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By/par MAJ Lawrence Lim

Effects-Based Operations:
Learning From the Past to Revolutionalize the Future

<u>ABSTRACT</u>

An avid student of the military art will note that one of the cardinal principles espoused by Clausewitz is that war should not be an end unto itself. Rather, war is among one of the many political instruments a state could leverage for the pursuit of larger national policy goals.   As such, the strategic end-state as envisioned by policy should provide the unifying purpose to focus the efforts of the military, as well as the other elements of national power towards the accomplishment of higher and more ultimate ends.   In contemporary times, the US military, spurred by a Revolution in Military Affairs (RMA) had begun to codify this principle into what is now known as Effects-Based Operations (EBO). An examination of history will reveal that effects-based thinking is not new.   Nevertheless, EBO concepts (i.e. how to conduct EBO) have evolved over the years in response to operational challenges, as well as in the search for greater strategic expediency. Thus, this paper examines the evolution in EBO concepts, primarily within the context of the US military from World War I to the present information age. It posits that the perennial "struggle" in operationalizing EBO could be attributed to the lack of adequate means; getting to grips with "knowing the enemy" (in terms of gaining knowledge on the operational context); and "knowing yourself" (in terms of the planning processes and structures required to direct means to ends). As the successful conduct of EBO is contingent on a clearly articulated strategic end-state, and that the operational context could be modelled as a "system of systems", these pre-requisites could also potentially limit EBO's utility in the future. Thus, this paper concludes that EBO as a higher form of operational art should be leveraged for the insights it would provide and not be pursued as an end unto itself.

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INTRODUCTION

> We see, therefore, that war is not merely an act of policy but a true political instrument, a continuation of political intercourse, carried on with other means. . . . The political object is the goal, war is the means of reaching it, and means can never be considered in isolation from their purpose.[1]

An avid student of the military art will note that one of the cardinal principles espoused by Clausewitz is that war should not be pursued as an end unto itself. In fact, war should be viewed as one of the many political instruments that a state could leverage in its pursuit of larger national goals. As such, the strategic end-state (or outcome) as envisioned by policy should provide the unifying purpose to focus all military actions, in conjunction with the other elements of national power towards the accomplishment of higher and more ultimate ends. Despite Clausewitz's insight on the object of war, and its relationship vis-à-vis other instruments of national power, the military (notably the US military) has just begun to codify this principle under the banner of Effects-Based Operations (EBO), touted as one of the key initiatives enabled by an ongoing Revolution in Military Affairs (RMA).[2]

Seen from this perspective, effects-based thinking is clearly not new.[3] From the writings of early airpower proponents such as Giulio Douhet, to the architects of the German *Blitzkrieg* and Soviet Deep Operation Theory, the annals of history is replete

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[1] Carl von Clausewitz, *On War*, edited and translated. Michael Howard and Peter Paret (Princeton: Princeton University Press, 1976), 87.

[2] David A. Deptula, *Effects-Based Operations: Change in the Nature of Warfare* (United States: Aerospace Education Foundation, 2001), 17.

[3] Williamson Murray and Kevin Woods, *Thoughts on Effects-Based Operations, Strategy and the Conduct of War,* Report Prepared for Institute for Defense Analyses (Alexandria Virginia: Joint Advanced Warfighting Program, January 2004), 5-14.

with examples of how military planners have attempted to apply effects-based thinking in the search for greater combat efficiencies and expediency, albeit at different levels of war.[4] Nevertheless, with a fundamental change in the security environment brought about by the end of the Cold War, there has been renewed interests in EBO, particularly on how the concept could be applied to "low intensity" conflicts such as the fight against terrorism and military operations other than war (MOOTW).[5] Accordingly, effects-based thinking expanded from a narrow focus on the expedient application of military power, to a more inclusive concept that seeks to integrate all elements of national power in achieving directed policy goals over a broader spectrum of operations.[6]

With the current emphasis on EBO, a thorough understanding of the concept and its potential limitations would not only be quintessential for military commanders, but would also be equally relevant to civilian leaders in other government agencies. As such, a study on how effects-based thinking and concepts have evolved over the years would be instructive, if one were to learn from the lessons of the past with a view of revolutionizing the future. While many authors have opined that effects-based thinking is not new, they however did not elaborate on the factors that have constrained practitioners

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[4] According to the US Army Field Manual 3-0: Operations, three levels of war may be identified: Strategic, Operational and Tactical. See United States, United States Army Headquarters, *Field Manual 3-0 Operations* (Washington D.C.: US Army Headquarters, 2001), 2-2.

[5] Dennis J. Gleeson , et al, *New Perspectives on Effects-Based Operations: Annotated Briefing*, Report Prepared for the Institute for Defense Analyses (Alexandria Virginia: Joint Advanced Warfighting Program, 2001), 2-3.

[6] Edward Mann and Gary Endersby and Tom R. Searle, *Thinking Effects: Effects-Based Mythology for Joint Operations* (Maxwell Air Force Base: Air University Press: October 2002), 4-10.

over the years, nor shed light on how the prevailing geo-political and operational realities have shaped effects-based thinking.[7]

Thus, the purpose of this paper is to examine the evolution of EBO concepts, primarily within the context of the US military from World War I up to the present information age. It posits that while effects based thinking is not new, the perennial "struggle" in bringing effect-based thinking into fruition could be attributed to the lack of adequate delivery means, difficulties in acquiring and maintaining a "structural knowledge" of the enemy, and the absence of a planning process and structure necessary to support EBO type operations.

To this end, the genesis and experiences of conducting EBO type operations during the two World Wars will first be examined. The analysis will demonstrate that although practitioners had instituted an effects-based planning process, they were constrained by the delivery means available and frustrated by a lack of knowledge on the enemy. The impact of the Cold War on the effects-based thinking will then be addressed, followed by a discussion on the potential limitations of EBO when applied to contemporary operations such as coalition warfare and in MOOTW. The paper will show that the advent of nuclear weapons had the effect of making total war a less effective tool in the conduct of international relations, thus necessitating a more holistic approach in resolving limited conflicts. As the successful conduct of EBO is contingent on a clearly articulated end-state and requires support from a comprehensive intelligence collection

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[7] See Gene Myers, "Effects-Based Operations: Everything Old is New Again, as Concept Reveals," *Armed Forces Journal*, June 2003, 47-49; Joshua Ho, "The Advent of a New Way of War: Theory and Practice of Effects Based Operations," *Institute of Defence and Strategic Studies Singapore Working paper Series*, December 2003, 2; and Leonard D. Rickerman, "Effects-Based Operations: A New Way of Thinking and Fighting," (Kansas: United States Command and General Staff College Monograph, 2003), 10-16.

and analysis system, these pre-requisites could also potentially limit EBO's utility in the future. Thus, this paper will conclude that EBO as a higher form of operational art should be leveraged for the insights it would provide and not pursued as an end unto itself.

The Roots of the RMA

The ongoing RMA in the US military has its roots back in the 1980s where the confluence of experiences from the "shock" of Vietnam, the "inflexibility" of strategic nuclear weapons in securing America's wider interests, and the overwhelming conventional threat posed by the Soviet Union in central Europe galvanized a fundamental rethinking on operational strategies, fighting concepts and force structures.[8] Despite the massive build up of nuclear arsenal by the two superpowers during the Cold War, the use of nuclear weapons paradoxically became increasingly remote. The US propensity to employ nuclear weapons on any scale was held in check by a larger strategic concern that it could potentially trigger a global nuclear confrontation with the Soviet Union.[9] The two superpowers became locked in a paradigm of "mutual vulnerability", with nuclear weapons acting as policy instruments of strategic deterrence, rather than flexible means for winning limited wars.[10]

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[8] Williams A. Owens, "The Once and Future Revolution in Military Affairs," *Joint Force Quarterly*, Summer 2002, 56.

[9] Lawrence Freedman, "The First Two Generations of Nuclear Strategists," In *Makers of Modern Strategy: From Machiavelli to the Nuclear Age*, edited by Peter Paret (Princeton New Jersey: Princeton University Press, 1986), 769.

[10] *Ibid.,* 758, 769.

Thus, initial RMA efforts within the US military were largely driven by the services from the ground up, aimed at solving conventional combat "deficiencies" under the geo-political dynamics of a nuclear stalemate. To overcome the numerical superiority of conventional Warsaw Pact forces in central Europe, the US Army rediscovered the operational art, developed and experimented with AirLand Battle and instituted doctrine as the primary engine to rebuild an Army smarting from the sting of Vietnam.[11]

Meanwhile, armed with the lessons learned from Vietnam, the US Air Force reasserted air superiority as a critical enabler of future warfare. To achieve air superiority, it advocated the use of stealth aircraft and fighters, supported by electronic countermeasures and C^3I systems to enable rapid penetration and destruction of vital Soviet systems.[12] To capitalize on the aircraft's stealth capability in penetrating sophisticated air defence systems, US Air Force planners also developed the concept of "Parallel Warfare", which sought to destroy Soviet capabilities in a simultaneous rather than sequential fashion.[13]

On the other hand, the US Navy adopting an aggressive forward "defence" posture was more concerned about the menace of anti-ship missiles fired from Soviet staging areas. Consequently, US naval combat systems were designed based on a

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[11] Donn A. Starry, "Extending the Battlefield," *Military Review*, January 1997, 1-5.

