Deterrence and Policy Space feature prominently. The 3rd Generation RSAF, furthermore, will have to operate in an uncertain environment encompassing a wide range of scenarios from the peace to war continuum, and under complex, more dynamic and higher operating tempo conditions.

As a full-spectrum force, the RSAF has to deal with operations spanning across the peace-troubled peace-war

continuum – from a conventional hot war scenario that is highly structured, massive in scale and concentrated, to an unstructured OOTW scenario, or to even lean HADR or extended PSO operations at the other end of the scale. As an integrated force, the network-centric 3rd Generation RSAF will deliver integrated airpower to play a dominating role for the air-land-sea campaigns. This will mean greater cross-domain as well as greater cross-functional integration. While traditional vocational, platform and type-based competencies as in the 1st and 2nd Generation RSAF remain important, however, the 3rd Generation RSAF Airman must also develop greater competencies to operate at the operational level beyond traditional service domain boundaries and functional expertise stove-pipes.



Operating and maintaining the Super Puma helicopters aboard a LST; a step towards greater cross-domain integration.

The 3rd Generation RSAF Airman

The drivers of change and the characteristics of the 3rd Generation RSAF, therefore, will require the Air Force to develop professional Airmen with new competencies and attributes for them to function effectively to meet the new demands. Defining these competencies and attributes can then

serve as the basis for the requisite knowledge, skills and attitudes to be inculcated and imparted into them as part of a comprehensive people development and training approach.

Anchoring and Strengthening

Even as new competencies and attributes are identified for the Airman in the 3rd Generation RSAF, there is a need to identify a set of core competencies and attributes that have served to successfully build up the 1st and 2nd generation RSAF and which will remain relevant ahead. These core competencies include being skilled in vocational fields and being strong in technical/type knowledge. It is not surprising that core competencies will remain relevant even as the RSAF restructures to become task-based and more integrated with cross domain capabilities. In fact, the utility a RSAF Airman brings towards a 3rd Generation SAF should foremost rest upon the 3rd Generation Airman being anchored on his own type and vocational competencies first. In addition to these core vocational/type competencies, the 3rd Generation Airman should continue to ground himself firmly on the RSAF core values. This is necessary in the 3rd Generation RSAF given the greater uncertainty and broader roles that our Airmen will play.

New Competencies and Attributes

With the above competencies and attributes anchoring the 3rd Generation Airman, the following new competencies and attributes may be required to better prepare our Airmen to operate in the 3rd Generation RSAF. While these competencies and attributes are drawn from the drivers and characteristics of the 3rd Generation RSAF, the extent and degree

of development of these competencies and attributes would probably differ according to the deployment and rank of the various Airmen.

a. **Task Oriented and Integrated Mindset.** Following on from the anchors of being fundamentally skilled in vocational fields and experts in technical/type knowledge, the new 3rd Generation Airman in a subsequent broadening shift needs to learn to operate beyond traditional boundaries based on vocations and specialisations in the RSAF, so as to operate cross-domain (Air-sea-land) effectively to *Dominate from the Air*. A 3rd Generation Airman must be comfortable operating based on a task focus that unites cross-functional (ops-int, ops-logs) expertise to deliver integrated force capabilities for the SAF. This attribute will also be essential in more new joint setups where different domain expertise (air-land-sea) is brought together for the prosecution of SAF missions through integrated airpower.



An aircrew participating in a HADR mission; the 3rd Generation Airman needs to learn to operate beyond traditional boundaries.

b. **Capable of Harnessing Cross-Domain Capabilities, coupled with Deep understanding of Military Operational Art.** The 3rd Generation Airman has to be conversant in harnessing cross domain capabilities that do not just necessarily reside in the RSAF alone. This will require collaboration and integration with sister services and Joint to achieve common task success. In conjunction with the harnessing of cross-domain capabilities, our 3rd Generation Airmen have to be equipped with a deep understanding of military operational art at the operational level for the orchestration of cross-domain missions for the SAF. The dynamic operating environment confronting such missions will also require our Airmen to adopt flexible mindsets to better handle uncertainty and complexity.

c. **Competent in Current Ops and Comfortable in Force Development.** As a well-rounded professional, the 3rd Generation Airman needs to be able to switch seamlessly between the developmental mode of thinking, and the management of current operations whilst still ensuring that safety is not compromised. As part of force development, the 3rd Generation Airman should be able to harness advanced technologies to push operating boundaries and concepts as part of the new 3rd Generation RSAF, in addition to being highly conversant on current operations.

d. **Policy Instinct and Media Astuteness for Full-Spectrum Operations.** The 3rd Generation RSAF would be expected to conduct OOTW overseas. Our 3rd Generation Airmen need to be prepared to be

able to respond and deploy overseas at short notice. They need the policy instinct and media astuteness to adequately understand the higher policy considerations to guide their actions during their operations. For a HADR mission in a foreign country as an example, this will require our deployed personnel to understand the objectives of the host authorities to better support them and the other humanitarian relief organisations. Our people would also need to be comfortable in working with the media in such settings, as they are the public face of the RSAF and the nation's ambassadors.

Developing the 3rd Generation Airman

Approach

To develop well-rounded professional Airmen with the new set of desired competencies and attributes, a comprehensive people development and training approach based on knowledge, skills and attitudes would need to be drawn up.

a. **Knowledge.** The education provided by RSAF will have to be more broad based after an Airman attains his initial technical/type knowledge. This can comprise integrated warfare for the surface campaigns as part of the operational strategy of Dominating from the Air, as well as cross functional, and cross-domain concept of operations and doctrines. A 3rd Generation Airman will also have to be familiar with linkages for the waging of integrated operations at the operational level (cross-functional and inter-service).

In addition, the full-spectrum of operations will necessitate our Airmen to be familiar with their roles in Defence Diplomacy and Defence Relations.

b. **Skills.** Besides the primary vocational skills inculcated through the RSAF training system, there is a need to equip our Airmen with a broader range of competency skill-sets in other cross-domain and cross functional areas. In addition, the SAF Leadership Competency Model (comprising competencies in Mission, Conceptual Thinking, Social, Developmental and Self) could be leveraged upon to equip our Airmen with other non-vocation specific skills so as to develop more effective leaders to harness the potential of all Airmen.



Training the 3rd Generation Airman will require tighter integration of traditional Human Resource and Training domains.

c. **Attitudes.** Besides a strong grounding in the RSAF core values, there is a need to shape the right attitudes to inculcate the right mindsets and to guide the actions of the 3rd Generation Airman in the complex and uncertain operating environments. In addition, there is also a need to foster the will and commitment of our Airmen to effectively enable the transformation into a 3rd Generation RSAF.

Enabling the Transformation

To inspire our Airmen to be committed and take on the challenge and ownership to deliver the 3rd Generation RSAF, the management of our Airmen will have to be enhanced. To do so, this should involve the tighter integration of traditional HR (people management and career development) and Training domains to recruit, train, deploy, reward and develop our Airmen better. The recent development of a clear RSAF People Development framework is an important step to provide better focus to nurture the desired 3rd Generation Airman. Besides seeking to equip the Airmen with the necessary competencies and attributes, as well as reinforcing the RSAF core values in daily work, this framework also recognises the need to build greater emotional bonds with our Airmen. This bonding is crucial for the 3rd Generation Airman to be one who is committed, motivated and willing to do his or her best for the RSAF. This will necessitate the sustenance of an open learning culture, a culture of coaching and grooming at all levels in the workplace, as well as opening up of greater opportunities to realise the full potential of our Airmen.

Conclusion

The RSAF has long recognised that people are key to organisational success. In the 1st Generation and 2nd

Generation RSAF, people development focused on developing values-centred, well-trained professionals strong in type and vocational knowledge and skill-sets, as part of the core Air Defence and Air Superiority imperatives. In the 3rd Generation RSAF, the people development emphasis will remain a key building block for the RSAF's transformation. Our Airmen need to be prepared to harness advanced technologies and concepts within the new organisational structures. Anchoring on a strong grounding in core values, vocational and type competencies, a generation of well-rounded professional Airmen, with new competencies and attributes, will be able to function effectively as part of an integrated and full-spectrum force. It is also important to recognise that the will and commitment of our Airmen are key to enable our transformation. These should be the main thrusts of our people development efforts in the coming years to transform into the 3rd Generation RSAF. ©

Acknowledgement

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Endnote

- ¹ Airman refers to a serviceman or servicewoman serving in the RSAF.



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EBO: Thinking Effects and Effective Thinking

by Dr. Paul T. Mitchell

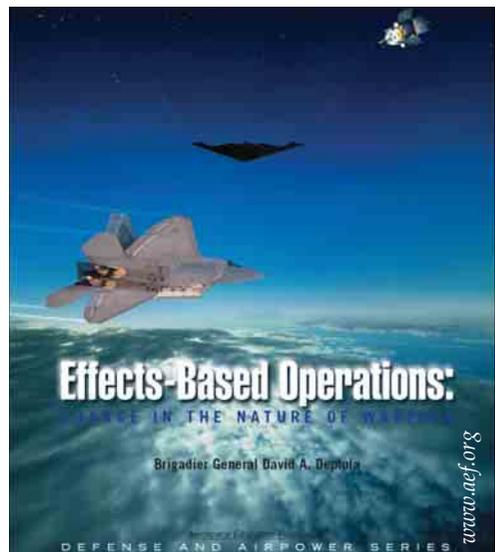
Effects Based Operations (EBO) has a relatively brief but vibrant history. The term EBO burst out of the aftermath of Desert Storm, when American military planners began to wonder if fundamental changes in military technology were generating a “revolution in military affairs” (RMA). Like its counterpart network centric warfare (NCW), EBO describes certain military practices that actually have well established lineages in terms of military thought. However, the impact of modern information and communication technologies (ICT) has transformed these traditional capabilities and objectives into something entirely new. The truth of this assumption is yet to be definitively proven; nevertheless, wider social, political, and economic developments stemming from the impact of ICT suggests that there is “something afoot”, even if the ultimate significance of it for military operations as yet remains unclear.

This paper suggests that the social science model that underlies EBO is seriously flawed from a number of methodological directions. Not all is doom and gloom, however. Militaries, and more importantly, states can use “effects based” approaches to confront their non-state opponents without, however, the chimerical certainty promised by the theory of EBO. Here,

the prosecution of the “long” Cold War offers some lessons in the application of “effective thinking”.

A Brief History of Effects Based Thinking

EBO emerged publicly in 1999 with the publication of then Brig. Gen. David Deptula’s *Effects Based Operations: Change in the Nature of Warfare*. While the concept of EBO certainly predates this publication, it was confined to doctrinal speculation within various US military battlelabs. For example, as early as 1995 *Joint Vision 2010* contained a version of the concept of “Full Spectrum Operations” that was oriented around the creation of “massed effects”.



EBO emerged publicly in 1999 with the publication of this book by then BG Deptula.

The modern version of EBO finds its origins in the thinking of Col. John Warden. In 1988, Warden published *The Air Campaign*, an expanded version of his National Defense University master's thesis. In it, Warden argued that there were few rigorous analyses that examined *how* to fight a war as much of the literature on war focused on the strategic level of warfare. *The Air Campaign* posed a model of warfare that stressed the identification and massive attack of an enemy's "centres of gravity" as well as recognising the important relationships between policy and operations.

Warden later added additional complexity to this argument in an article appearing in the *Airpower Journal* in 1995 where he argued that opponents must be analysed as a "system". Warden posed a five-ring model of an interdependent system, with leadership at the centre, organic essentials, infrastructure, population, and fielded military in concentric circles each further out. The importance of this model was to focus military planners on the essence of their tasks.

Strategic war is war to force the enemy state or organization to do what you want it to do. In the extreme, it may even be war to destroy the state or organization. It is, however, the *whole system* that is our target, not its military forces. If we address the system properly, its military forces will be left as a useless appendage, no longer supported by its leadership, organic essentials, infrastructure, or population.¹

Warden played an important role in the design of air operations during the 1991 Gulf War. Warden chose to focus

the air campaign on the strategic level, rather than simply tactical operations in support of a ground offensive. His plan, "Instant Thunder" (so named to distinguish it from the sequential "Rolling Thunder" of the Vietnam War), hearkened back to the strategic campaigns of World War Two. A series of target categories were established to guide targeting, including:

- Leadership, command and control facilities and telecommunications;
- Production facilities including oil, electricity, and military production;
- Infrastructure including rail, ports and bridges;
- Fielded forces, air defences and airfields; and
- Nuclear and chemical weapons facilities and research labs²

Warden was assisted in his task by the development of new technology as well. In particular, careful attention was paid to the crafting of strikes against Iraq on the initial night of operations. The first order of business was to eliminate the ability of Iraqi air defences to engage attacking coalition aircraft. Checkmate used a whole range of relatively untried technology such as TLAMs and F-117 stealth aircraft, as well as non-traditional air assets such as Apache helicopters and targeting drones, to target Iraqi air defences on the first night.³ Responsibility for planning for the air campaign eventually moved to CENTAF itself. The principle officers of Checkmate, including Deptula but not Warden, became the nucleus of a planning cell known as the "Blackhole".