[12] Walter J. Boyne, *Beyond the Wild Blue: A History of the U.S. Air Force* (New York: St. Martin's Griffin, 1997), 255-257.

[13] David A. Deptula, "Parallel Warfare" What Is It? Where Did It Come From? Why Is It Important?" In *Eagle in the Desert: Looking Back on U.S. Involvement in the Persian Gulf War,* edited by William Head and Earl H. Tilford, Jr., (United States: Praeger Publishers, 1996), 135-138.

collaborative engagement architecture, which subsequently evolved to become the father of Network-Centric Warfare (NCW).[14]

The confluence of these early RMA efforts culminated in a new generation of service-centric equipment, technologies and operational concepts, whose mettle were to be put to the test during Operation Desert Storm.[15]   Yet paradoxically, despite its phenomenal success in Desert Storm and the demise of the Soviet Union, the call for the US military to transform had not waned but assumed a greater sense of urgency and purpose. While earlier RMA efforts were predicated on the paramount need to defeat the Russian bear, the transformation agenda had to be re-orientated to enable the US military to operate more effectively in the post Cold War environment. In particular, such a transformation must empower the US military to confront a wider spectrum of security challenges; operate effectively in a new world social-economic order built around information and knowledge; yet maintaining its technological superiority over adversaries who have access to advanced military technologies and weapons of mass destruction.[16]

The Strategic Imperatives for EBO

On the security front, the fall of the Iron Curtain had not brought about a "peace dividend", but ushered in a paradigm marked by the phenomenon of failed and rogue

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[14] Williams A. Owens, "The Once and Future Revolution in Military Affairs," *Joint Force Quarterly*, Summer 2002, 56.

[15] Alvin Toffler and Heidi Toffler, *War and Anti-War: Survival at the Dawn of the 21st Century* (Canada: Little, Brown & Company (Canada) Limited, 1993), 54-55.

[16] National Defense University, *Quadrennial Defense Review 2001: Strategic-Driven Choices for America's Security* (Washington D.C.: National Defense University Press, April 2001), 34-35, 38-39.

states; the emergence of non-state actors (such as NGOs); and the ascendance of amorphous trans-national threats (such as terrorists organisations and organized crime cartels) employing asymmetric strategies that accentuate the inherent weaknesses of modern open societies.[17] While the possibility of a total war among the major powers had receded along with the break up of the bipolar world order, this was replaced by a strengthening of resolve among terrorist organisations united by the common aim of waging "*jihad*" against developed democracies and pro-Western societies; as well as an increased frequency of low intensity intra-regional conflicts fanned by ethnic and religious fervour.[18]

In place of a clearly defined enemy who threatened the existence of the free world, the US military increasingly found itself fighting ill-defined enemies, often for less than vital national interests.[19] These new security challenges, thus, have prompted a re-evaluation of US national security strategy to strengthen the ability of policy makers to respond more effectively over a wider spectrum of operations, and at a cost (in terms of casualties and resources) that is more aligned with US strategic interests.[20] Moreover, the need to stabilize and reconstruct failed states after the "internal" problems of ethnic cleansing and instituting "regime change" have been tackled also demanded a more

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[17] United States, The White House, *The National Security of the United States of America* (Washington D.C., September 2002), 2-3, 4-16,

[18] United States, United States Joint Force Command, *A Concept for Rapid Decisive Operations: RDO White Paper Version 2.0 (Draft)*, Norfolk Virginia: J9 Joint Futures Lab, 22 August 2001, 1.

[19] Robert Scales Jr., "Checkmate With Operational Maneuver: Warfare in the American Age," in

"total" approach that could better leverage all sources of power to provide holistic and enduring solutions. In this respect, the recent experience in Iraq is a case in point.

As the brute and "mindless" application of force could be counter productive in limited scenarios such as MOOTW,[21] it would be more expedient, if not more effective to apply military power in conjunction with other policy instruments if potential humanitarian crises are to be mitigated, and if "hearts and minds" are to be won. Therefore, rather than be fixated on the destruction of an adversary, military planning must increasingly adopt a wider strategic perceptive that seeks to de-escalate violence, promote peace and civil order, and actively engender the right conditions to facilitate reconstruction work.[22] To provide policy makers with a more flexible and robust set of responses to deal with "low-intensity" crises, the US "toolbox" of means was thus expanded to include other "non-kinetic" instruments to better augment the advanced "kinetic" arsenal that had proven their worth during the Gulf War.[23]

Furthermore, the need to incorporate non-kinetic means as part of a comprehensive package of policy instruments was also partly necessitated by the fundamental transition of the world's economic-social system from a "Second Wave" civilisation forged by the machinery of the industrial age, to a "Third Wave" civilisation

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[21] US Joint Publication 3-07 defined MOOTW as "[operations] encompass[ing] the use of military capabilities across the range of military operations short of war. These operations can be applied to complement any combination of the other instruments of national power." See United States, United States Joint Chiefs of Staff, *Joint Publication 3-07: Joint Doctrine for Military Operations Other Than War* (Washington D.C.: U.S. Government Printing Office, 16 June 1995), I-1.

[22] United States, United States Joint Chiefs of Staff, *Joint Publication 3-0: Doctrine for Joint Operations* (Washington D.C.: U.S. Government Printing Office, 10 September 2001), I-3–I-4.

[23] United States, United States Joint Force Command, *A Concept for Rapid Decisive Operations: RDO White Paper Version 2.0 (Coordinating Draft)* (Norfolk Virginia: J9 Joint Futures Lab, 22 August 2001), 32.

powered by information and knowledge.[24]   Although Internet networks and modern

communication systems have drawn societies closer together into a global village and

have increased the economic outputs of nations through trade and commerce, the

openness and inter-connectedness have also become critical points of vulnerability. With

the ubiquitous connectivity enabled by the global Internet network, this connectivity

could also be exploited by anyone to wage "cyberwar" virtually at anytime and from

anywhere.

Additionally, the reach of the Internet to mass populations and the richness of its

content could be leveraged by non-state actors and terrorist organisations to conduct

psychological operations against target populations with a view to influence public

opinion and erode political will. As these threats operate as "nodes" in the intangible

information highway, they cannot be readily or directly countered using kinetic means.

Even when perpetrators could be localized geographically, the ability of the US in taking

military action could be complicated and constrained by the potential political fallout.[25]

Thus, while kinetic means would remain the cornerstone of future US military capability,

more expedient means that are "non-kinetic" in nature must be employed if the "network

threats" of the information age are to be defeated during peacetime and in war.[26]

Compounding the above security challenges, advances in NBIC (Nano, Biological

Information and Communications) technologies have also enabled violence to be applied

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[24] Alvin Toffler and Heidi Toffler, *War and Anti-War: Survival at the Dawn of the 21st Century* (Canada: Little, Brown & Company (Canada) Limited, 1993), 64-80.

[25] United States, United States Joint Force Command, *A Concept for Rapid Decisive Operations: RDO White Paper Version 2.0 (Draft)* (Norfolk Virginia: J9 Joint Futures Lab, 22 August 2001), 4.

[26] United States Joint Chiefs of Staff, *Joint Vision 2010* (Washington D.C.: U.S. Government Printing Office, 1995), 16-24.

faster, "better" and cheaper.[27] Coupled with the wider diffusion of technical know-how,

off-the-shelf availability of sophisticated military hardware and powerful information

systems, future conflicts could be expected to be bloodier, especially if potential

adversaries adopt asymmetric strategies that are tailored towards inflicting en-masse

casualties.[28] To avoid being drawn into a protracted bloody conflict, the US military

intends to deploy its might with greater incisiveness and intelligence to achieve a swift

and decisive victory.[29] As the Internet and modern communication systems have

empowered adversaries to collaborate in smaller but flexible elements, the US military

had also decided to deconstruct its command and control structures with a view of

speeding up decision cycles and enhancing the ability of commanders to adapt.[30]

Conceptually, this will be achieved through "information superiority" by conducting

"offensive" and "defensive" information warfare.[31]

The Agenda for Transformation

Thus, the nexus of security, social-economic and technological developments

brought about by the end of the Cold War demanded that the US military sustain its RMA

to also bring about an intellectual revolution, besides the inherent technological

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[27] Alan Kay, "Emerging Technology and Growth Areas," in *Future Force: Concepts for Future Army Capabilities* (Kingston, Ontario: Directorate of Land Strategic Concepts, 2003), 31.

[28] National Defense University, *Quadrennial Defense Review 2001- Strategic-Driven Choices for America's Security* (Washington D.C.: National Defense University Press, April 2001), 34-35, 38-39.

[29] United States Joint Chiefs of Staff, *Joint Vision 2020* (Washington D.C.: U.S. Government Printing Office, June 2000), 4-11.

[30] United States Joint Chiefs of Staff, *Joint Vision 2010* (Washington D.C.: U.S. Government Printing Office, 1995), 14.

[31] *Ibid*., 16.

innovation, if it is to remain relevant and effective in the information age.[32] In charting

the course for transformation, *Joint Vision 2010 (JV2010)* first articulated a "conceptual

template" to provide the overarching framework to transform the US military from a

service-centric industrial age force to one capable of "Full Spectrum Dominance."[33]

However, while *JV2010* had alluded to the need to "dominate the full range of military

operations from humanitarian assistance, through peace operations, up to and into the

highest intensity conflict" by operationalizing the joint concepts of "Dominant Maneuver

[sic], Precision Engagement, Focussed Logistics and Full-Dimensional Protection,"[34] one

could argue that full spectrum dominance remained essentially a military-centric concept,

since it did not elaborate on how the US military would integrate with, and complement

the other elements of national power. Furthermore, *JV2010* also did not address the

threat posed by global terrorism and the challenges of conducting MOOTW in the post

Cold War epoch.

Nevertheless, Joint Vision 2020 (*JV2020*) subsequently expanded *JV2010's*

initial range of threats and operations, fleshing out the concept of full spectrum

dominance in greater detail. In elucidating the means required to achieve full spectrum

dominance, *JV2020* stated that this would be realized by an adaptable and flexible

knowledge-based joint force capable of conducting a spectrum of operations "as one

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[32] United States Joint Chiefs of Staff, *Joint Vision 2020* (Washington D.C.: U.S. Government Printing Office, June 2000), 1-5.

[33] United States Joint Chiefs of Staff, *Joint Vision 2010* (Washington D.C.: U.S. Government Printing Office, 1995), 1-2.

[34] *Ibid.*, 25.

element of a unified national effort", and in partnership with other national agencies, coalition partners, international and regional organisations and NGOs.[35]

By making this distinction, *JV2020* underscored the need to more judiciously employ US military power in conjunction with other elements of national power (such as Diplomatic, Information, Military and Economic) and contributions from other stakeholders in accomplishing directed policy goals.[36] More subtly, *JV2020* also articulated a requirement for an all encompassing framework that could further strengthen the linkage between military power and policy ends, as well as tie in the services' established operational concepts of AirLand Battle, Parallel Warfare and Network Centric Warfare.[37]

EBO Codified

Building on the foundation laid by *JV2020,* the conceptual framework that would establish the linkage between the myriad of policy instruments to desired strategic objectives was subsequently codified as EBO by US Joint Forces Command (USJFCOM) as follows:

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[35] United States Joint Chiefs of Staff, *Joint Vision 2020* (Washington D.C.: U.S. Government Printing Office, June 2002), 12.

[36] *Ibid.,* 15-18.

[37] Dennis J. Gleeson , et al, *New Perspectives on Effects-Based Operations: Annotated Briefing*, Report Prepared for the Institute for Defense Analyses (Alexandria Virginia: Joint Advanced Warfighting Program, 2001), 39-40.

Effects Based Operations (EBO) are operations that focus on influencing or changing system behaviour or capabilities using the integrated application of selected instruments of power in order to achieve directed policy aims. EBO are planned, executed, assessed, and adapted based on a holistic and dynamic understanding of the operational environment.[38]

Viewed under this construct, effects-based thinking could be construed as a higher form of operational art writ large at the strategic level of war, since it explicitly advocates traceability between ways, means and ends.[39] By focusing on desired policy outcomes rather than on an adversary's military capabilities, effects-based thinking encourages planners (both military and civilian) to adopt a broader perspective with regards to the prescription of means, thereby achieving greater unity of effort at the national level, as well as derive greater coherence to desired policy objectives. An effects-based approach also opens up the "mental space" for planners to consider influencing an adversary's behavior as an alternative to the parochial aim of destroying his military capabilities linearly.[40] In so doing, operations could then be conducted more intelligently and meaningfully by harnessing all available sources of power (both kinetic and non-kinetic) to achieve desired policy goals in the most effective and efficient manner practicable.[41]

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[38] United States, United States Joint Force Command, *The Effects Based Operations Process Concept of Operations (CONOPS) Version 0.61 (Draft)* (Norfolk Virginia: Joint Experimentation Directorate, 4 November 2004), 3.

[39] Dennis J. Gleeson , et al, *New Perspectives on Effects-Based Operations: Annotated Briefing*, Report Prepared for the Institute for Defense Analyses (Alexandria Virginia: Joint Advanced Warfighting Program, 2001), 6.

[40] *Ibid.*, 18.

[41] United States, United States Joint Force Command, The Joint Warfighting Centre Joint Doctrine Series Pamphlet 7: Operational Implications of Effects-Based Operations (EBO) (Suffolk Virginia: J7 Joint Training, 17 November 2004), 6-8.
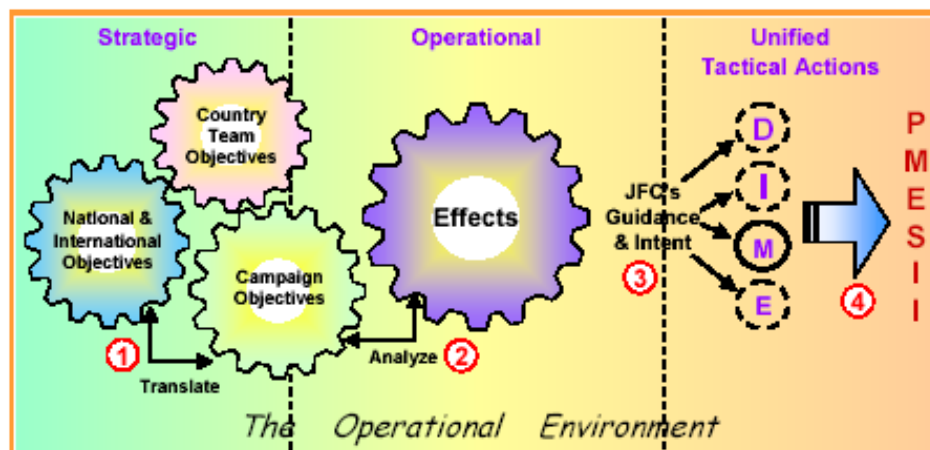
Figure 1 – The Effects-Based Approach

Source: United States Joint Force Command, *The Joint Warfighting Centre Joint Doctrine Series Pamphlet 7: Operational Implications of Effects-Based Operations (EBO)*, 7

Implicit in USJFCOM's definition, the successful conduct of EBO would

necessitate that planners have a firm understanding on the strategic objectives to be

achieved, as well as possess and maintain a "structural knowledge"[42] of the operational

context (including the enemy and all stakeholders). To identify the critical path towards

the attainment of desired policy outcomes, such knowledge should permit planners to

isolate "vulnerabilities" or "centers of gravity."[43] In addition, planners should have a

comprehensive appreciation on how the application of the various forms of power

(kinetic and non-kinetic) could potentially impact the situation. As targets will adapt in

response, planners also need to continually monitor and assess the evolving situation so

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[42] Dietrich Dörner, The Logic of Failure: Recognising and Avoiding Error in Complex Situations (New York: Metropolitan Books, 1996), 5-6.

[43] Desmond S. Newton and Aaron B. Frank, "Effects-Based Operations: Building the Analytic Tools," *Defense Horizons*, no. 19 (October 2002): 3; Article online: available from http://www.ndu.edu /inss/DefHor/DH19/193-619_DH19.pdf; Internet; accessed 11 November 2004; and United States, United States Joint Force Command, *The Effects Based Operations Process Concept of Operations (CONOPS) Version 0.61 (Draft)* (Norfolk Virginia: Joint Experimentation Directorate, 4 November 2004), 98.

as to provide the "feedback" to permit dynamic re-calibration of subsequent efforts.[44]

Thus, while effects-based thinking could be compellingly straightforward, implementing

EBO is nevertheless a challenging enterprise, considering the complexity, diverse scope

and comprehensive intelligence required to make it work.

For instance, even if the strategic outcomes to be accomplished could be clear and

unambiguous, acquiring and maintaining an accurate "structural picture" of the prevailing

operational context could pose significant challenges, since this would necessitate a

comprehensive analysis on the range of potential effects each element of national power

could exert on the operational context.[45] Furthermore, as effects could be direct or

indirect, permanent or temporal, primary or secondary and can manifest themselves either

in the physical or cognitive domains, its multi-faceted nature and possible permutations

greatly compound the analysis and assessment processes to facilitate EBO planning.[46]

To overcome these challenges and realize EBO, the US military intends to

develop and maintain a Knowledge Base (KB) to enable commanders to "gain a holistic

and dynamic understanding of their operational environment".[47] The KB would also

serve as the template where effects could be systematically analyzed, assessed and

synchronized. Judging from the complexities involved, an endeavor such as a KB would

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[44] United States, United States Joint Force Command, *The Effects Based Operations Process Concept of Operations (CONOPS) Version 0.61 (Draft)* (Norfolk Virginia: Joint Experimentation Directorate, 4 November 2004), 3-4.