Throughout the campaign, several innovative strike techniques were developed. The fusion of stealth aircraft with precision guided munitions allowed

small numbers of aircraft to operate in areas of incomplete or absent air control that were previously too difficult to fly over, particularly on the first night of an air campaign, and hit targets using small numbers of weapons.⁴ Targets such as aircraft shelters, air defence operations centres, headquarters, communication nodes, and bridges all became vulnerable to attack, even in the face of an un-attributed air defence system.

Deptula's analysis of EBO leaves off with the close of the Gulf War, and focuses largely on targeting, based on the theory of "parallel warfare" employed in that conflict. Using the analogy of a parallel electrical circuit, rather than sequentially striking targets from the easiest to attack, to the most heavily protected, rolling back enemy defences as one proceeds, modern technology embodied in the form of precision weapons and stealth permit multiple targets to be struck by single platforms. Simultaneous attack "on the entire array of high value objectives" would render an enemy unable to control its organisations, industries, and other important infrastructure. In effect, a rapid precise, parallel attack would quickly paralyse an enemy. "At that stage, the enemy has no choice but acquiesce to the will of the controlling force or face ever increasing degrees of loss of control."⁵



Deptula suggests that parallel warfare, enabled by modern technology such as precision weapons and stealth, would quickly paralyse an enemy.

While originating within the USAF, EBO has since been adopted as one of the key concepts of the US Joint doctrine. While not specifically referenced, the language of EBO permeates the November 2003 *Joint Operations Concepts* document.⁶ More specifically, Joint Forces Command (JFCOM) has published a series of pamphlets defining and describing EBO and its associated concepts, Operational Net Assessment (ONA), Comprehensive Information Environment (CIE), and Systems of Systems Analysis (SoSA).

Modern EBO

EBO has evolved beyond the early thoughts of Deptula and Warden to become a holistic theory of *war*, as opposed to their more limited speculations on *warfare*. As the JFCOM pamphlet on EBO notes:

Today's global environment consists of a network of complex interconnected adaptive systems that extend beyond the domain of historic military operations and geographic battlespace. Planning and execution of future operations must extend beyond US military stovepipes and integrate fully with government and non-government agencies as well as with multinational partners.⁷

Thus, EBO has moved beyond the joint operational considerations of parallel warfare and enemy systems and into the social scientific considerations of strategic behaviour and the coordination of both interagency and multinational efforts. Still, EBO is driven by a systems model that is derived from its "Newtonian" depiction of warfare as a series of cause and effect relationships.

EBO is defined as “Operations that are planned, executed, assessed, and adopted based on a holistic understanding of the operational environment in order to influence or change system behaviour or capabilities using integrated application of selected instruments of power to achieve desired policy aims”.⁸

In turn, a system is “a functionally, physically and/or behaviourally related group of elements that interact together as a whole”. This is typically described under the rubric “Political, Military, Economic, Social, Infrastructure, and Information” or “PMESII”. Effects are defined as “physical or behavioural states of the PMESII system that result from military and non-military set of actions”. These effects can take place at the tactical, operational, and strategic level. Strategic effects are changes in an opponent’s behaviour, operational effects are “changes in an opponent’s ability to operate coherently”, and tactical effects are changes in key systems.⁹ An important aspect of EBO, then, is that it seeks to apply *national* power, as opposed to strictly *military* power. As such, EBO introduces the notion of DIME or Diplomatic, Information, Military, and Economic power assets that are applied against nodes found in the enemy’s PMESII system.

Critical to EBO is the notion of “knowledge supremacy”. Knowledge supremacy makes possible superior manoeuvre as well as enabling precision strikes, whether of a “kinetic” or “non-kinetic” manner. To a certain degree, for the force with knowledge supremacy, the battlespace is to all intents and purposes, transparent. The so-called “fog of war” is eliminated to an unprecedented degree, and the impact of friction in operations is minimal. While some may argue that such a concept assumes a relatively

simple model of the battlespace, in fact, knowledge supremacy recognises the very complexity of modern military operations. “...the coherent and integrated application of national power requires extensive understanding and knowledge well beyond that of an individual, of the commander’s immediate staff, or of the direct support organizations”.¹⁰ In other words, the knowledge necessary to understand the battlespace is the *collective* understanding of many different sensors, people, and organisations. In order to take advantage of this collective understanding, a framework needs to exist to exploit it. The mechanism EBO suggests is the concept of Operational Net Assessment (ONA).

ONA suggests that “the more we know about the enemy, the operational environment, and ourselves, the more precisely we can focus our capabilities to produce desired effects while mitigating undesired effects”.¹¹ This is made possible by the ability to network people and sensors, as well as the increasing ability to store, manage, manipulate, and access data in computer systems. While knowledge has always been important to military operations, it is the new technology of ICT that has permitted the exploitation of the ultimate power of information.



ONA suggests that “the more we know about the enemy, the operational environment, and ourselves, the more precisely we can focus our capabilities to produce desired effects”.

ONA organises itself around the concept of “systems of systems”. The term was first introduced to the professional military literature by Vice Admiral William Owens in 1996 in the National Defense University’s *Strategic Forum*. “The Emerging System of Systems” described a concatenation of sensors, command and control systems, and precision weaponry.¹² EBO’s system of systems is a more complex concept, however. It describes an analytical process (System of Systems Analysis, or SoSA) which seeks to illuminate key relationships between the PMESII systems, allowing a force to manipulate dependencies and exploit vulnerabilities within them. The result of SoSA is the construction of “effect, node, action, resource (ENAR)” links. ENAR permits the correlation of a specific effect on a specific node in the PMESII system, which can be accomplished through the execution of a specific action using specific resources.¹³ As one source notes, then

The SoSA of the ONA enables us to set environmental conditions to force the target to adapt and choose *only* options that we make available.¹⁴

However, such capability is based on extensive analysis of a system prior to operational planning. The ONA vision foresees the creation of an ENAR database “complete with (secondary and unintended) effects” categorized. Such a database would be used to develop courses of action.¹⁵

Because an effects based plan is joint, inter-agency, and multinational, it must be put into operation within what is described as a “Collaborative Information Environment” or CIE. The national power DIME construct means that many effects will be caused by actions

unrelated to military operations. Further, as the battlespace is a single contiguous construct, geographic demarcations between services and multinational forces make little sense.

The plan may not assign component areas of operation, but rather may describe how component actions will be integrated during engagements. To describe the effects to be achieved, the joint force commander issues an “effects tasking order” that contains broad, mission-type orders to his components. Subordinate commanders collaborate across component lines to integrate the joint capabilities needed to create the assigned effects.¹⁶

In order to achieve this, actors within the joint/interagency/multinational environment will have to efficiently share information to collaborate successfully.

This is, without a doubt, a powerful vision of war, for it assumes the capability to deny free choice for the enemy. Recalling the desire to dictate the choices open to an opponent, however, under this vision the enemy is not an independent actor but rather the prisoner of a “Skinner box”.¹⁷

Theoretical Problems with EBO

It would be nice if we had in fact stumbled onto a military master concept that would promise victory in any given engagement. Sadly, this is not the case. From a simple Clausewitzian perspective, EBO makes little sense. From the wider perspective of the last forty years of social science theory, it makes even less.

As suggested above, EBO takes an instrumentalist and materialistic approach to the conduct of warfare. It is instrumentalist in that it views war as a

means to a specific end, a simple policy tool, albeit a highly complex and violent one. It is materialistic in that, first, its emphasis on the technological prosecution of conflict, and second, on its essentially “Newtonian” concept of war as a series of causes and effect relationships.

Clausewitz is anything but instrumentalist or materialistic in his approach to warfare. Clausewitz obviously makes the famous observation that “war is the continuation of policy with the admixture of other means”, however, in his “trinity” of warfare, he makes clear that there are crucial moral, *human* aspects to the conduct of war. On the opening page of *On War*, Clausewitz paints a picture of warfare as akin to a wrestling match between opponents. He imagines war to consist of “countless duels”, as though fought by a pair of wrestlers: “Each tries through physical force to compel the other to do his will; his immediate aim is to throw his opponent in order to make him incapable of further resistance”.¹⁸ Because both sides seek the same objective, that is to prevail in conflict, it is impossible to conceive of war as action performed by an actor on an inert mass. Instead, it must be understood as action taken against a reacting agent. The image created is necessarily interactive and most resembles a conversation between two individuals. Like arguments in a debate, whatever is done militarily must not only be in synchronisation with the political objective of the war, but also with the anticipation that the adversary, through their own efforts to avoid defeat or to prevail, will be reacting against those plans.

To extend the point, Edward Luttwak in his noted work *Strategy: The Logic of War and Peace*, notes that the classic axiom “if you want peace, prepare for war” suggests a logic similar to “if you

want to lose weight, eat more”. However, his observation follows directly from the interactive duel that Clausewitz uses to describe war. Strategy in warfare is “paradoxical” because of the need to confuse and mislead the enemy. From this perspective, a Newtonian model of the “warfare universe” makes little sense.

Lastly, the mechanistic notions of causality bear little resemblance to the actual practice of human relations. The dream of reducing enemy behaviour to a series of interrelated systems is tempting from the military planner’s perspective, especially in terms of simplifying the complex task of designing operations and campaigns. However, the mechanistic model of human behaviour is dangerously misleading. To understand why, we must return to the issue of choice that EBO falsely assumes can be controlled.

As noted above, the goal of EBO is to force the opponent to make choices that are consciously limited by the structure of a campaign. While this is true of all operations, the distinction between the assumptions of EBO and classic military campaigns is the degree of certainty associated with the limitations of those choices. A brilliant campaigner like Napoleon or Lee might be able, through his own intuition or *genius*, have the insight to lead his opponent about by the nose; EBO claims a scientific-like process for generating similar outcomes, reliably and in a replicable fashion.

Choice, however, is a matter of human judgement and interpretation. The complexity of any human society stems from the fact that even in the most repressive systems, there is a level of freedom in every human choice. Even the most totalitarian system has never been able to completely reduce human choice to a short list of politically acceptable options.

Despite draconian punishments, all political systems have dissidents and criminals. Illiteracy, ignorance, and madness itself also impacts on the choices individuals make and further complicates any model attempting to predict human behaviour. Indeed, the very distinctions between any of these categories are themselves suffused with uncertain political and moral judgements and individualistic interpretations of right and wrong.



Iraqi irregulars surrendering near Basra during OIF; Choice is a matter of human judgement and interpretation.

Freedom of choice, even as it exists in the most repressive of societies, ensures that political plans are often imperfectly realised. Just as freedom of choice negatively impacts on social policy, so too does it impact on any military systemic analysis of society. “To the extent that individuals are free to make such choices and to act on them, significant areas of social life will exhibit an unplanned and uncontrolled process of development”, in other words.¹⁹

Mechanical causality makes three assumptions:

- same causes have the same effects;
- there is an equivalence between the force of the cause and that of its effect; and
- the cause must precede the effect.²⁰

While these assumptions hold true in the physical world for the most part²¹, they are all critically affected by the independence of the human mind. Human action is based on interpretation of one’s situation, and that interpretation is inseparable from what one thinks about the world. Thus, the very process of thinking shapes the world around us, whether for good or evil. For Americans, the Crusades are an irrelevant event, totally unconnected to their present reality. The Crusades are, for all intents and purposes, “dead history”. For the peoples of the Middle East, the Crusades still live brightly in their mythology and their understanding of the world about them. Events nearly 800 years removed from our time live resonate as strongly as the events of 7 Dec 1941 for the United States.

To return to our model of mechanical causality that is implicit within EBO, recent deaths in South Lebanon had greater political impact than deaths taking place in Baghdad, despite the victims being Muslim as well as Shiite, and occurring in greater numbers in Iraq than those in Lebanon. In this case, deaths of Lebanese Shiites provoked widespread condemnation of Israel, and were utterly ignored in Iraq: the same causes had different effects and there was an absence of equivalence between the force of the cause and that of its effect.

Effects may even precede causes in the human environment. Humans *anticipate* events. Thus, as Lukas points out, “there are human situations in which it may be argued that what may happen tomorrow is the ‘cause’ of what happens today (or of what happened yesterday)”.