[45] An effect is defined as "[t]he physical and/or behavioural state of a PMESII [Political, Military, Economic, Social, Information, Infrastructure] system that results from a military or non-military action or set of actions (DIME)." *Ibid.*, 103.

[46] Edward A. Smith, *Effects Based Operations: Applying Network Centric Warfare in Peace, Crisis, and War* (United States: CCRP Publication Series, 2002), 110-112.

[47] United States, United States Joint Force Command, *The Effects Based Operations Process Concept of Operations (CONOPS) Version 0.61 (Draft)* (Norfolk Virginia: Joint Experimentation Directorate, 4 November 2004), 6-15.

not have been possible without modern advances in computing and information technologies.

However, while technology is arguably a critical enabler of EBO, its absence had nevertheless not dissuaded military practitioners from applying effects-based thinking in the past.[48] Without aid from sophisticated planning tools, it would seem plausible that early practitioners have to rely on their "gut" and other rudimentary forms of analysis instead. Therefore, while the conduct of EBO has evolved to become more science than art in contemporary times, it could be argued that it was more art than science in the past.

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[48] Williamson Murray and Kevin Woods, *Thoughts on Effects-Based Operations, Strategy and the Conduct of War,* Report Prepared for the Institute for Defense Analyses (Alexandria Virginia: Joint Advanced Warfighting Program, January 2004), 19-26.

THE TWO WORLD WARS

> Therefore I say: 'Know the enemy and know yourself; in a hundred battles you will never be in peril. When you are ignorant of the enemy but know yourself; your chances of winning or losing are equal. If ignorant both of your enemy and of yourself, you are certain in every battle to be in peril.'[49]

By challenging commanders to leverage all available instruments of power to influence an adversary's behaviour rather than simply attriting his military capabilities in a linear fashion, EBO seeks to terminate potential conflicts more quickly with lesser expenditure of resources and with fewer casualties.[50] Nevertheless, the successful conduct of EBO would necessitate clarity on the desired end-state to be achieved, hence the need for operational processes and structures capable of translating political objectives into desired effects; a set of analytical tools that could provide insights into an adversary's "centres of gravity" and his anticipated responses to the various forms of "friendly" kinetic and non-kinetic power that could be potentially brought to bear on his system; and a set of delivery means that could accentuate the desired effects when applied against the enemy's "critical points".[51] In this respect, Sun Tzu's maxim of "knowing yourself" and "knowing the enemy" aptly summarises the key prerequisites for conducting EBO, while capturing the essence of the operational challenges confronting practitioners during the two world wars.

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[49] Sun Tzu, *The Art of War*, translated. Samuel B. Griffith (London: Oxford University Press, 1963), 84.

[50] Philip S. Meilinger, "Air Warfare An Historical Perspective," In *Effects Based Warfare,* edited by Christopher Finn (London: The Stationery Office, 2002), 52-53.

[51] Desmond S. Newton and Aaron B. Frank, "Effects-Based Operations: Building the Analytic Tools," *Defense Horizons*, no. 19 (October 2002): 3-8; Article online: available from http://www.ndu.edu/inss/DefHor/DH19/193-619_DH19.pdf; Internet; accessed 11 November 2004.

Airpower and EBO

As one of the key tenets of EBO is an emphasis on attacking an adversary's "critical points" (or "centres of gravity") so as to expediently achieve desired strategic outcomes, airmen of the two world wars were perhaps the first to put effects-based thinking into practice, although they were advocating the pre-eminence of airpower instead of leveraging all elements of national power to destroy an opponent's industrial-economic base.[52]   On this point, some might however argue that sea power theorists have probably grasped the concept much earlier, after all, control of vital sea lines of communications could also potentially strangle an opponent's commerce and bring about devastating effect on its economy.[53]   Others (such as Hans Delbrück) might also point out that the idea of connecting ends and means has an even earlier lineage, as embodied in the military strategies of *Niederwerfungsstrategie* (annihilation) or *Ermattungsstrategie* (attrition), with the latter used by those poor in resources.[54]

Nonetheless, the advent of combat aviation in the early twentieth century offered military planners with an alternative dimension that could more directly and decisively destroy an adversary's source of war-making potential.   Effects-based thinking thus became firmly rooted in the development of airpower, as it provided a viable option of "bypassing" the tactical surface domain where bloody tactical battles were fought, and

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[52] Philip S. Meilinger, "Air Warfare An Historical Perspective," In *Effects Based Warfare,* edited by Christopher Finn (London: The Stationery Office, 2002), 52-53.

[53] Russell F. Weigley, *The American Way of War* (Bloomington: Indiana University Press, 1973), 174-175.

[54] Craig, Gordon A. "Delbrück: The Military Historian." In *Makers of Modern Strategy: From Machiavelli to the Nuclear Age*, edited by Peter Paret (Princeton New Jersey: Princeton University Press, 1986), 341-342.

where lives and resources were incessantly consumed.[55] In carving a niche for airpower, airmen began to advocate a new form of warfare where the inherent flexibility and reach of airpower could be utilised to decisively destroy an adversary's capability to sustain a conflict, rather than simply indulge in an attritionist approach of destroying his means of waging war over a protracted series of tactical battles.[56] Effects-based thinking and development of airpower thus became closely intertwined. A discussion on one would therefore necessitate an elaboration of the other.

The genesis of effects-based thinking could thus be traced to the turbulent era of the two world wars, where advances in aviation technology and a general disdain for war prompted a major rethinking in operational concepts with a view of terminating future conflicts with greater economy of effort and over a shorter period of time.[57] Additionally, it sparked an intellectual ferment on airpower's operational roles vis-à-vis the Army and the Navy, and if an independent Air Service should be created to permit extraction of greater combat efficiencies.[58]

However, in the context of the US military, such discussions were not broad-based in nature but viewed with suspicion, if not contempt by the other more established services.[59] Effects-based thinking was championed and pursued by airmen who argued

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[55] William Mitchell, *Winged Defense: The Development and Possibilities of Modern Air Power – Economic and Military* (New York: Kennikat Press, 1925 (Reprinted 1971)), 5.

[56] Philip S. Meilinger, "Development of Air Power Theory," In *Airpower Leadership Theory and Practice,* edited by Peter W. Gray and Sebastian Cox (London: The Stationery Office, 2002), 90-93.

[57] Philip S. Meilinger, "Air Warfare An Historical Perspective," In *Effects Based Warfare,* edited by Christopher Finn (London: The Stationery Office, 2002), 52-53.

[58] Richard J. Overy, "Strategic Bombardment before 1939 Doctrine, Planning and Operations," in *Case Studies in Strategic Bombardment*, edited by R. Cargill Hall (Washington D.C.: United States Government Printing Office, 1998), 13-21.

that more expedient outcomes could be achieved if airpower was concentrated against an adversary's strategic "vital centres", instead of being diverted to support surface operations for simple tactical success.[60] Consequently, effects-based thinking never became mainstream in the US military during the two world wars, nor was it instituted as part of a wider operational planning process involving the US Army and US Navy, even though strategic bombing doctrine and precision daylight bombers were developed by the Army Air Corps in the same period.

Efforts to permeate effects-based thinking were however more dynamic elsewhere. To avoid the attritionist-style trench warfare that had characterized World War I, mechanization and tank advocates such as J.F.C. Fuller and Liddell Hart began to conceptualise a new form of land warfare at the operational level of war. Anticipating the military aspects of the EBO approaches of the 1990s, these prophets of modern manoeuvre warfare theory emphasised the need to concentrate force against an enemy's weak points to seize the initiative and develop the situation to one's advantage.[61] In their view, the objective should be to create operational level effects by integrating manoeuvre and firepower to rapidly rupture and dislocate an enemy in his rear to bring about his swift capitulation without the need to physically destroy his entire defence layout.[62] The German *Wehrmacht* and Soviet Red Army would subsequently develop these ideas

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[59] William Mitchell, Winged Defense: The Development and Possibilities of Modern Air Power – Economic and Military (New York: Kennikat Press, 1925 (Reprinted 1971)), ix.

[60] Richard J. Overy, "Strategic Bombardment before 1939 Doctrine, Planning and Operations," in *Case Studies in Strategic Bombardment*, edited by R. Cargill Hall (Washington D.C.: United States Government Printing Office, 1998), 38-47.

[61] Robert R. Leonhard, *The Art of Maneuver: Maneuver-Warfare Theory and AirLand Battle* (Novato California: Presidio Press, 1991), 49-50.

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independently and assimilate them into operations in the form of *Blitzkrieg* and deep operational manoeuvre.[63]

Nevertheless, EBO remained firmly rooted in the dogma of early airpower proponents, providing a conceptual framework to facilitate the planning of strategic bombardment operations. Despite the compelling logic of an effects-based approach, two pertinent issues however remained unresolved. Firstly, airmen could not reach consensus as to what constituted an adversary's "centres of gravity", nor could they adequately demonstrate how the destruction of such vital centres could potentially contribute to the achievement of desired policy outcomes. Consequently, the notion of vital centres was often subjected to divergent interpretation, guided by anecdotal and empirical "gut" feel, rather than a comprehensive and objective analysis of an adversary's war-sustenance system.[64] For instance, some believed strategic vital centres to be more tangible in nature, such as the fighting forces or the "choke points" within the industrial-economic base of an adversary. Others however maintained that the intangible component to be of greater significance, emphasising the need to psychologically shatter the morale of a nation as a prerequisite to compel "favourable" policy changes in the targeted political regime.[65]

Secondly, it could also be argued that airmen had probably underestimated the technical challenges and practical difficulties required to operationalize EBO. Air bombardment was after all in its infancy stage of development with precision bombing

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[63] Richard E. Simpkin, *Race to the Swift: Thoughts on Twenty-First Century Warfare* (Great Britain: A. Wheaton & Co. Ltd., 1982), 24-25, 37-39.

[64] Arthur W. Tedder, *Air Power in War* (London: St. Paul's House, 1948), 89-92.

[65] Philip S. Meilinger, "Development of Air Power Theory," In *Airpower Leadership Theory and Practice,* edited by Peter W. Gray and Sebastian Cox (London: The Stationery Office, 2002), 91-93.

technology relatively immature.[66] In order to destroy an adversary's vital centres, this thus necessitated the use of large numbers of bombers to compensate for the lack of terminal precision, and the possibility of en-route attrition by enemy defensive action. In addition, there was a need to mount sustained bombardment operations over prolonged periods of time until the desired outcomes became imminent.[67] Nevertheless, airmen diligently did what they could to assimilate effects-based thinking as part of strategic bombardment operations during the two world wars, though not always achieving the swift and decisive results that they have hoped for.[68]

World War I: The Genesis of EBO in Air Warfare

The first concept paper that attempted to incorporate effects-based thinking into military operations could be attributed to Major Edgar S. Gorrell, when he penned the U.S. Air Service's bombardment plan against Germany in 1917.[69] Noting that the war had stagnated to stalemate machine-gun trench warfare after three years of fighting on the ground, Gorrell felt that a new "policy" of attacking Germany should be adopted if the incessant loss of lives and resources were to be reversed, and if the Great War was to be brought to a swift conclusion. To this end, he argued that if the desired effect was to

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[66] United States, United States Strategic Bombing Survey, *United States Strategic Bombing Survey Summary Report (European War)* (Washington D.C.: Government Printing Office, 1945), 1.

[67] Richard J. Overy, "Strategic Bombardment before 1939 Doctrine, Planning and Operations," in *Case Studies in Strategic Bombardment*, edited by R. Cargill Hall (Washington D.C.: United States Government Printing Office, 1998), 21-26.

[68] Philip S. Meilinger, "Air Warfare An Historical Perspective," In *Effects Based Warfare,* edited by Christopher Finn (London: The Stationery Office, 2002), 52-53.

[69] Maurer Maurer, *The U.S. Air Service in World War I: Volume II* (Washington D.C.: U.S. Government Printing Office, 1978), 14, and Philip S. Meilinger, "Air Warfare An Historical Perspective," In *Effects Based Warfare,* edited by Christopher Finn (London: The Stationery Office, 2002), 53.

induce collapse in the German front, then the means by which the German Army used in sustaining that front had to be decisively destroyed if a strategic breakthrough was to be achieved.

Using an analogy, and referring to the German Army as the sharp point of a drill, Gorrell opined that rather than fighting the hard "point", it would be more prudent to break the drill's "shank", since a broken drill could no longer do any harm.[70]   As such, he devised a plan that relied on the reach of airpower to destroy German "manufacturing centres" distributed over four distinct industrial regions. These targets included chemical factories that rolled out artillery shells for use at the front lines, as well as engineering plants that produced German aircraft engines and parts.[71] By destroying these targets, Gorrell argued that not only would Germany's capacity to sustain the fight be severely dented, the indirect effect of "wrecking" the morale of German industrial workers and the collateral damage caused by fires would also weaken the will of the German people in prolonging the war.   In Gorrell's mind, the compendium of these effects would result in the swift culmination of Germany, thereby achieving results "… out of proportion to the immediate effects of the bombs."[72]

While Gorrell had cogently argued the mer

German war effort (such as chemical factories and aircraft engine plants), Gorrell's target list appeared to be all encompassing and included virtually the entire German war-making industrial base. Furthermore, he also did not provide guidance on the priority of targets to be attacked but had simply earmarked targets in four large geographical regions that should be destroyed.[73]

In seeking an explanation for Gorrell's lack of resolution in these two aspects, one could deduce that he was constrained by at least three factors. Firstly, Gorrell did not utilise a coherent planning process that could link the destruction of German industrial targets vis-à-vis their relative contribution to the desired strategic outcome of collapsing Germany's war-sustaining potential. Consequently, he adopted a more conservative all-inclusive approach by simply placing all German industrial targets of interest in his target list. Secondly, Gorrell's inability in discriminating the targets to be attacked, nor ascribe their priority for destruction also reflected the lack of an intimate understanding on the inner workings of the German industrial-economic system, and the value of each target to the German war effort. Thirdly, Gorrell's decision to assign areas, rather than point targets was probably necessitated out of practicalities and reasonableness, since he understood that the technology to enable precision bombing were unavailable then, and went on to emphasise that pilots should be exceptionally skilled in the art of navigation to assure success.[74]

Unfortunately, with the armistice in late 1918 coupled with the delay in the American bomber construction programme, Gorrell's plans were never carried out. Thus,

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[73] *Ibid*., 143-145.

[74] *Ibid*., 149-150.

the efficacy of an effects-based approach remained to be validated at the premature

conclusion of World War I. Nevertheless, the "trauma" of the Great War had fired the

imagination of airpower proponents and manoeuvre warfare theorists, compelling them to

search for a more expedient way of waging and terminating future conflicts. These ideas

would subsequently be incorporated as part of the Allied strategic bombing campaign

against Nazi Germany and Imperial Japan during World War II.

The Interwar Years

In the aftermath of World War I, airpower proponents, notably General Giulio

Douhet of Italy and General Billy Mitchell of the United States began to build on

Gorrell's ideas, adopting what is essentially an effects-based framework to rationalize the

prescription of airpower.[75] Like Gorrell, Douhet and Mitchell were appalled by the

carnage and devastation caused by trench warfare on the western front, and advocated

airpower as a more direct and expedient instrument in extinguishing an adversary's will

to fight.[76] Though both had adopted an effects-based argument in furthering the case for

airpower, much of their energies were however focussed on carving a niche for airpower

and the need to create an independent air service for the defence of their nations. Thus,

little intellectual power was devoted towards developing effects-based doctrine within the

realm of airpower. As such, effects-based thinking remained a conceptual framework

during the interwar years, up to the outbreak of World War II. A recurring theme

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[75] Philip S. Meilinger, "Air Warfare An Historical Perspective," In *Effects Based Warfare,* edited by Christopher Finn (London: The Stationery Office, 2002), 54.

[76] Giulio Douhet, *The Command of the Air*, translated by Dino Ferrari (New York: Arno Press, 1972 (Reprinted)): 7-10; and William Mitchell, *Winged Defense: The Development and Possibilities of Modern Air Power – Economic and Military* (New York: Kennikat Press, 1925 (Reprinted 1971)), 14.

constraining EBO type operations during this period was the absence of a planning process and staff organization capable of connecting means to ends; the inability in knowing the enemy, and the lack of adequate delivery means required to achieve the desired effects on targets.

In many respects, Douhet's ideas were similar yet more expansive when compared to Gorrell. For instance, while Gorrell had paid particular attention to the destruction of an adversary's industrial centres, Douhet ascribed greater importance on the need to break a nation's will, with destruction of its industrial centres as one of the other possible lines of operation.[77] On the other possible target sets, Douhet also added "…peacetime industrial and commercial establishments; important buildings, private and public; transportation arteries and centres; and certain designated areas of civilian population as well."[78]

Douhet also viewed airpower as a decisive instrument in war, an "offensive weapon par excellence," with targeting for effects as the key in unleashing its full potential. To this end, he opined that the targets must be judiciously selected and attacked on a massive scale to collapse the collective will of a nation, as well as on a sustained basis in order to deny the enemy any chance of recovery.[79] To accentuate the desired effects, Douhet even went as far as to promote the use of incendiary and aero-chemical bombs, opining that if these bombs were mix in the right proportions with high

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[77] Philip S. Meilinger, "Giulio Douhet and the Origins of Airpower Theory," In *The Paths of Heaven: The Evolution of Airpower Theory*, edited by Philip S. Meilinger (Maxwell Air Force Base: Air University Press, 1997), 11-12.