²² Again, the fear of Hezbollah’s growing military capability, as much as the

seizure of the two Israeli soldiers, was an important factor in the decision to wage war recently in Lebanon, as was the fear of Saddam's future actions for the American decision to invade Iraq in 2003.

Effective Thinking

As a model of human behaviour, EBO leaves much to be desired. Indeed, it strikes this author as a concept dreamed up by systems engineers with little understanding of the social sciences. Nevertheless, the motivations that underlie EBO bear remembering. That military planners should consider the operations they plan lead to some political outcome is a worthwhile goal. Many a war has been needlessly prolonged because of the failure to consider the wider linkages between operations and politics. Indeed, looking at the recent Cold War past using the DIME rubric of EBO suggests important lessons for the on-going War on Terror.

Like the current War on Terror, the Cold War was an ideological struggle that had no real military solution. Any purely military solution to the Cold War ran the risk of a global nuclear war. In the context of the forty-year struggle between the West and the Soviet Union, it is possible to see an "effects based" campaign in retrospect, however.

Diplomatically, the West continually sought to undermine the political and ideological roots of Soviet Communism. This was done most crucially through the signing of the Helsinki accords. While hard core strategic analysts often undervalue the role of human rights in foreign policies, the accomplishment of Helsinki was to effectively remove any claim of legitimacy that the Soviet Union operated in the best interests of humanity. Indeed, it revealed it for what it was: an evil police state.

In terms of information, the continuous broadcast of images and news from Western media sources also fundamentally undermined the ideological claims supporting the "socialist paradise". In this West German television broadcasting episodes of "Dallas" and "Dynasty" were as important as official broadcasts from "Radio Free Europe" and "The Voice of America". The visible differences between the accomplishments of the Western economies with the failure of socialist ones sapped the ideological moral of committed communists, and lead to a critical increase in cynicism within Eastern societies.

The Military was obviously critical to the winning of the Cold War, simply not in the "kinetic" application of firepower. The ability of the West to work together within the confines of NATO, to this day provides a shining example of international relations. Further, the rapid progress of military technology in the form of stealth technology and computerised network systems ultimately played an important role in convincing the Soviet Union that it could not keep up with the West.

Finally, the West, lead largely by the US, waged a brutal economic war on the Soviet Union. The series of economic and technological embargoes prevented the Soviet Union from modernising its economy, as well as denying access to hard Western currencies to buy such modernisation. The pooling of all these measures, none of which involved the actual use of force, combined to create the collapse of Soviet Communism, much as George Kennan predicted as far back as 1948.

EBO, as it exists in the baroque doctrine of JFCOM, will unlikely play a similar role in shaping the collapse of global Jihadist

based terrorism, however, the message of EBO is important to consider in this existentialist challenge. Just as the goal of the Cold War was to defeat Communism without blowing up the world, our goal today must be to defeat Jihadi terrorism without creating a “clash of civilisations”. This too must be an “effects based” campaign for what we are targeting is an *idea*, rather than a military organisation. We can do little wrong by considering the retrospective example of the successful, though highly serendipitous, “effects based” Cold War. 

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- 14 Emphasis added. *Concept Primer: Operational Net Assessment*, p1.
- 15 *Operational Implications of ONA*, p9.
- 16 *Concept Primer: Effects Based Operations*, pp5-6.
- 17 A Skinner box is a tool used by experimental psychologists investigating the basis for behaviour. By using a system of rewards and punishments, psychologists could “condition” certain behaviour from the occupants, usually rats, although some have suggested that slot machines are in effect Skinner boxes.
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The Science of War

by LTC Gurbachan Singh

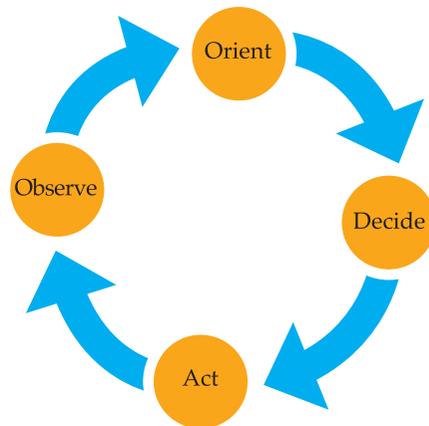
“War is a science covered in darkness, in the midst of which one does not walk with an assured step...all the sciences have principles, but that of war as yet there are none”.

Marshall de Saxe, 1757

Introduction

Scientific and technological advances in platforms, weapon systems, electronic spectrum and space technologies today offer opportunities for unprecedented dominance in conventional warfare. So pervasive is the addiction to science, system and technology that some strategic thinkers and defense planners firmly believe that warfare could be systematically studied, reduced to certain immutable principles and won decisively. In the 21st century, the time has come where space-based technologies and remotely piloted vehicles can not only identify targets but also destroy them in near real-time.¹ Science and technology will not only ‘lift the fog of war’,² but through decision support systems, even provide commanders with options to select the best course of action. The late Arthur K Cebrowski propounded that ‘Network-centric warfare enables a shift from attrition-style warfare to a much faster and more effective war fighting style characterized by the new concepts of speed of command and self-synchronization. Very high and accelerating rates of change have a profound impact on the outcome, “locking-out” alternative enemy strategies and “locking-in” success’. John Boyd also contends that ‘if you can go through the Observation-

Orientation-Decision-Action (OODA) Loop faster than your enemy, you’ll live and he’ll die’.



John Boyd contends that ‘if you can go through the OODA Loop faster than your enemy, you’ll live and he’ll die’.

History is replete with examples where science and technology have made the difference between victory and defeat. Archimedes, through his inventions, was able to hold off the Romans from the fort of Syracuse for three years.³ The invention of the six-foot yew long bow by England offered a significant competitive advantage over decades of warfare against the Scots and Welsh.⁴ The side that could best exploit and integrate inventions in the battlefield prevailed. Germany’s blitzkrieg operations integrating airpower, communications and tanks

decisively defeated France during the Second World War. The invention and dropping of the hydrogen bombs on Hiroshima and Nagasaki also brought about the speedy and unconditional surrender of Japan. The more recent unprecedented battlefield successes of the Gulf wars of 1990 and 2003 have further brought to the fore the notion that wars could be fought and won through an overwhelming superiority in science and system.

This essay rationalizes the extent to which war could be studied as a science or system and whether its outcomes could indeed be deterministic. It reviews the origins of the science and systems approach, the ideas of Antoine-Henri Jomini, J.F.C Fuller, John Boyd and John Warden, the nature and dimensions of war and strategy and finally the extent to which war could be studied scientifically and therefore be deterministic and the extent it will continue to be in the realm of uncertainty requiring the intervention of the intuitive judgment of the human in the loop.

Science and System

The 17th and 18th Century Age of Enlightenment gave momentum to the notion that human reason, more than blind adherence to certain belief system and authority, could be used to build a better world. According to Ferguson most scholars agree that ‘Enlightenment finds its touch stone in the primacy of reason, assertion of scientific method, concern for experience, a belief in progress or at least in the possibility of collective human freedom, and finally a general

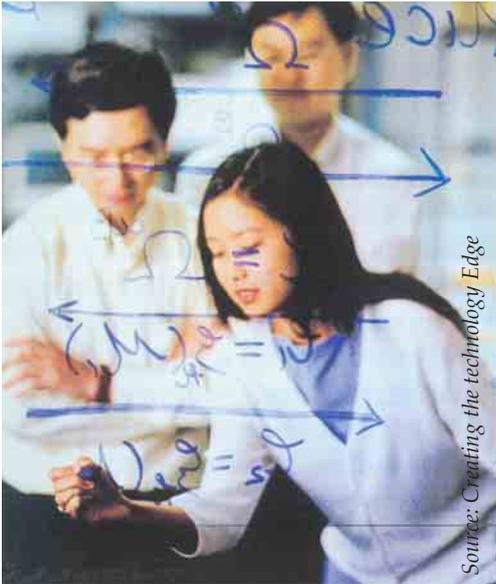
disregard for tradition or constituted authorities’.⁵ Although tempered with the Kantian caution against pure reason alone, rationality and science have been spurred on by the successes of Newtonian physics and taken centre stage in most transforming societies.

In 1609, Galileo used the first telescope to discover a new ‘truth’ that Earth was not the centre of all celestial movement as was believed by the Ptolemaic system. His discovery of acceleration of falling objects through the postulation of vacuum (even before it could be attained), destroyed Aristotelian physics and demonstrated that at the heart of the modern scientific method is a balance between intuitive thought and empirical testing. Galileo believed that nature was too complex to be understood by empirical testing; only by reasoning could we comprehend its perfect nature.⁶ Conversely, pure reasoning without physical evidence is also fallible.

I believe mankind’s penchant to seek order and system stems from his innate and primordial fear of the unknown that could potentially threaten his very survival. The fundamental premise of science is that there is ultimately some order in the universe and therefore it could be analyzed and studied. Regardless of whether it is a linear or non-linear relationship, there must be a cause or causes to an effect and therefore it could be studied. The antithesis to science is therefore that a totally random phenomenon cannot be scientifically studied.

Hypothesis, theories and laws or principles govern science. Science essentially aims to discover the ‘truth’.

A scientific law is a statement of fact that is accepted as true and universal. A scientific theory 'is an explanation of a set of related observations or events based on proven hypothesis'.⁷ The essential difference between law and theory is that theories are generally more complex and helps to explain a series of related phenomena. Hypothesis is a proposition or provisional explanation of phenomena that can be tested. Principles in the scientific discipline are also referred to as laws. However, in other disciplines principles, may refer to a set of prescriptions, rules, action statements, parameters or merely guidelines.



Hypothesis, theories and laws or principles govern science, and science essentially aims to discover the truth.

More recently, systems theory, which has its origin in 1940, was proposed by a biologist Ludwig van Bertalanffy. Rather than reduce a phenomena to its essentials for greater clarity, systems theory emphasize that real

systems are open and interacting with the environment and therefore continually evolving. Through using concepts of emergence, hierarchy, communication and control, it 'focuses on the arrangement of and relations between the parts which connect them into a whole'.⁸ Similar concepts are also used in complexity theory to better understand and explain non-linear phenomena. The ideas of complexity theory show how systems adapt to randomness and the external environment and 'give us insights into dealing with uncertainty in warfare'.⁹ Beinhocker says, 'What's needed is a model of a world where innovation, change, and uncertainty are the natural state of things'.¹⁰ However, both system and complexity theories continue to rely on the basis premise that systems have certain 'schema' or patterns that are determinable. These patterns could in turn provide insights on how to manage the real world and by drawing a parallel how to systematically win wars.

The illustration of scientific enquiry suggests that it has its usefulness in better understanding and managing aspects of warfare, which are definitive. Indeed there are many aspects where scientific enquiry could be applied (e.g. Geography, weapons systems, etc) and resource management issues could be readily optimized through simulation and modeling. System and complexity theories, however suggest that despite the non-linearity of the cause and effects of the myriad dimensions of warfare, there is still a possibility for scientific analysis and useful degree of determinism. Indeed,

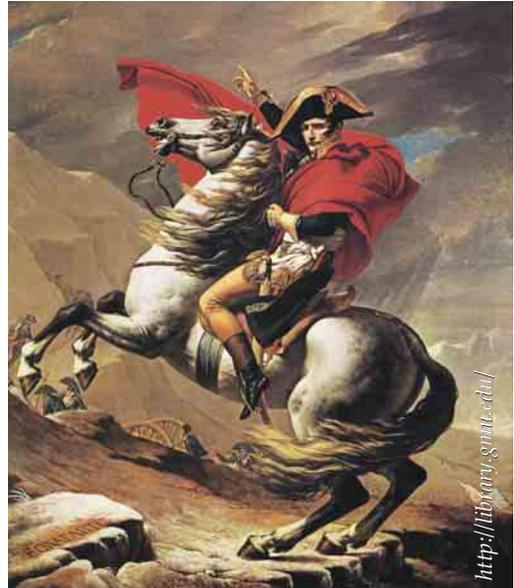
this line of argument will reinforce and provide a strong basis for the existence of the immutable principles. After all, the historical basis of Jomini's analysis may have discovered the 'truth' although initially without a theoretical foundation. This inductive and deductive cycle of reasoning is very much grounded in scientific enquiry. The question therefore arises whether there could indeed be certain schema or patterns of war that could be systematically analyzed and where definitive methodologies could be devised achieve success?

Science, System and Principles of War

The modern concept of principles of war has been traced by Azar Gat to the writings of Montecucoli in the 16th century. It was however during the era of the enlightenment that the 'ideal of Newtonian science ... gave rise to an ever-present yearning to infuse the study of war with the maximum mathematical precision and certainty possible'.¹¹ While thinkers like De Saxe, Puseygur, Turpin, Maizeroy and Guibert advocated the development of the principles of war, they acknowledged that there were aspects of war and strategy that require the creativity and genius of the commanders.¹² Examples of some early principles could be gleaned from the following writings and maxim of Napoleon in 1804:¹³

'Remember always three things: unity of forces, urgency, and a firm resolution to perish with glory. These are the three great principles of the military art that have brought me success in all my operations'¹⁴

'Gustavus, Turenne and Frederick, as well as Alexander, Hannibal and Caesar, have acted on the same principles. To keep one's forces together, to bear speedily on any point, to be nowhere vulnerable, such are the principles that assure victory'¹⁵



Napoleon I, the military genius

Antoine-Henri Jomini inspired by Napoleon's achievements wrote in his summary of the art of war in 1838 that 'there are a number of fundamental principles of war, which can not be deviated from without danger, and the application of them, on the contrary, has been nearly always crowned with success'.¹⁶ This principle was 'to throw by strategic movement the mass of forces of an army, successfully, upon the decisive points of a theater of war, and as much as possible upon the communication of the enemy without compromising one's own'. J.F.C. Fuller in *The Foundation of the Science of War* expounded the scientific method as a common sense approach to know the 'truth about the past, and how we can

apply this truth to the conditions which surround us and which will probably exist during the next war'.¹⁷ The U.S. Army presently has nine principles of war and they are mass, economy of force, objective, offensive, maneuver, unity of command, security, surprise and simplicity. With minor modifications, the other armies in the world also use most of these principles.

In these modern times, strategic thinkers like John Boyd and John Warden also advocated a largely systems approach in analyzing and waging war. Although they acknowledged and have taken into account in their models the moral, morale and frictional forces that could affect the outcome of wars as highlighted by Clausewitz, they continue to be strong advocates of a deterministic approach of using superior science and system to defeat the enemy. John Boyd's OODA loop aims to achieve strategic paralysis by being faster in observing, orienting, deciding and acting than the enemy. John Warden viewed the enemy as a system and aimed to target the will of the enemy by attacking at the centre of gravity of the five rings of the system. The centre of the ring is the leadership which if targeted could cause a speedy collapse of all the other rings comprising the organic essentials, infrastructure, population and fielded forces¹⁸.

A closer examination of the principles of war suggests that they could serve as broad guidelines or considerations to facilitate military planning. They emphasize a judicious employment of limited resources and possible approaches and when correctly applied, could potentially enhance the probability

of success. As an illustration I will now discuss the principle of mass as it was the main one promulgated by Jomini. The principle of mass stems from the need to overwhelm one's opponent by applying maximum force at a decisive point and time. The decisive point could be a critical strength or vulnerability. There are three variables in this principle (i.e. mass, decisive point and time). Mass does not necessarily mean greater numbers, but rather the effective force, for example, a single precision guided missile would have greater mass than 100 bombs of the World War II era. Decisive point and time on the other hand are of intuitive and subjective nature. Identifying the tipping point would require an intuitive assessment after considering all the ensuing circumstances. As an illustration, Napoleon's loss at Waterloo could either be attributed to the weather, failure of a right combination of force or mass, or the failure to attack the decisive point. The analysis could be further complicated by the change in the force ratio upon the arrival of Blucher. Had Napoleon succeeded in mass, he could still have failed if he did not exercise economy of force or achieved tactical surprise. Consequently while these so called principles are useful considerations, they are by no means immutable. Secondly and more importantly, it is the judicious combination of these considerations, based on the prevailing conditions and with the right judgment on the ground that the probability of success could have been enhanced. The principles therefore serve as useful start points or checklist but should not be viewed as the silver bullets that could enhance or guarantee success. The specific situation must be studied carefully.

It is also noteworthy that most countries have different principles of war, and they even have principles for each type of operation (e.g. offensive and defensive operations). As an illustration, the principle of defence-in-depth while promulgated for defensive operations does not exist for offensive operations. This shows that having general principles not tailored to the specific types of operations could be unduly restrictive and may not match to the context or situation. Bernard Brodie also emphasizes that principles of war can stifle initiative and innovation and remarks that ‘the so-often-repeated axiom that I quoted a moment ago – “methods change, but principles are unchanging” – has had on the whole an unfortunate influence on strategic thinking, encouraging, as it does, the lazy man’s approach to novel problems with potentially detrimental consequences’.¹⁹ They are useful however, as they embody some of the best practices that according to General Pershing ‘remained unchanged’.²⁰

Clausewitz, who studied the Napoleonic campaigns and regarded Napoleon as a ‘military genius, suggested that while we should continue to study war, it is a complex phenomenon governed by many variables where the outcomes could never be certain. While Clausewitz also ‘frequently spoke loosely of certain ‘principles’ to be observed and followed ... he specifically rejected the notion that there could be any well defined body of particular rules or principles that universally dictated one form of behavior rather than another’²¹.

In his early writings on *Strategy as a Science*, Bernard Brodie highlights the main limitation of the principle of

wars as ‘they not only contain within themselves no hints on how they may be implemented in practice, but their very expression is usually in terms which are either ambiguous or question-begging in their implications – a trait which has grown more marked since Jomini’s day under the effort to preserve for them the characteristics of being unchanging’.²²

In summary, it could be argued that the principles of war may serve as useful guides to the application of military force, rather than unquestionable ‘truth’ with universal applications. These principles should not serve as substitutes for creative thinking, situational analysis and leadership judgment. It could also be surmised that while most strategic thinkers agree that war could and should be studied, they are generally divided on the extent to which war could be analyzed and waged deterministically. The debate on the extent to which science and system can influence the outcomes of wars is far from over. To examine that warfare could indeed be waged and won through science, system and technology, we would firstly need to examine the purpose of war within the international system, its dimensions and ultimately its nature.

The International System and the Nature of War

The international stage comprises of a vast collection of sovereign governments. While there are laws enacted within these countries to govern its affairs, the world stage is largely anarchic without any legitimate government or mandate to enforce law and order. These nation states have national interests which are safeguarded

or advanced by national policies. These policies include the use of economic, diplomatic and military power to advance the national interests. War is but one of the instruments of policy to advance the national interests. It entails the use of force to get other nations to do its will. At the policy level countries formulate the grand strategy, which is essentially the art and science of using economic, diplomatic and military force to achieve the national objectives. At the military level, a military strategy is formulated which essentially is the art and science of employing military force to fulfill the national policies. At the operational level, the operational strategy involves the art and science of planning engagements, in a specified theater of operation to fulfill the military objectives. At the tactical level, it is the art and science of winning battles to fulfill the operational objectives. What is therefore the art and science of strategy or operations?

Michael Howard suggests that war (as a strategy) comprises of four main dimensions and these are social, technological, logistical and operational. As an illustration, the social dimension includes moral and political dimensions as well as the will of the people. These dimensions are by no means exhaustive and can be further divided into several sub-dimensions. Colin Gray's suggested dimensions of war and strategy are ethics; society; politics; people; command; economic and logistics; organization; military preparations; operations; technology; information and intelligence; adversary, friction chance and uncertainty; and time.²³ It becomes apparent from these dimensions that war is a complex endeavour and

includes many disciplines straddling almost the entire spectrum of the arts and sciences.

There are clearly aspects of warfare that are largely deterministic. These include the understanding weapons/equipment and platforms characteristics/capabilities, geography and resource management (e.g. budget, ammunition, and petrol). These are essential knowledge that supports the formulation of military plans. The German general staff was created to address this aspect comprehensively. Based on the characteristics of the systems, they devised methodologies to employ them in the varying military context. This translation of systems employment into doctrines and methodologies can be said to be the blending of science of warfare with the art of war. Depending on the complexity of the systems, doctrines could be largely scientific or be in the realm of art. The US Army defines doctrine as 'fundamental principles by which the military forces or elements thereof guide their actions in support of national objectives. It is authoritative but requires judgment in application'. The key differentiating factor would be whether the employment of the equipments or platform is definitive and therefore could be prescriptive or requires the weighing of numerous factors offering several possible options, and therefore requires the rational and intuitive judgment of the user. There is also the issue of an opportune time and circumstances to offer battle where there may be no prescribed solutions and therefore novel plans will have to be derived. Hew Strachan aptly highlights that 'routine and method of tactical

precepts gave junior commanders rapid reactions to critical situations; the solidity they imparted ensured confidence in the troops and bought time of their leaders to consider his next move. But as the smashing of Fredericks's army at Jena had so vividly demonstrated, routine in strategy destroyed the flexibility essential to genuine awareness'.²⁴



Jomini acknowledges that 'War in its ensemble is not a science, but an art'.

Art of War

Ironically in his famous *Precis*, Jomini acknowledges that 'War in its ensemble is not a science, but an art' and 'Strategy, particularly may be regulated by fixed laws resembling those of positive science, but this is not true if war is viewed as a whole'.²⁵ Clausewitz also advances the notion that war is an extremely complex phenomenon that involves the clash of wills between *dynamic* as opposed to static human forces. Clausewitz viewed the nature of war as a paradoxical trinity composed of 'primordial violence, hatred and enmity', 'the play of chance and probability' and 'of its element of subordination as an 'instrument of policy' which makes it subject to 'reason alone'.²⁶ It is due to the dynamic interplay of these forces that war will remain a complex phenomenon with a great deal

of uncertainty. According to Clausewitz, combat in a realm of fear, danger, physical exertion, uncertainty, and chance where countless minor incidents can give rise to 'friction' in which the 'simplest thing is difficult'.²⁷ Therefore 'Great part of the information obtained in war is contradictory, a still greater part is false, and by far the greatest part is of doubtful character. Most reports are false, and the timidity of men acts as a multiplier of lies and untruth'.²⁸ Kaufman further reinforces the argument that 'no amount of networking of information will change the import of Clausewitz's observation because he talks about man's natural reaction to information, not the information itself' and 'that the proposition that networking translates into information superiority is manifestly true, and only if, the enemy passively lays himself out to be observed'.²⁹

Clausewitz therefore argued that a military genius is required who have 'an intellect that, even in the darkest hour, retains some glimmerings of the inner light which leads to truth or coup de oeil; the courage to follow this faint and the strength of character and mind to overcome or exploit friction, chance and uncertainty'.³⁰ Moltke highlights that 'Strategy is a system of expedients' and 'the doctrine of strategy do not go beyond the rudiments propositions of the common sense; they can hardly be called a science; their value lies in almost entirely in their application to the particular case. We must, with proper tact, understand a situation which at every moment assumes a different aspect, and then do the simplest and most natural thing with firmness and circumspection'.³¹ Strachan therefore

aply suggests that ‘rather than dogma, criticism should come to the aid of sound judgment’ and ‘the education of the officer should not therefore prescribe formulae but should sharpen the individual’s faculties’.³² Clausewitz suggests that such intellect could be developed through realistic training.

While warfare has both an art and a science dimension, I contend that its nature fundamentally remains an art. Kant, a scientist and mathematician, in an attempt to answer whether empirical reasoning alone allow us to understand the nature of the universe, suggested that there are three forms of knowledge that man can acquire and these are understanding, reason and judgment.³³ While understanding is created by scientific concepts or order in nature, reasoning is a process of making decision based on our innate sense of morality and free will. As for judgment, he suggests that there are two types, determinate and reflective. Determinate judgment arises as outcome of applying a concept held in advance while reflective judgment is an invention of the thinker himself.³⁴ It is this reflective judgment that constitutes the intuitive creation that we call *art* and which will continue to make human endeavors dynamic and their outcome perpetually uncertain. The art of war, I will therefore contend, is the weighing of the situation, the enemy, the complex integration and interaction of the diverse systems or dimensions of war through ‘coup d’oeil’³⁵ or intuitive (reflective) judgment and thereby derive plans that can best fulfill the political or military objectives. It could well be argued that it is ultimately this ability to adapt, create or invent from within and

without that simultaneously provides humans the capacity to achieve and fail in their endeavours.

Similar lines of argument have been advanced by those who are against the leaning of Enlightenment towards scientific enquiry. Shimony outlines that the main arguments against Enlightenment are the inadequacy of the cognitive powers of humans to postulate the future or on entities external to human experience, the simple lack of a universal human nature, the lack of universal grounded ethics or sets of truths of reason in the diverse societies, the presence of the deeper aspects of human nature governed by passion, faith, introspection, imagination, intense feeling and finally the internalization of the inherited traditions of people.³⁶ More significantly, science has not been able to conclusively determine how ‘life’ started from the elements and whether there is also life (motion at the atomic level) or growth/transformation in inanimate objects. Shimony however, clarifies that although the debate is still ongoing, and that there have been obvious benefits brought about by the age of Enlightenment, there remain significant skepticism in a primacy of reason and order approach. There remains ‘genuine concern with the difficult epistemological problems concerning the meaning of truth: the relevance of a correspondence concept of truth to actual scientific practice, the legitimacy of inductive inference, and especially the alleged inevitable under-determination of the theory of evidence’.³⁷ Shimony suggest that the way ahead should be to use the history of science to constructively refine the scientific methodology and to

recognize that what is more important is the élan or enthusiasm in seeking human progress.