[78] Giulio Douhet, *The Command of the Air*, translated by Dino Ferrari (New York: Arno Press, 1972 (Reprinted)), 20.

[79] *Ibid.*, 20.

explosives, their combined effects on the target would be of greater impact than if only a single type of bomb was used.[80] However, on how targets should be selected and prioritised, Douhet like Gorrell, did not offer any additional insights but conceded that this endeavour would require exceptional insights and the *coup d'oeil* of air commanders.[81]

In a similar vein, Mitchell also advocated the use of airpower as the most expedient means of imposing a nation's will on another.[82] He argued that airpower would permit future wars to be waged more humanely and economically, since lethal force could now be directly applied towards the "heart" of a country from standoff distances at a time of one's choosing. Mitchell went on to assert that the effect of the threat of bombing from the air in itself would serve to deter nations from going to war if they could not assure command of the air.[83] Even if that deterrence failed, Mitchell opined that by virtue of airpower's ability to strike immediately at an enemy's "… centres of production of all kinds, means of transportation, agriculture areas, ports and harbours and shipping", this would have a crippling effect on an adversary's ability to sustain the war, since such infrastructure would not be easily replaceable over a short period of time.[84] The annihilation of such "vital centres", in his opinion, would oblige an enemy to sue for peace, thereby minimising the loss of lives and further expenditure of

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[80] *Ibid.*, 57-58.

[81] *Ibid.*, 59-60.

[82] William Mitchell, *Winged Defense: The Development and Possibilities of Modern Air Power – Economic and Military* (New York: Kennikat Press, 1925 (Reprinted 1971)), 214.

[83] *Ibid.*, 5-6, 31.

[84] *Ibid.*, 16-17, 126-127.

resources.[85] Thus, while Douhet had ascribed greater importance on breaking a nation's

will, Mitchell on the other hand believed that the destruction of selected industrial and

infrastructural targets would have a more decisive impact on an adversary's war-

sustaining potential.[86]

Nevertheless, like Douhet, Mitchell had probably assumed that air resources were

infinite relative to targets, as he also did not elaborate on the processes by which an

enemy's vital target sets could be identified, nor within a cluster of targets, which should

be destroyed in priority. It was also ironic that while Mitchell had noted that the

selection and training of personnel would be especially critical to support EBO type

operations, he did not go further to enunciate the substance of that training, nor the

knowledge and skill sets that air planners should possess.[87] In examining the literature of

Douhet and Mitchell, it would thus be reasonable to conclude that while they fully

appreciated the efficacy of an effects-based approach with regards to the application of

airpower, they did not have sufficient insights on the challenges associated with

implementing EBO type operations, nor knew exactly how to bring the concept into

fruition.

Fortuitously, the economic hardships brought about by the Great Depression in

the 1930s had the effect of validating the theories espoused by Douhet and Mitchell, for it

highlighted the inherent strong coupling between the well-being of an industrialized

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[85] *Ibid.*, 5-6, 31.

[86] Richard J. Overy, "Strategic Bombardment before 1939 Doctrine, Planning and Operations," in *Case Studies in Strategic Bombardment*, edited by R. Cargill Hall (Washington D.C.: United States Government Printing Office, 1998), 40.

[87] William Mitchell, *Winged Defense: The Development and Possibilities of Modern Air Power – Economic and Military* (New York: Kennikat Press, 1925 (Reprinted 1971)), 159-180.

nation and the health of its economy. [88] Hence, airmen reasoned that if a severe

economic recession could wreck havoc and bring a country to its knees during peacetime,

surely the systematic destruction of an adversary's industrial system during wartime

would achieve far greater "success". [89]

Against this backdrop, the US Army Air Corps began to develop a doctrine for

strategic bombardment along the lines of Mitchell, from the premise that airpower alone

could be decisive. The doctrine alluded to the use of airpower in destroying "critical

points" of an adversary's industrial-economic system to cause strategic paralysis. It was

thought that such attacks would also indirectly fragment the will of the enemy's civilian

population. [90] Direct attacks against civilians in cities were not encouraged, as it was

"repugnant to American mores" and therefore deemed as "an undesirable stratagem". [91]

Thus, at the Air Corps Tactical School (ACTS), the concept of precision bombing

against selected industrial targets began to take shape. To operationalize this concept,

ACTS planners tackled the "problem" that Douhet and Mitchell had thus far avoided,

developing an operational planning processes called the "Air Estimate" to reconcile the

policy goals of strategic bombardment with tasks, targets and means. [92] The creation of

the Air Estimate process was significant in two respects. Firstly, it instituted a

methodology whereby air planners could begin to prioritise targets vis-à-vis the

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[88] Philip S. Meilinger, "Air Warfare An Historical Perspective," In *Effects Based Warfare,* edited by Christopher Finn (London: The Stationery Office, 2002), 55.

[89] *Ibid.*, 55.

[90] Haywood S. Hansell, *The Strategic Air War Against Germany and Japan: A Memoir* (Washington D.C.: Office of the Air Force History, 1986), 9-10.

[91] *Ibid.,* 11, 13.

[92] *Ibid.*, 15-17.

attainment of desired policy objectives. Secondly, by going through the estimate process, airmen also began to develop the skill sets and expertise required to support effects-based planning.

Besides planning processes, ACTS planners also realized that for precision bombing to be effective, it must be ably supported by an intelligence organization capable of analysing diverse and complex socio-economic systems.[93] To rapidly build up such a capability, ACTS planners first used the American industry as a proxy to develop a model whereby "choke points" in an adversary's industrial-economic system could be systematically identified. Though some of the intelligence inputs used were rudimentary and qualitative in nature, ACTS was nevertheless able to codify a process and uncovered "electric power, transportation, fuel, food and steel" as the "heart" of the American industrial system, in order of priority.[94] The insights from the pioneering efforts of airmen at ACTS would profoundly affect the way in which American strategic offensive airpower was employed, when the US entered World War II in December 1941, after the Japanese pre-emptive attack on Pearl Harbour.

The War Against Nazi Germany

Even prior to the US entering the war, Army Air Corps planners, in anticipation of America's potential involvement in the conflict had already initiated preliminary preparations by studying the German industry in collaboration with the British.[95] A

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[93] *Ibid*., 19-22.

[94] *Ibid*., 12, 22.

study on Japan's industrial system however proved more challenging as planners could not penetrate the Japanese "curtain of secrecy."[96] Using the Air Estimate developed by ACTS, Army Air Corps planners begun to level up their knowledge on Germany's "industrial-economic structures" by synthesising the intelligence provided by the British, information scoured from open source literature and reports, as well as data gathered from industry captains and individuals with economic links to Germany.[97] The result was the identification of one hundred and fifty-four German industrial-economic target systems whose destruction was deemed crucial in inflicting strategic paralysis on Germany's ability to sustain the war.[98]

In certain ways, the targets identified from the study on Germany were similar to the earlier analysis conducted by ACTS on the American economy. They included similar systems such as electrical power distribution systems, critical transportation nodes and oil production facilities. The only exception was German aircraft production plants, which was accorded with top priority.[99] Known as Air War Plans Division Plan 1 (AWPD-1), this initial Army Air Corps contingency plan was assimilated as part of President Roosevelt's larger Victory Program,[100] which provided an initial assessment of

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[95] Richard J. Overy, "Strategic Bombardment before 1939 Doctrine, Planning and Operations," in *Case Studies in Strategic Bombardment*, edited by R. Cargill Hall (Washington D.C.: United States Government Printing Office, 1998), 70.

[96] Haywood S. Hansell, *The Strategic Air War Against Germany and Japan: A Memoir* (Washington D.C.: Office of the Air Force History, 1986), 22-23.

[97] Philip S. Meilinger, "Air Warfare An Historical Perspective," In *Effects Based Warfare,* edited by Christopher Finn (London: The Stationery Office, 2002), 56-57.

[98] Haywood S. Hansell, *The Strategic Air War Against Germany and Japan: A Memoir* (Washington D.C.: Office of the Air Force History, 1986), 33-35.

[99] *Ibid.*, 52.