Martin van Creveld suggests that ‘When the chips are down, there is no “rational” calculation in the world capable of causing the individual to lay down his life’.

Martin van Creveld also suggests that ‘When the chips are down, there is no “rational” calculation in the world capable of causing the individual to lay down his life. On both the individual and collective levels, war is therefore primarily an affair of the heart. It is dominated by such irrational factors as resolution and courage, honor and duty and loyalty and sacrifice of self. When everything is said and done, none of these have anything to do with technology, whether primitive or sophisticated’.³⁸ Martin van Creveld adds that ‘An army’s worth as a military instrument’, explains, “equals the quality and quantity of its equipment multiplied by [its] fighting power. The latter rests on mental, intellectual, and organizational foundations; its manifestations, in one combination or another, are discipline and cohesion, morale and initiative, courage and

toughness, the willingness to fight, and the readiness, if necessary, to die.”³⁹

Conclusion

From the essay it becomes apparent that although the science and systems approach may provide great opportunities for winning future wars and should be pursued, it should not be at the expense of studying and preparing for the other important aspects of warfare. As warfare is ultimately a human endeavor, we should continue to adopt a more holistic approach to studying and preparing for it. While the plans could be developed and guided by science and system, they will need to be augmented with good understanding of the nature of war that is being fought, good leadership development and a sense of realism to respond to the uncertainties and dynamism inherent in warfare. Having carefully traced the development of science and system in warfare, Andrew Krepinevich aptly summarizes that such innovations must be backed up by new operational and organizational concepts, that the competitive advantage are often short-lived and that there is no guarantee of continued dominance.⁴⁰ The 19th century witnessed the rise and fall of the French Empire and the 20th century witnessed the rise and fall of Germany and Japan despite their superior industrial capacity and numerous technological innovations.

It has also been discussed that while the principles of war do not have a strong basis to be regarded as immutable laws or principles; they do embody the wisdom of historical analysis of wars and therefore serve

as useful operational considerations for the study and planning of wars. It has also been rationalized that having a set of general principles may be too restrictive and could stifle creativity or appreciating the appropriate context of the war. It is therefore suggested that there be separate principles at the grand strategy, military strategy, operational and tactical levels and also for different types of operations. Despite all the best efforts, we must be cognizant of the fact that war is ultimately a dynamic duel between two or more opposing wills and therefore its outcome can never be certain. So long as war continues to be a human endeavor, the Clausewitzian notion of uncertainty and friction will continue to reign supreme. ☹

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Near-Space, Near Future

by MAJ Jeoh Leo

Introduction

In the age where we are transforming and leveraging on info-communications technologies towards networking for joint operations under the ambit of IKC2¹, a persistent node or maneuverable surveillance equipment placed high over the battlefield such as those that were used by the United States for their military campaigns could be a keystone to enable better battlefield situational awareness and data-sharing between all forces over a large theatre of operations. Classically, with the damage susceptibility, relatively limited loiter time, and the high cost of maintaining an aircraft airborne, the common choice of platform to deliver such functions would have been a network of satellites set aloft high in earth-orbit. This has been used rather effectively by the United States; however, for countries without the economic prowess or agenda to launch-and-recover orbital vessels, the tactical advantage of Space is diminished as there is little or no control and assurance that the orbital platform would be at the battlefield of choice at the right time. Yet before we abandon the idea of having our own efficient means to create the space-effect, this paper intends to introduce a region of airspace between 65,000 ft and 100 km above the ground, commonly known as “Near-Space”, which has been

a blind-spot throughout these years as it is too high for aircraft and too low for satellites. This region is not a stranger to the aerospace world as weather-balloons are capable of penetrating up to 100,000 ft, but culturally, we have been driven more to focus on Space/satellite and aircraft technology, favoring the allure and obvious tactical advantage of speed, power and deep-space coverage over “simple balloons”. Hence this paper will examine Near-Space and its characteristics, the advantages and shortfalls of a “Near-Space vehicle”, and finally its strategic uses that may help to further our quest towards better battlefield awareness.



Zephyr 4 UAV: QinetiQ has developed and built a platform that leads to an Unmanned Aerial Vehicle (UAV) system capable of long endurance remote sensing and communications. The system will operate above cloud and high winds providing a wide field of regard and communication. The platform is capable of continuous operation through the use of solar power and low drag aerodynamics. (http://www.qinetiq.com/home/commercial/space/space_missions_and/development_projects/zephyr_uav.html)

Enduring and Engineering to Near-Space

The environment of this “un-alluring land of balloons”, loosely defined to be the region bounded between the top of ICAO controlled space at 65,000 ft and the Karman² line at 100 km³ is a region of airspace beyond the troposphere and hence devoid of the weather patterns of cloud, rain, or turbulence that we are familiar with. This makes the environment more predictable, allowing designers to tailor Near-Space vehicles to specifically endure the environment in this region. In fact, this region has characteristics similar to that of Space; however, there are subtle differences in temperature, winds, pressure and corrosive effects. The combination these factors make it such that the actual useable portion of Near-Space is from 65,000 ft to 120,000 ft, and hence this paper will focus at the characteristics of Near-Space only in this portion of airspace.

Looking at temperatures, the region between 65,000 ft and 120,000 ft is not as cold as one would envision. Near-Space temperatures start from -75° F (-59 °C) at about 65,000 ft. In-fact, the lapse-rate of -5.4° F (-2° C) per 1,000 ft which we are so familiar with stops at 36,000 ft where the temperature thereafter then remains somewhat constant at about -75° up to 65,000 ft.⁴ Temperatures actually start rising at altitudes higher than 65,000 ft, increasing up to -10° F at 120,000 ft. This is in contrast to Space,

where the concept of temperature is irrelevant as there is no ambient air. Instead, in space, surfaces facing the sun would be hot whilst others facing away or in the shadow would be extremely cold. Hence engineering of Near-Space vehicles is relatively easier compared to designing a Space vehicle as one would only have to design to moderately cold temperatures as opposed to having to deal with a hysteresis of extreme temperatures.

Wind patterns are also different in Near-Space as opposed to Space above 100 km. Compilations of surveys of the general wind condition in Near-Space has shown that for equatorial regions such as ours, wind speeds average at 15 kts with speeds gusting up to 40 kts 95% of the time.⁵ However, as the density of the atmosphere in Near-Space ranges between 7 percent of sea level down to 0.5 percent of sea level at 120,000 ft⁶, gusts and transient changes in wind speed will have minimal effects as there are very few air molecules to transfer momentum. Only sustained winds will cause an object to slowly accelerate to the ambient wind velocity, so all-in-all, the environment can be characterized by 15 to 30 kts of ambient wind speed. By designing the correct types of propulsion, it would technically not be hard to design a vessel to over-come such speeds as has been demonstrated by programs such as NASA’s Helios program which has achieved up to 150 kts at 96,500 ft.⁷

The Helios Prototype was a unique electrically powered experimental lightweight flying wing developed by AeroVironment, Inc., under NASA's Environmental Research Aircraft and Sensor Technology (ERAST) program. Using energy derived from the sun by day and from fuel cells at night, the Helios Prototype was designed as the forerunner of high-altitude unmanned aerial vehicles that could fly on ultra-long duration environmental science or telecommunications relay missions lasting for weeks or months without using consumable fuels or emitting airborne pollutants. (<http://www.nasa.gov/centers/dryden/history/pastprojects/Erast/helios.html>)



As mentioned, there are other nuisances to the Near-Space environment. One such nuisance comes in the form of reduced ambient pressures, whereby designers would have to accommodate for the expansion of any gas-filled vessels. Another such nuisance, is the corrosive and harsh solar radiation environment that this regions presents. In our environment, ozone is the primary absorber of UV radiation; however, at higher altitudes, the ozone concentration reduces significantly, and very little UV radiation is absorbed. UV degradation can be as damaging as corrosive effects; case-in-point, sun-tanning or the fading of colors of items left in a car exposed to sunlight. As such, designers would have to design to accommodate UV damage. To escape UV damage, one could fly in the lower portion of Near-Space. However, the density of ozone increases up to thirty times as much as that at 120,000 ft⁸, which makes the vessel then susceptible to corrosive effects of ozone. Hence, although not impossible to accommodate, designing Near-Space vehicles would have to trade-off between ozone corrosion and UV protection depending on its intended operating altitude.

Overall, although harsher than what we are used to as aviators flying up to 60,000 ft, it is not impossible to send and maintain vessels in the Near-Space region. Classically, the rigors of Near-Space were overcome by designing free-floating lighter-than-air balloons which had little or no maneuvering capability. By sizing the balloon and choosing the right materials, one could feasibly fly hundreds to thousands of pounds of payloads up to 100,000 ft as has been demonstrated in applications such as weather balloons. This would work well for applications requiring coverage such as communications applications; however, such designs have limited maneuverability which precludes it from any useful surveillance as placement would be at the mercy of the winds. For surveillance type activities, the vehicle would ideally have to be able to quickly launch and recover from the ground, and be maneuverable at the operating height with station-keeping capabilities. Unfortunately, no organization has flown such a vehicle in Near-Space to-date, although there are various ongoing projects in the United States such as GlobeTel's Sanswire⁹ and Techsphere System's AeroSphere¹⁰ as

well as UK QinetiQ's Zephyr 3¹¹. In fact, in a recent study conducted by the Air Force Research Laboratories, it was noted that with the advances in battery and solar/fuel cell technologies and the ongoing miniaturization of electronics and sensors, the lack of such maneuverable Near-Space vehicles is not due to insurmountable technical challenges, but due primarily to the lack of sustained funding.¹² Hence overall, it is not technically impossible to design a platform to deliver capabilities from the Near-Space region. With the advances being made in the field of designing UAVs, Near-Space vehicles would be but an adaptation of such technologies to suit the nuances of the Near-Space environment.



The Sanswire Stratellite™ is a specialized rigid airship that will operate in the stratosphere at 65,000 feet and be used to transmit various types of wireless communications by GlobeTel Communications in the USA. (<http://www.sanswire.com/>)

How Capable is Capable?

So having introduced Near-Space and the possibility of designing vehicles to utilize this region, we swing around to take a look at the capabilities which such platforms could deliver and their tactical usages. As alluded to earlier, Near-Space vehicles come in two forms; free-floaters,

and maneuverable types. Essentially, both types have the same characteristics of being effective in providing a large coverage area, persistence, low-cost, rapidity in deployment, and survivability, though maneuverable types gives an extra flexibility in getting the platform to the exact location of interest as would be required for surveillance type functions.

Being placed high up in the air, these Near-Space vehicles would be an obvious platform from which to deliver a large coverage area for either communications or surveillance functions. As there are essentially no obstacles between terra-firma and Near-Space, the maximum expected communications range can be estimated by using the line-of-sight equation¹³ assuming that the output power of the radio is high enough to propagate through this distance or that the lens used is wide-enough to capture the full area of operations for surveillance type functions. For example, the Air Force Space BattleLab has been experimenting with a free-floating Near-Space vehicle in their Combat SkySat program which is essentially a floating balloon attached with a PRC-148 radio aimed at providing a communications re-broadcasting facility from a height of approximately 100,000 feet to increase communications range. At 100,000 ft, the maximum expected range would be 378 nm as calculated by the line-of-sight equation, and test data showed that the Combat SkySat had effectively increased the range of the PRC-148 to over 350 nm as opposed to 9 nm when using the radio on ground.¹⁴

A Near-Space asset and part of the Joint Warfighting Space Concept, Combat SkySAT was designed to be operationally and tactically controlled within theatre up to 90,000 ft. It is essentially a weather balloon platform that is designed to extend the Line-of-Sight range of tactical UHF/VHF communication from approximately 10-400 miles using an airborne communications repeater. – JEFX 2006 Guidebook (http://afeo.langley.af.mil/content/documents/initiatives/Combat_Skysat.pdf)



Delivering coverage over a large area can actually be achieved through the use of any airborne vehicle so long as it is high enough and equipped with the right radios or the right lenses for surveillance. However, the key advantage of a Near-Space vehicle would be the persistence that it delivers due to the inherent nature of its design. Common air-breathing aircraft and UAVs are usually bound by fuel, whereas satellites are bound by orbital mechanics. Although Geo-stationary satellites could essentially stay on station, such satellites are usually extremely expensive due to the heights that they need to be boosted to, and once boosted, have limited fuel for maneuvering, giving it less tactical advantages as it would be unable to cater for any changes in the area of operations. Conversely, a Near-Space vehicle could be launched anywhere at any point in time and with the advent of efficient solar cells and lightweight and compact fuel cells the vehicle could become self-sufficient and stay within the area of operations for long periods of time. Recognizing that, the United States has already revealed plans for a near-space vehicle designed to stay on station for at least six months, with planned follow-ons to stay aloft for years.¹⁵

Surprisingly, the large area of coverage and capability for long persistence comes with a pretty light price-tag as compared to other alternatives. Take, for example the fulfillment of delivering intelligence and reconnaissance as well as communications/data broadcasting over a large area of operations over an arbitrarily selected period of thirty days. Although classically these functions could be delivered by launching surveillance/EW type aircraft such as the Airborne Warning Aircraft (AWACs) or JSTARs type airborne command centers, lets assume that these functions are taken up by the more cost efficient method – through the use of UAVs. Unfortunately, UAVs have the same fuel constraints as any conventional air vehicle. Even the Global Hawk, which comes at a unit cost of US\$48 million could only deliver such capabilities for at most one day.¹⁶ Comparatively, launching a Geostationary or non-geostationary Low Earth Observable (LEO) would cost about US\$15 million, in year 2000, per launch of up to 5,000 pounds¹⁷ and an initial satellite cost of between US\$50 to 100 million per unit for smaller satellites¹⁸, and would not be a sound choice for a short thirty days campaign. Drawing parallels

from operations of Goodyear blimps and multiplying it by a factor of 2 for argument's sake, the envisioned operating costs of a Near-Space vehicle are much smaller as compared to the other two options at only US\$2,000 to US\$20,000 dollars a unit with only a single launch required.¹⁹ Hence the same if not better functions could be delivered by Near-Space vehicles for a significantly less cost as opposed to our more conventional means today.

Tactically, a Near-Space vehicle is able to deploy relatively rapidly, and once deployed would have a high survivability rate. Although not as rapid as launching fixed-wing assets, at an ascent rate of 1,000 to 1,200 ft per minute²⁰, a Near-Space vehicle could be launched virtually anywhere within two to three hours and is definitely a much faster option as compared to the preparations required to launch a satellite. The key here would be that the delivery of the desired persistent effects, be it communications or surveillance, could be easily achieved at any time that it is required. In terms of survivability, drawing from other Armed Forces' experiences on tracking weather balloon, such designs typically have a very low radar and thermal cross-section, and with a drift of only 15 kts, present very little Doppler shift for radar pickup. In addition, at the operating height of 100,000 to 120,000 feet, these balloons would become very small optical targets which would be virtually impossible to spot unless one knows where exactly to look for it. Finally, comparing the costs of any missile to the envisioned cost of a Near-Space vehicle would show that the aggressor would be at a loss, and

since other Near-Space vehicles can be readily launched as a replacement, time and resource would be better spent targeting other assets.

Applying Near-Space

In the "new mathematics" of NCW whereby with force multipliers, one plus one equals more than two, such algebra can be achieved through the discretionary usage of Near-Space. In a nation with limited resources, leveraging on a network grid with inter-service sharing of information and joint operations undoubtedly optimizes our firepower by allowing us to deliver precise, concerted, and "informed" strikes. To these ends, Near-Space vehicles could potentially form the main basis of this network grid. A recent technology demonstration carried out both locally and in an overseas detachment has shown that the sharing of position, voice, and even video streams between both air and ground units with the appropriate client software is possible by just hoisting commercial off-the-shelf 802.11 wireless routers onto a balloon up to 200 ft. A similar sort of payload could be implemented onto a Near-Space vehicle, albeit that the payload would have to be hooked up to a higher gain antenna with greater output power to be able to cover the 425 nm range promised at a height of 120,000 ft. Unlike the balloon at 200 ft which had to be taken down to accommodate weather and air-traffic, having a Near-Space platform doing this same job would mean that this network grid could potentially function indefinitely throughout the whole duration of any military campaign as it will be well clear of both.

The High Altitude Spherical Airship, the AeroSphere, is designed as a platform with significant payload capacity suitable for stationary, long endurance, unmanned operations at an altitude between 60,000' and 70,000' MSL. (<http://www.techspheresystems.com/Technology/Technology+for+High+Altitude+Platforms/default.aspx>)



When using Near-Space vehicles for intelligence and surveillance functions, these platforms would be able to provide persistent coverage of the battlefield and hence monitor any dynamic changes to the area in question, helping to uncover the fog of war. With a better battlefield picture, commanders would be able to make more informed choices as to where to send precious air assets. For example, the Near-Space platform might give a broad-scope view of the area, picking up possible points-of-interest, and the battlefield commander can then elect to send air assets such as UAVs specifically to these points-of-interest to gain further details or designate any identified targets for strategic strike. This could effectively free up air assets to conduct other tasks on the battlefield, as they will be more efficiently employed by being immediately directed to the specific points of interest, or in response to a surprise threat.

However, as rosy as the picture looks, satellites have a peculiar advantage in that it is given freedom of over-flying any country as dictated by international treaty²¹, whereas Near-Space vehicles would be technically be subjected to sovereign airspace rights. Although above ICAO airspace, in the current definition of “airspace”, Near-Space

vehicles could not be openly and lawfully deployed over other countries, thus restricting its open usage to within self-territorial airspace during peacetime operations. However, this is akin to the protocols binding the usage of UAVs which, being closer to ground, are more susceptible to being detected either through electronic or standard visual and aural means.

Also, like UAVs, the technology behind Near-Space vehicles is not beyond the knowledge of our local engineering corps. By being able to adapt or even develop an in-house Near-Space platform, a country could be self-reliant and enjoy the functions that satellites currently deliver in the form of airborne intelligence and long-distance field communications without having to pay large sums for exclusive satellite launch. For example, current militaries rely heavily on the usage of GPS for both ground and air navigational purposes as well as tasks such as force-tracking. However, the operation of the GPS constellation is currently solely at the discretion of the United States, and should they decide to remove it altogether, this capability would come to a stand-still unless there are other means for force-tracking. Albeit not easy due to the

possible drifts in Near-Space vehicles, it is believed that by using a DGPS type setup with a designated ground station, a network of such vehicles could potentially create a substitute positional reference system, thus allowing full self-sufficiency in such areas. All-in-all, the utilization of Near-Space assets would then allow for more self-sufficiency in providing Space-effects, especially in times when the sustainability of capabilities borrowed from alliances could become questionable.

Near-Space in the Near Future

In reality, Near-Space is not as new a concept as one would think, but it is the renewed emphasis on the utilization of Near-Space with the advent of new technologies which makes it a worth-while topic. In terms of practicality, designing and flying Near-Space vehicles has already been demonstrated, albeit not yet to the maximum height of 120,000 ft. NASA's Helios program, a light-weight flying wing, has achieved up to 150 kts at heights of 96,500 ft, carrying payloads up to 2,400 lbs for almost two days, whilst the USAF, UK and other American commercial and educational institutions are now actively refining Near-Space vehicle designs. As aforementioned, the capability to deliver persistent data-sharing networks, communications networks, and surveillance makes these Near-Space vehicles a potentially revolutionary tool for battlefield commanders. In fact, for the US, "Space-effects have [already] revolutionized modern warfare"²², and the next step would be to develop cost-effect means to deliver such functions better. Whereas recent

conflicts such as the Iraq war had "persistent and organic ISR (Intelligence, Surveillance and Reconnaissance), and 24/7 over-the-horizon communications desperately needed and provided through the extensive use of satellites, UAVs, and airborne Command and Control platforms"²³, smaller nations could attain these functions at a much lower cost utilizing the Near-Space regime. With the right emphasis and direction in development, it would not be long when smaller nations without Space-faring capabilities or infrastructure have the ability to deliver GPS type force-tracking and navigational network, long-distance communications and data network, and eye-from-the-sky surveillance to their battlefield commanders to enable better decision making and inter-service operations. (E)

(Ed note: This essay was a merit award winner of the 2005 CDF Essay Competition.)

Endnotes

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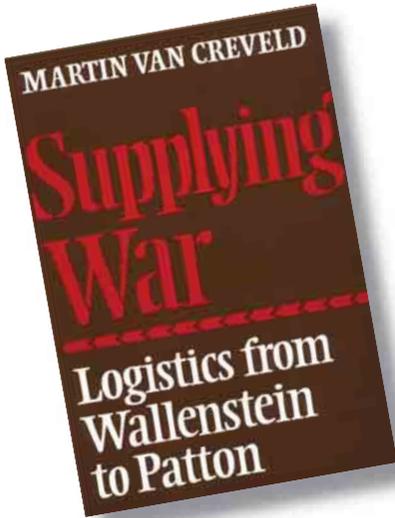


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BOOK REVIEW

Martin van Creveld's Supplying War: Logistics from Wallenstein to Patton

by MAJ Lim Kheng Choon



“The more I see of war, the more I realize how it all depends on administration and transportation. It takes little skill or imagination to see where you would like your army to be and when; it takes much knowledge and hard work to know where you can place your forces and whether you can maintain them there. A real knowledge of supply and movement factors must be the basis of every leader’s plan; only then can he know how and when to take risks with those factors, and battles are won only by taking risks”. **A.C.P. Wavell.**

Logistics is a mundane business that hardly appeals to the imagination, yet often it is this practical art of moving armies and keeping them supplied that military commanders have to grapple with even before operations can begin. *Supplying War* is a book that will open the readers’ eyes to the intricate and complex machinery of logistics. Dr van Creveld has meticulously researched and scrutinized a breathtaking array of supply data, from tonnage of supplies, to number of railways stocks used in campaigns, to even the amount of rounds the soldier carries, to analyze the impact of supply administration on war. These details, up to time *Supplying War* was published, were unexploited nor given any detailed attention by

mainstream writers and students of war. Often, they tended to focus on the glamorous aspects such as strategy or tactics and logistics by itself was hardly afforded any detailed study. Many conclusions drawn on previous classic wars, such as those waged by Napoleon, Rommel and Allied forces on D-Day, were put through the paces by Dr van Creveld and found wanting.

It is this refreshing and meticulous approach of the author that makes *Supplying War* such an interesting read. In addition, the book highlighted some key principles on logistics that has relevance to RSAF today. This essay will attempt to share some of these principles and explore their significance

within the context of RSAF logistics operations, especially now that we are undergoing a major force transformation and reorganization.

Military commanders must appreciate the capabilities and limitations of logistics in order to maximize the full potential of the forces at their disposal.

This is probably the most important theme that *Supplying War* is advocating. The bold Schlieffen Plan of 1914 was conceived with little attention to its logistic practicality. The intention was for more than 33 Corps of 46,000 men each, stationed along the entire western border of Germany, to march in a great phalanx west through Belgium, wheeling south against France and Paris in its midst before turning back east to pin the French Army from the rear. The plan called for the rightmost wing to march 400 miles in 42 days. Exhaustion notwithstanding, there were no concrete plans on how to keep the army supplied adequately during its march. For example, the 84,000 horses in the right wing army would have required two million pounds of fodder a day, filling up to 924 wagons traveling only up to 25 miles a day in ideal conditions. With the rail heads sometimes trailing 80 miles behind the nearest front, they would have needed more than 5,000 wagons shuttling back and forth. This was an impossible task considering the formation wagon establishment was only 5,500 wagons to haul all its supplies. However, there were no plans conceived by high command to manage this problem with the result that the cavalry and horse drawn heavy artillery lost their effectiveness very early in the fighting.

Take another example; Rommel's exploits in the deserts of North Africa were well known for their audacity and brilliance. It was often said that the desert fox's defeat in Africa was due largely to insufficient support from Hitler and the losses suffered by the Axis Mediterranean convoy fleet. Yet, upon close scrutiny of the supply tonnage that was delivered to African ports, the long and vulnerable distance to his front, the speed and capacity of his motor transport, one would realize his difficulties stemmed more from his inability to transport the supplies through his hopelessly long supply line than from the above factors. While fuel ran out during the battle of El Alamein, Rommel's supplies were piling up in the port of Benghazi, hundreds of miles behind. For all his tactical brilliance, he made a strategic blunder to push into Egypt without realizing his supply situation was insoluble.