American military capabilities required to defeat the Axis powers. AWPD-1 would subsequently provide the blueprint in which US airpower was deployed throughout the war in Europe and Pacific,[101] and was further developed and expanded into AWPD-42 to include one hundred and seventy-seven targets within six target systems.[102] Specific to the European theatre, German aircraft production facilities were accorded with "overriding" priority, because air planners assumed that destruction of these facilities would simultaneously lead to the destruction of the *Luftwaffe.*[103] Other "critical" targets identified include German submarine pens, and industrial manufacturing plants such as ball-bearing and steel factories.[104]

Although there were considerable pressures to retaliate against Japan in the wake of the Pearl Harbour attack, the grand strategy of staging a "strategic offensive" against Germany while maintaining a "strategic defensive" in the Far East was agreed upon and adopted by the Allies.[105] In line with this grand strategy, a Combined Bomber Offensive (CBO) involving the Army Air Forces (AAF),[106] and the Royal Air Force (RAF) was

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[100] With Russia's imminent collapse looming in July 1941, President Roosevelt asked the United States Joint Chiefs of Staff for a force capability estimate and a contingency plan to defeat the Axis powers. This was initiated with the larger aim of organizing and harnessing America's industrial capabilities for war. This was known as the Victory Program. *Ibid.*, 30-31.

[101] Stephen L. McFarland and Wesley Philips Newton, "The American Strategic Air Offensive Against Germany in World War II," in *Case Studies in Strategic Bombardment*, edited by R. Cargill Hall (Washington D.C.: United States Government Printing Office, 1998), 184.

[102] Haywood S. Hansell, *The Strategic Air War Against Germany and Japan: A Memoir* (Washington D.C.: Office of the Air Force History, 1986), 57-60.

[103] *Ibid.*, 57-60.

[104] United States, United States Strategic Bombing Survey, *United States Strategic Bombing Survey Summary Report (European War)* (Washington D.C.: Government Printing Office, 1945), 5, 10-11.

[105] Haywood S. Hansell, *The Strategic Air War Against Germany and Japan: A Memoir* (Washington D.C.: Office of the Air Force History, 1986), 43, 135-136.

developed to "… weaken Germany sufficiently to permit initiation of final, combined operations on the Continent."[107]

To achieve this desired outcome, the CBO envisaged a plan that would simultaneously destroy Germany's industrial capability to sustain the war while collapsing the will of its people in supporting the political aims of the Nazi regime. Thus, it was decided that the AAF would focus on day precision bombing against selected German industrial-economic targets along the lines of APWD-42, with the RAF conducting night area bombing of large German industrial cities.[108] By sustaining large scale bombing operations against Germany's "critical points" by day and by night, the CBO would give Germany no respite and "fatally weaken" its war machinery and psychological will to resist.[109] Although it could be argued that the desired outcome was ultimately achieved in the end, it was nevertheless not a swift and decisive victory that is congruent with an effects-based approach.[110] The CBO ultimately became as attrition orientated as any campaign in World War I. This observation, however, does not necessarily imply that there is an inherent flaw in effects-based thinking. Rather, the lessons learned from the strategic air offensive against Nazi Germany would serve to

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[106] The Army Air Corps became an "autonomous" command after the Japanese attack on Pearl Harbour and was re-designated as the Army Air Forces (AAF) vide *Circular 59: War Department Reorganization*. See Walter J. Boyne, *Beyond the Wild Blue: A History of the U.S. Air Force* (New York: St. Martin's Griffin, 1997), 22.

[107] Stephen L. McFarland and Wesley Philips Newton, "The American Strategic Air Offensive Against Germany in World War II," in *Case Studies in Strategic Bombardment*, edited by R. Cargill Hall (Washington D.C.: United States Government Printing Office, 1998), 192.

[108] Haywood S. Hansell, *The Strategic Air War Against Germany and Japan: A Memoir* (Washington D.C.: Office of the Air Force History, 1986), 69-73.

[109] *Ibid*., 69-73.

[110] *Ibid*., 260.

amplify the challenges of conducting EBO type operations without a "structural knowledge" of the enemy. In addition, it demonstrates that the efficacy promised by an effects-based approach would be limited by the delivery means available.

For instance, even though ACTS planners had instituted the Air Estimate process to strengthen the prescription of airpower vis-à-vis the desired outcome to be accomplished,[111] and had explicitly recognised intelligence and analysis as the *sine qua non* of strategic air warfare,[112] they were to be constrained by the quality of information they could obtain on the German economy. Consequently, vital targets that would have dealt a decisive blow to the German war effort were not identified upfront and attacked with priority. These targets include tetraethyl lead manufacturing facilities that produced fuel additives for the *Luftwaffe*,[113] as well as a handful of grinding-wheel factories, which produced abrasives essential for armament production.[114] Additionally, in lieu of credible information, air planners resorted to "mirror-imaging" and hedged their calculations and assessments based on their own personal experiences or empirical knowledge.[115] This practice of "mirror-imaging" would lead to at least two strategic miscalculations.

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[111] *Ibid*., 15-16.

[112] *Ibid*., 22.

[113] Philip S. Meilinger, "Air Warfare An Historical Perspective," In *Effects Based Warfare,* edited by Christopher Finn (London: The Stationery Office, 2002), 63.

[114] Haywood S. Hansell, *The Strategic Air War Against Germany and Japan: A Memoir* (Washington D.C.: Office of the Air Force History, 1986), 130.

[115] Stephen L. McFarland and Wesley Philips Newton, "The American Strategic Air Offensive Against Germany in World War II," in *Case Studies in Strategic Bombardment*, edited by R. Cargill Hall (Washington D.C.: United States Government Printing Office, 1998), 192.

Firstly, air planners wrongly assumed that the German economy was already fully mobilized like those of the Allies.[116] Thus, this perpetuated a belief that German industrial-economic system was susceptible to strategic interdiction. Consequently, air planners underestimated the amount of time and resources required to collapse the German economy, which in many respects was still operating under its full capacity when the Allies commenced their strategic air offensive in 1943.[117] As a result, the CBO degenerated into a protracted and attritionist contest of air superiority with the *Luftwaffe* over the skies of Germany, rather than dealing a decisive blow to Germany's war sustaining capability. In connection with this point, it should be highlighted that air planners had also erred in believing that the bomber would always penetrate German air defences with minimal losses and that destruction of German aircraft production facilities would indirectly incapacitate the *Luftwaffe*.[118] It was not until the arrival of the long-range escort fighters that the *Luftwaffe* was decisively defeated and bomber attrition decreased significantly to permit bombing en-masse.[119]

Fortuitously, the Allies were able to mobilize their economies much faster to maintain pressure on Germany's industrial-economic system, progressively bringing about its culmination in 1944.[120] It was only after this point was reached that the CBO

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[116] Philip S. Meilinger, "Air Warfare An Historical Perspective," In *Effects Based Warfare,* edited by Christopher Finn (London: The Stationery Office, 2002), 58.

[117] United States, United States Strategic Bombing Survey, *United States Strategic Bombing Survey Summary Report (European War)* (Washington D.C.: Government Printing Office, 1945), 2.

[118] Haywood S. Hansell, *The Strategic Air War Against Germany and Japan: A Memoir* (Washington D.C.: Office of the Air Force History, 1986), 10, 58-59.

[119] Stephen L. McFarland and Wesley Philips Newton, "The American Strategic Air Offensive Against Germany in World War II," in *Case Studies in Strategic Bombardment*, edited by R. Cargill Hall (Washington D.C.: United States Government Printing Office, 1998), 210-213.

truly begun to deliver decisive results.[121] Nevertheless, earlier air bombardment

operations had been catalytic in achieving this outcome, for it forced the Germans to

disperse their key industries (such as aircraft and raw materials) and accept lower

production yields due to diseconomies of scale and frequent disruptions in the German

transportation system.[122] Besides, the RAF's night area bombing against German cities

also affected the morale of German factory workers and lowered their productivity.[123]

However, although civilian morale was affected by bombing, it did not galvanize

widespread political dissatisfaction nor dent the will of the Nazi party, after all, the

oppressed German people lacked the will and the means necessary to effect swift political

change.[124]

By mirror imaging, air planners also made the second strategic miscalculation of

assigning wrong priorities to targets. Among some of the more glaring mistakes was the

omission of German electrical power system from the prioritised target list, as it was

deemed by analysts to be beyond the Allied air bombardment capability.[125] This was

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[120] Arthur W. Tedder, *Air Power in War* (London: St. Paul's House, 1948), 104; and Stephen L. McFarland and Wesley Philips Newton, "The American Strategic Air Offensive Against Germany in World War II," in *Case Studies in Strategic Bombardment*, edited by R. Cargill Hall (Washington D.C.: United States Government Printing Office, 1998), 238.

[121] Haywood S. Hansell, *The Strategic Air War Against Germany and Japan: A Memoir* (Washington D.C.: Office of the Air Force History, 1986), 119-130.

[122] Stephen L. McFarland and Wesley Philips Newton, "The American Strategic Air Offensive Against Germany in World War II," in *Case Studies in Strategic Bombardment*, edited by R. Cargill Hall (Washington D.C.: United States Government Printing Office, 1998), 195.

[123] W.A. Jacobs, "The British Strategic Air Offensive Against Germany in World War II," in *Case Studies in Strategic Bombardment*, edited by R. Cargill Hall (Washington D.C.: United States Government Printing Office, 1998), 156.