Within RSAF context, the need for commanders to fully appreciate the limitations and strengths of logistics cannot be understated. For that to happen, there is a need for greater operations and logistics (Ops-Log) integration beyond the current structure. Historically, Air Logistics has evolved as a distinct entity apart from operators, providing focus on building up vocational knowledge and professional competence needed to maintain and enhance technically complex aircraft platforms. Posting of logistics officers were largely within the Air Logistics Organization with minimal representation in manpower, plans and operations departments. Even though the Air Logistics Squadrons and Logistics

Flights were under the command of operators, the units were very much left to function within its specialist areas of aircraft recovery, rectification and operational logistics. Where operations required, Air Logistics provided the planning inputs, parameters and proceeded to 'make it happen'. Exactly how to 'make it happen', were usually left to the logisticians to sort it out. While there was a lot of mutual trust, the relationship was more akin to a user – supplier model. Closer at heart, even the Air Force Advanced Officer Course (AOC) syllabus did not cover any logistic subjects throughout the four-week common module except for one session on armament supply. Considering AOC is a key Route Of Advancement course for future flight commanders, the state of Ops-Log integration is aptly summarized.

However, with the ever increasing focus on dynamic operations and network centric warfare, such stove pipe organizational structure and culture may not be suitable and more must be done to further assimilate operations and logistics without diluting the vocational expertise that RSAF has painstakingly built up. To quote Mr Teo Chee Hean: "Specifically, [leaders in 3rd Generation SAF] need to be knowledgeable in your respective specialty areas and have stronger critical thinking skills for dealing with uncertainties and for managing new technologies and complex systems." Fortunately, there has been increasing engagement between operators and logisticians in order to optimize resources. Sense and response logistics was a recent paradigm change on the part of Air Logistics to

implant themselves within the operator processes so that they stay ahead of the OODA (Observe, Orient, Decide, Act) loop, sensing and responding to operational requirements. The benefit of this paradigm was demonstrated in Ops Flying Eagle (OFE). Through active sensing in the policy making and planning processes, Air Logistics were able to anticipate the high commitment level of the Chinook fleet as well as the possibility of re-shuffling aircraft assets within the South Asian theatre. The phase modular servicing package as well as the modular detachment groups was thus conceived. The former aimed to reduce servicing downtime so as to increase aircraft availability for flying while the latter grouped the Chinook logistics crew into multiple independent detachments self-sufficient with tools, publications and support equipment for quick deployment.

Besides cultural changes, it is hopeful that stove piping will also be alleviated and integration further enhanced with the upcoming RSAF reorganization. As it is now, a portion of logistics manpower and planning staff functions have been reorganized under the respective manpower and plans departments. AFLC also dual reports to both ALD and ADOC, with the resulting consequence that logisticians are formally plugged into the HQ operations planning cycle. There will also be formalized logistic representation within the command complex planning cells to provide for greater Ops-Log collaboration right at the strategic/operational conceptualization stage. Even the AOC syllabus has been reviewed to feature more logistics content. Hopefully, with these structural

changes, cultural changes will follow, paving the way for closer integration and allowing commanders to have better appreciation and understanding on the capabilities and limitations of logistics at his disposal.

Increasing exploitation of technology in logistics does not necessary improve its overall speed and effectiveness.

It was often assumed that the development of logistics could be categorized neatly based on the transport technology available in that era. The horse-drawn wagon was succeeded by the railway, which in turn was succeeded by motor transport. With the improving means of transport, armies were supposed to operate faster and further. Yet, as *Supplying War* has demonstrated, increasing application of transport technology led to other problems and armies never fully realize the maximum theoretical speed of the transport at their disposal. The maximum marching pace of an 18th century army was fifteen miles a day against the walking pace of a man at three miles per hour. Compare this five: one ratio with the maximum speed of motor vehicles in WWII (easily more than fifteen miles per hour) against the maximum pace of about seventy-five miles a day achieved by the British Blade Force chasing Rommel in the desert and one will appreciate the effect of Clausewitz's friction – "Compared to ordinary life, waging war is like man trying to walk in water: anything that seems easy suddenly requires a much greater effort, and every movement is slowed down".

The advent of modern technologies such as railways and motor transport meant more complex parts and greater

probability something will fail. It also means the modern armies now need fuel, POL and spare parts to keep them moving. That is, the friction within human or mechanical machines increases with more moving parts and greater complexity. More things can now go wrong.

In RSAF context, with our limited manpower and the increasing complexity of combat platforms, it is necessary for us to harness information technology to improve our logistics processes. For example, there is increasing dependence on computerized Management Information Systems (MIS) to track end-to-end logistics activities in an effort to capture and automate the logistics processes of the entire SAF. The aim of MIS is to improve efficiency and reduce the human effort, bringing about savings in manpower. But in practice, MIS system rollouts can encounter problems such as human error due to inadequate training, slow bandwidth or intermittent connection. Security and hardware limitations also mean these MIS are usually not deployable in overseas detachments. With increasing emphasis on international participation in Peace Support and HADR missions, such a limitation may prove critical. For example, during OFE, the detachment depended very much on the traditional pen and paper to track and manage all logistic movements outside the MIS. The result was a disjoint in the process which required intensive human intervention to catch up on the data.

Another much celebrated offspring of IT age - electronic technical manuals for aircraft maintenance, have introduced new challenges in terms of updating

information and diagrams. A simple exercise of bringing paper bound manuals to work on aircraft in the field have now developed into a major exercise to ensure portable power is nearby to power laptops in order to “flip the books”. Thus, the limitations of IT should be recognized and awareness maintained of any unforeseen problems arising from its use.

Planning, no matter how detailed, cannot account for all the contingencies nor can it replace human ingenuity, improvisation and determination.

On this aspect, *Supplying War* was critical of the logistics planners in Operation Overlord. The allied planners had spent more than 18 months planning and preparing thoroughly for the D-Day offensive. Every detail was meticulously evaluated, debated and dealt with and a rigid order of priorities established. Unfortunately, when operations started, there was much truth to the old dictum that: “No plans survive first contact with the enemy.” The heavy surf and strong enemy resistance delayed the sequence and threw all plans out of synchronization. Attempts to adhere to the strict priorities led to confusion while staffers bobbed from ship to ship looking for lost supplies. Beaches and ports became hopelessly congested. The breakthrough came on D+2 day when order was finally made to abandon all sequence and unload all supplies. The unloading thus proceeded successfully, in many cases against the plans.

Logistics planners were also too pessimistic and cautious in their assumptions, insisting to dictate the pace of the operations based on their

schedule. This led to slow progress in the early phase of D-Day. Fortunately for the Allies, General Patton took charge of the situation, ignoring the logisticians’ timetables and affected a breakout by 3rd Army under his command. Even when 3rd Army stormed ahead and reached their objectives fully eleven days ahead of schedule, the logisticians continued to insist that his pace was impossible. Indeed, no plan can anticipate all contingencies.

This was the common experience that reverberated from RSAF’s recent participation in Operation Iraqi Freedom. Despite detailed planning and preparations, much of the logistics issues encountered were not anticipated and had to be resolved through ingenuity, improvisation and sheer determination. Language barriers as well as cultural differences meant the detachment had to adapt quickly to local conditions. A simple task of clearing materials through customs become an elaborate exercise of tea sessions and pilgrimages to many offices before approval could be processed; this was despite having laid the procedures in place with higher authorities prior to deployment. On the area of spares, for all the preparation that was made, the detachment still ran into supply difficulties at some point. It was through the intimate relationship that we had built up with the Americans during the course of the detachment that we managed to borrow spares from their servicing aircraft to tide us over.

This is not to say that planning is not important. Planning is critical to ensure that issues are considered, analyzed and catered for but there must always be flexibility built into the plans and people

trained to deal with uncertainties. Had the detachment insisted on sticking to the customs clearance procedures, it would be highly doubtful whether they would have received anything from home during the entire three months they were there.

Conclusion

Even though *Supplying War* covers a vast period of land conflicts that may not be immediately relevant to a modern Air Force such as RSAF, this essay draws parallel between the two eras and highlighted some of the evergreen principles of logistics that continues to be of relevance today and probably well into the future. It is therefore important that as we evolve and transform, these lessons are entrenched within our structure and culture so that our people do not have to learn them the hard way.

People are RSAF's greatest asset and the only resource that we truly possess. In the current RSAF reorganization, People (along with Concepts, Technology, Force Structure and Organization) has been rightly identified as a fundamental key in underpinning the drive towards meeting future challenges such as resource constraints and expanded mission scopes. It is thus important that the RSAF truly transforms in the areas of training and personnel policies so that its people are better attuned and empowered in the 3rd Generation RSAF to fight the network centric warfare and wider spectrum operations. It will also be invaluable in addressing the classic issues highlighted in *Supplying War* such as better command appreciation of the role of logistics in operations, the limitations of technology and the need for flexibility in planning and dealing with uncertainties. 🇸🇬



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FEATURED AUTHOR



Martin van Creveld

Professor Martin van Creveld is a specialist in military history and strategy, and has been on the faculty of the History Department at the Hebrew University since 1971. Born in the Netherlands in 1946, he has lived in Israel since 1950, and was awarded a PhD in international history at the London School of Economics. Professor van Creveld has assumed the role of a consultant to the armed forces and defence ministries of several countries; the United States, Canada and Sweden included. Throughout his exceedingly illustrious career, Professor van Creveld has lectured or taught at virtually every single strategic learning centre or higher military institution in the Western world. Also, he is one of only two civilian experts ever to address the assembled Israeli general staff.

Perfectly indicative of his success and reputation as an author, Professor van Creveld is the only non-American author on the US Army's required reading list for officers, and is the only author – foreign or American – to have

more than one book on that list. The man behind classic legendary titles such as *The Transformation of War* (1991) and *Command in War* (1985), one only needs to read the praise for Professor van Creveld's works to understand his position as one of the greatest authors of military strategy in history. Brian Bond described *The Transformation of War* as "The most important book on war we are likely to read in our lifetime", while the *Journal of Strategic Studies* regarded *Command in War* as "A masterpiece... not likely to be rivaled for at least a generation". With such a string of noteworthy accolades behind his belt, one might assume that Professor van Creveld would bring to the table an air of unapproachability, but he remains a humble, loving partner and devoted father, and currently lives with his partner in life, Dvora Lewy. Their children, Adi and Jonathan, are both Israeli Defense Force (IDF) veterans.

Professor van Creveld's more recent masterpiece, *The Sword and the Olive: A Critical History of the Israeli Defense Force*

tracks the evolution of the IDF, arguably one of the greatest and most significant armed forces of all time, from its humble beginnings to the military might it has become today. Throughout the course of history, the IDF has conquered overwhelming odds and has defeated enemies in victories so dramatic that it has achieved a status that is nothing short of mythical. The Arab-Israeli War of 1948 saw the Arab population outnumbering the Israelis by more than forty-to-one, but it was eventually Israel who was left standing in the battlefield. The 1973 Yom Kippur War saw the complete decimation of Egyptian and Syrian forces by the IDF. However, behind the velvet robe of victory, Professor van Creveld is quick to note that “Behind every myth... there is a reality (after all)”. In this book, Professor van Creveld shows why it is necessary to understand the early internecine conflicts in order to fully comprehend contemporary Israeli politics, strengthening the notion that the political and military developments of a country are almost always invariably intertwined with one another. It then becomes obvious that *The Sword and the Olive* is more than a journal about the epic rise of the IDF. In 1982 in Lebanon, the IDF fought a considerably weaker enemy for the first time but failed miserably. It ultimately served to remind the IDF that its biggest enemy may not be from the Arab nations, but from within. In all, Professor van Creveld brilliantly illuminates “the history of one army as the history of a nation”, which serves as a guiding principle of the factors that cause the rise and fall of all militaries – including our very own.

The Rise and Decline of the State beautifully echoes Professor van Creveld’s passion for the history of

politics, and how he uses it as a tool of critical analysis for the prediction of what’s next in our current political climate. Professor van Creveld holds the hand of the reader and guides him through a fascinating history of the state, from its origins in Western Europe to its eventual place in every corner of the globe. The decline of the state, he claims, will reap both “dangers and opportunities”. On one hand, those who are “internationally oriented”, whose wealth and status are independent of the state will be able to embrace the freedom of choice and enterprise that globalisation promises. However, there is also a risk of being eventually governed by a less accountable organisation. From the military perspective, he predicts the waning of major interstate war, but is quick to point out that with the emergence of nuclear technology, “the greater the danger to the survival of the victor”. The ultimate conclusion of Professor van Creveld’s findings is perhaps most succinctly and perfectly captured by this verse of Mao Tse-tung: “The Sun will keep rising(,) trees will keep growing(,) and women will keep having children”, that is, basic human instinct, like nature, will continue to flourish even though social constructs may sometimes change.

Another compelling piece by Professor van Creveld is *Men, Women & War*, which supports his stand that women do not have a place in the front line of war. His willingness to challenge orthodoxy becomes immediately apparent to the reader, and this decidedly controversial book is ground-breaking because Professor van Creveld tosses aside all reservations to boldly claim that more often or not, “political correctness not only puts national security at risk, but also

endangers the lives of those very soldiers who are there to protect us". While introducing women to the military may seem like a fulfilling social experiment, in military terms, it is ultimately a disaster, he claims. He states that many proven factors such as physical differences render women ineffective in front line units. Also, the women who enter front line units normally do so on more favourable conditions, and are often not subjected to the same military discipline and regimentation as men. To add insult to injury, the recent onslaught of sexual harassment cases have driven the morale of mixed units down to an all-time low. Professor van Creveld is keen to abandon the fallacy that is "political correctness", and reminds us to make sound military decisions for the long-term welfare of the country, and not to merely temporarily satisfy the voices of detractors.

Widely regarded as one of the most mesmerizing and charismatic individuals in military history, the life story and achievements of Moshe Dayan are etched onto every page of Professor van Creveld's succinctly named *Moshe Dayan*. Joining the Hagana at the age of twenty-one, Dayan went on to start a career that saw him serve in every war fought in the Middle East from the War of Israeli Independence in 1948 to the Yom Kippur War of 1973. Having led Israel into resounding victories twice, the book is a poignant reminder of how the element of surprise, coupled with precision and speed, are key characteristics of battle-winners. However, it is winning the war in the long term that truly matters at the end of the day. Dayan was certainly aware of this, as although he was ruthless and unforgiving in the battlefield, his sympathy towards the

Arabs and deep appreciation of IDF tactics made him an intuitive, practical and sensible policy maker. Although Professor van Creveld concedes that the 1973 Yom Kippur War had tarnished Dayan's image somewhat, he was still arguably the most enduring, endearing epitome of leadership, bringing victory out of chaos with his professionalism, accuracy and tact. Instantly recognized as the affable military legend with an eye-patch, Dayan's influence "towers over (his men) like Nelson over the Battle of Trafalgar".

Julian Thompson wrote the foreword of *Moshe Dayan* and, interestingly enough, he described Dayan as one who "stands head and shoulders above his contemporaries of all nationalities". The same can easily be said of Professor van Creveld, who will undeniably go down as one of the world's finest authors on military history and strategy. Originally written in English, his works have been widely translated to many languages, giving us a glimpse of the scope of his influence in this generation. Military strategists today continue to cling on to his every word as he analyses the apotheosis, maturation and growth of popular global trends both past and present, in an attempt to look into the future of military development. A flexible, talented writer, he also comments, in pointed wordings, on contemporary societies and politics. Professor van Creveld is, to say the least, the personification of wisdom. His position in society today is testament to individual discipline, and his contribution to the academic world thus far has been immeasurable. It is an absolute honour to feature Professor van Creveld in *POINTER*. 

PERSONALITY PROFILE

General Aung San



Introduction

Aung San (1915-1947) remains one of the most enigmatic figures of Asia in the twentieth century, whose destiny and promise was left unfulfilled by a cruel twist of fate. At the time of his death, he was the undisputed leader of the Burmese Independence movement as well as the Prime Minister-in-waiting of the budding nation of Burma. He was a towering personality whose life's work was to help his homeland gain her independence from the colonial tentacles of the Imperial Britain. His able leadership, honesty and quiet determination won him respect from the British as well as acceptance from minorities leaders, who agreed to join

Aung San in forging his dream of creating a Union of Burma, whereby all ethnic groups would be treated equally and live in harmony. Unfortunately, he was assassinated on 19 Jul 1947 by a political rival at the young age of thirty-two; just before Burma was due to receive her formal independence. Today, many Burmese remember and regard him fondly as the founding father of modern Burma and as a national martyr.

Early Life and Second World War

Aung San was born on 13 Feb 1915 in a small town of Natmauk in central Burma. He was the youngest of the nine children of U Pha, a lawyer. His family was well known in the nationalist resistance movement as his granduncle was U Min Yaung, a prominent nationalist leader in Burma who was beheaded by the British for opposing their rule. Aung San grew up listening to his grandmother's stories of his granduncle's heroism, and he displayed a strong nationalist streak from young. He himself later noted that even as a child, he dreamt of rebelling against the British.

As a child, he was late learning to speak Burmese and his family was worried that he might be mute. This proved untrue and throughout his later

life, Aung San never hesitated to speak up. At the age of eight, Aung San started his formal education in the U Thaw Bita Monastery, a school run by monks. Five years later, he left the monastery to join the Yenanchaung National High School, where one of his elder brothers taught. There he excelled in his studies and in 1930, after only one year of formal schooling, he passed the seventh standard – a nationwide examination – and topped all students throughout Burma. He was awarded a government scholarship as a result of his excellent academic achievements. In 1937, he graduated with a Bachelor of Arts degree in English Literature, Modern History, and Political Science from Burma's premier educational institution then, the Rangoon University.

Other than academic brilliance he also displayed good leadership potential. At Rangoon University, he was initially elected to the executive committee of the university's Students' Union and also served as the editor of their student magazine, *Owei* (Peacock's Call). Rangoon University served as a testing and nurturing ground for Aung San's leadership skills and powers of persuasion.

In 1934, Aung San and a group of like-minded students began meeting to discuss politics. They decided on a strategy to help one other get elected to the Students' Union and change its focus to oppose the British. In the next year, many in the group were elected to major positions in the Students' Union. They shifted the Union's conformist orientation towards an anti-British political bias. In February 1936, he had his first major brush with the authorities.

He was briefly expelled from the University as he refused to reveal the name of the author of a critical article which he published in the students' magazine. His bravery and principled stand brought him much support and respect from the student population and a university students' strike was held to express solidarity with Aung San. After some negotiations with the university administration, Aung San was readmitted to the university. This event greatly increased the stature of Aung San and within two years, he was elected to the post of president of both the Rangoon University Students' Union as well as the All-Burma Students' Union – a new organisation set up during the university students' strike to represent all students across Burma. In that same year, the colonial government appointed him as a student representative on the Rangoon University Act Amendment Committee.

In 1938, Aung San elevated from a student leader to that of a national leader, leading the fight against imperialism. At this time, he was extremely anti-British. He was involved in the *Thakin* movement, which was a movement whereby students and activists called each other by the respected title of *Thakin*, which means master in Burmese. It was the title the British expected the Burmese to address them by; hence it was a powerful statement of equality with the British. He was also involved in forming and organizing several other nationalist organisations, such as the Dobama Asiayone (We Burmans Association), the Communist Party of Burma, among others. By 1940, the British sought Aung San's arrest for his anti-British activities and he fled to China but was persuaded by the

Japanese to travel to Japan. In return, he obtained Japanese political support for his nationalistic endeavours.

While Aung San was in Japan, he met Keiji Suzuki, a Japanese military officer and head of a Japanese organization set up to help Burmese independence fighters against the British. He managed to obtain Japanese arms, financial support and military training. He soon returned to Burma to plan for the eventual uprising against the British as well as to recruit more allies for this mission. Aung San and a group of comrades went to the then Japanese-occupied Hainan Island to receive some basic military training. In Burmese national history, these “Thirty Comrades” are commemorated for their leading role in winning national liberation. From December 1941 onwards, the Japanese and their Burmese allies, led by Aung San, fought and defeated the British swiftly. By March 1942, Rangoon, the Burmese capital had fallen to the Japanese and the Japanese military administration took over control of the country.

During Japanese Occupation

Aung San soon realised that the Japanese were unwilling to relinquish control over his resource rich homeland and to make the Burmese equal partners in the running of their own country. He was disillusioned but continued working overtly for the Japanese regime.

In July 1942, he re-organised the Burma Defence Army with the support of the Japanese, although he bore his own agendas. After the reorganisation, he remained as the Commander-in-Chief of the Burma Defence Army with

the rank of Colonel. In March 1943, he was promoted by the Japanese to Major-General and awarded the Order of the Rising Sun by the Emperor of Japan.

He was a leading voice among the Burmese who collaborated with the Japanese, often taking the Japanese to task for their harsh treatment of the Burmese population and continuing to advocate self-rule for the Burmese. With the tide of the Second World War turning against the Japanese, the Burmese leaders increased their pressure on the Japanese, toughening the terms for their cooperation in the war effort. On 1 Aug 1943, the Japanese declared Burma nominally independent, though it was clear that the Japanese still called the shots. However, Aung San and a few nationalist allies became sceptical of Japanese promises of independence, and were dismayed by the Japanese maltreatment of fellow Burmese. In an ironic twist, Aung San re-established contact with his erstwhile hated British colonial masters, seeking to help them oust the Japanese from Burma. The proposed cooperation with the British remained a short term expedient, as Aung San’s goal of attaining full independence for his nation remained unchanged.

It was only in late March 1945, when the Japanese became weak enough and the British were returning to Burma, that Aung San led his renamed Burma National Army in a revolt against the Japanese regime. In May, he met with the commander of the returning British Army, General William Slim, to discuss cooperation against the Japanese. They reached an agreement and managed to rapidly defeat the Japanese troops. The very next month, they held a

victory parade in Rangoon. In General Slim's first report back to London after meeting Aung San, he noted that his greatest impression of Aung San was his honesty; this was a quality of Aung San that many would appreciate throughout his lifetime.

Nation-building after Second World War

After the Japanese surrendered, the struggle for Burmese independence started afresh as the returning British were themselves divided about whether to acknowledge Aung San as the leader of the Burmese Independence movement and negotiate with him regarding Burma's future. By this time, Aung San was widely accepted as the military and political leader of Burma; he was then the Chief Commander of the Burma National Army as well as the key organizer of Burma's largest and most coherent political organization, the Anti-Fascist Peoples' Freedom League (AFPFL).

The British tried to induce Aung San into their administration with a post of inspector – general of the new Burmese army. Aung San wisely rejected the offer and resigned as a military officer and entered politics with the intention of gaining true independence for his homeland.

Aung San took over the post-war independence movement as leader of the AFPFL, constituted by nationalist organizations across the political and social spectrum. He began to pressure the British through strikes, rallies and speeches. The British were resigned to losing Burma but were not sure what

the best course would be or how long it should take. They commissioned a report that recommended a transition period of three years before a slow process of elections. This report was swiftly rejected by Aung San and the AFPFL. They demanded and argued for an immediate provisional government for Burma run by the Burmese.

Aung San added pressure on the British by consolidating his control over a potential armed powerbase - a new group called the People's Volunteer Organisation, whose objective was to secure the complete freedom of Burma. Furthermore, he would not renounce the use of violence as a last resort. The British caved in and began to initiate steps to reach a final agreement with Aung San. In January 1947, Aung San led a delegation to London for a conference to negotiate the terms of Burmese independence. Here, Aung San achieved the first of his two greatest achievements in his political career; he reached the famous Aung San-Attlee Agreement with then British Prime Minister, Clement Attlee.

Aung San's second greatest political achievement was his feat of persuading the leaders of the various minorities living in the frontier areas of Burma to join his dream of creating a multi-ethnic Burmese nation-state. This was no simple feat especially after decades of British rule marked by a deliberate policy of ethnic differentiation with regard to the different ethnicities existing in Burma. In early February 1947, he arranged for a special conference in Panglong with the leaders of the different ethnic groups and managed to reach the

momentous Panglong Agreement with them, whereby they voluntarily agreed to join the proposed Union of Burma.

Thus, the task that remained was the final preparations for the Burma's independence and Aung San's ascension as national leader. Sadly, on 19 Jul 1947, Aung San was assassinated along with six others as he held a meeting of the pre-independence cabinet. Investigations determined that the attack was masterminded by U Saw, a political rival of Aung San. U Saw and the men he sent to kill Aung San were arrested and later executed. Although Burma gained her formal independence from Britain on 4 Jan 1948, the political damage to independent Burma was immense and it robbed the budding nation of her greatest and most experienced leader.

Conclusion

General Aung San lived a short but extremely eventful and purposeful thirty-two years. He was a successful military commander and national statesman, who held to his principles and did not

play to the galleries for populist support. He managed to lead successful strikes against the British during his time as a student leader at Rangoon University. He obtained Japanese support to rid Burma of her colonial masters, the British during the Second World War. After discovering that the Japanese were unwilling to grant the Burmese their independence and were in fact worse occupiers than the British, Aung San began plotting against them. He re-established contact with the British and they jointly acted to defeat the Japanese in 1945. After successfully navigating his homeland through the challenges posed by the geopolitical realignments of the Second World War, he started to negotiate with the British for a clear roadmap towards Burmese independence. Aung San's leadership skills and admirable personality traits such as honesty and quiet determination won him the respect of his friends and foes alike. His many achievements during the short span of his career is testimony to his greatness. 🕊️

* *Burma is now officially renamed as Myanmar.*

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