[124] United States, United States Strategic Bombing Survey, *United States Strategic Bombing Survey Summary Report (European War)* (Washington D.C.: Government Printing Office, 1945), 4.

premised on the assumption that the German electrical distribution grid was as robust as the US system, and built with excess capacity in mind.[126] In a similar fashion, air planners also did not accord a higher priority to the destruction of German oil refineries, which had been modified to produce rubber and other chemical products.[127] Air planners had simply assumed that German refineries were similar in construction to Allied refineries, when destruction of these plants would have sent ripple effects throughout the German industrial-economic system and affect explosives production as well, besides gasoline.[128]

Other than possessing a limited "structural knowledge" of Germany's industrial-economic system and narrow understanding on the German social-political fabric, air planners were also frustrated by the lack of intelligence means required to conduct Battle Damage Assessment (BDA). Although the Allies possessed ULTRA and could intercept top-level German military communications, information provided by ULTRA yielded little information on the impact of the CBO on German military operations.[129] The only means for BDA then was through the use of a photointerpreter (PI), which could only provide an exterior photo-image of bombed structures.[130] As a result, air planners

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[125] Haywood S. Hansell, *The Strategic Air War Against Germany and Japan: A Memoir* (Washington D.C.: Office of the Air Force History, 1986), 131-132.

[126] Edward Mann and Gary Endersby and Tom R. Searle, *Thinking Effects: Effects-Based Mythology for Joint Operations* (Maxwell Air Force Base: Air University Press: October 2002), 19.

[127] Philip S. Meilinger, "Air Warfare An Historical Perspective," In *Effects Based Warfare,* edited by Christopher Finn (London: The Stationery Office, 2002), 63.

[128] *Ibid*., 63.

[129] Stephen L. McFarland and Wesley Philips Newton, "The American Strategic Air Offensive Against Germany in World War II," in *Case Studies in Strategic Bombardment*, edited by R. Cargill Hall (Washington D.C.: United States Government Printing Office, 1998), 192-193.

assessed the effects achieved on targets by extrapolating from the percentage of roof destroyed, rather than the actual damage inflicted to the machinery and equipment stowed below.[131]

This deficiency in BDA further compounded the challenges of maintaining an accurate "structural picture" of Germany's industrial-economic system, and inhibited the initiative of air planers in making re-attack recommendations. Consequently, target attack priorities tended to shift according to the "gut" feel of commanders or to meet pressing operational imperatives.[132] For instance, even though General Eisenhower conceded that the destruction of German oil production facilities would elicit a catastrophic collapse in Germany's war-machinery, he nevertheless decided that the destruction of the German rail system should be accorded with higher priority, as this would achieve the more timely effect of isolating the Normandy beaches from German reinforcements and better support Operation OVERLORD.[133] Fortunately, the Fifteenth Air Force continued the attacks against German's oil production facilities from its bases in the Mediterranean, and obliged the *Luftwaffe* in diverting its units to defend the remaining oil plants in Germany, instead of opposing the Allied operations at Normandy.[134]

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[130] Edward Mann and Gary Endersby and Tom R. Searle, *Thinking Effects: Effects-Based Mythology for Joint Operations* (Maxwell Air Force Base: Air University Press: October 2002), 19.

[131] *Ibid*., 19.

[132] Philip S. Meilinger, "Air Warfare An Historical Perspective," In *Effects Based Warfare,* edited by Christopher Finn (London: The Stationery Office, 2002), 62-63.

[133] Stephen L. McFarland and Wesley Philips Newton, "The American Strategic Air Offensive Against Germany in World War II," in *Case Studies in Strategic Bombardment*, edited by R. Cargill Hall (Washington D.C.: United States Government Printing Office, 1998), 222-223.

[134] *Ibid*., 226.

Apart from the practical difficulties associated with conducting BDA, the effects air planners could potentially bring to bear on targets were also constrained by the delivery means available. Despite the use of "state of the art" Norden bombing sights, air-delivered bombs still lacked accuracy, with its performance adversely affected by clouds and weather. Only about 20% of all bombs hit within 1,000 feet of their aiming points.[135] Furthermore, aircraft-mounted target locating radars (such as the H2X and H2S) also lacked the resolution required to support the precision bombing doctrine practiced by the AAF.[136] Even if the bombs did hit their intended targets, they were also insufficiently powered to penetrate hardened German factory roofs and cause appreciable damage to the machinery below.[137] As delay fuses had not been used, most bombs in fact detonated on contact with the roofs! To m

à-vis their relative contribution to the desired outcome of paralysing Germany's industrial-economic system and collapsing the will of its people. Nevertheless, even though a planning process was established, planners were constrained by an inability to gain and maintain a "structural knowledge" of Germany's industrial-economic system, and the lack of delivery means capable of achieving the desired terminal effects on targets. These observations would subsequently recur during the war in the Pacific, when the US turned its full attention towards imperial Japan after the defeat of Hitler in early 1945.

The War Against Imperial Japan

The Allies approved the initial grand strategy for the war in the Pacific during the Cairo Conference in December 1943. In many ways, this strategy was firmly grounded in the tenets of EBO, notwithstanding that its substance was similar to that employed in Europe. Galvanized in part by an American desire to avoid a costly invasion of Japan, and the hope that its newly commissioned B-29 Superfortress would prove its mettle in paralysing the Japanese industrial-economic system from offshore bases,[139] the initial Allied Pacific strategy accorded top priority on the use of strategic air bombardment and naval blockade to progressively steer Japan onto the path of capitulation by "weakening" its capability and will to sustain the war.[140] A land invasion of the Japanese home islands

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[139] Alvin D. Cox, "Strategic Bombing in the Pacific 1942-1945," in *Case Studies in Strategic Bombardment*, edited by R. Cargill Hall (Washington D.C.: United States Government Printing Office, 1998), 315.

[140] *Ibid.*, 138-141.

would be considered, only if an intensive air bombardment and naval blockade by themselves could not bring about the strategic defeat of Japan.[141]

Nevertheless, behind this veil of rhetoric, a land offensive of mainland Japan homeland had always been regarded as the *sine qua non* of achieving victory by the US Joint Chiefs of Staff (JCS).[142] Thus, the initial grand strategy established by the Cairo Conference was subsequently "refined" by the US JCS, giving preference to a land invasion, with air and naval power playing critical supporting roles.[143] The shift in grand strategy however did not prevent air planners from applying effects-based thinking. Since the achievement of air superiority would be critical to support a land offensive, besides being an enabler of strategic bombardment operations, airmen reasoned that they should accord top priority towards the destruction of the Imperial Japanese Army Air Force (IJAAF) "sources" of power. [144] Thus, as was for the case in Europe, destruction of the Japanese aircraft industry was designated as an "objective with overriding priority." [145] Steel, iron, oil, shipping and large-industrial cities were also identified as "profitable" targets.

Besides adopting an effects-based approach within the confines of air operations, airmen also extended its application to a joint operation with the US Navy in March 1945 during Operation STARVATION, the blockading of key Japanese commercial ports.

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[141] Haywood S. Hansell, *The Strategic Air War Against Germany and Japan: A Memoir* (Washington D.C.: Office of the Air Force History, 1986), 141.

[142] *Ibid.*, 264.

[143] *Ibid.*, 219.

[144] *Ibid.*, 216-220.

[145] *Ibid.*, 147, 220.

The desired outcome of STARVATION was to "choke" the flow of raw materials streaming into Japan from China via the Sea of Japan, as well as to impede the movement of supplies to Japanese forces distributed across its home islands.[146] The AAF achieved this objective not by destruction of Japanese port infrastructure or interdicting maritime vessels, but indirectly, and notably more effectively by laying mines using radar at night. Even though the doctrine and equipment required for night aerial mine-laying were not developed then, airmen improvised and adapted to get the job done.[147] The mines deployed by the AAF constituted only about 5% of all sorties flown in the Pacific theatre, but accounted for an astounding two-thirds of all Japanese maritime vessels damaged during the war.[148]

The wider implementation of effects-based type operations in the Pacific was however plagued by the same problems experienced in Europe: the inability to gain and maintain a "structural knowledge" of the enemy, and the lack of delivery means capable of achieving the desired terminal effects on targets. Without an accurate "structural picture" of the Japanese industrial-economic system, target priorities and choices were driven more by the "gut" of commanders and the need to demonstrate "visible" results.[149] For instance, even though analysts had previously identified Japanese steel and iron

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[146] Alvin D. Cox, "Strategic Bombing in the Pacific 1942-1945," in *Case Studies in Strategic Bombardment*, edited by R. Cargill Hall (Washington D.C.: United States Government Printing Office, 1998), 344.

[147] Wesley F. Craven and James L. Cate, editors, *The Army Air Forces in World War II: Volume 5. The Pacific: Matterhorn to Nagasaki, June 1944 to August 1945* (Chicago, University of Chicago Press, 1948-1958), 665.

[148] *Ibid.*, 344.

[149] Curtis LeMay and MacKinlay Kantor, *Mission with LeMay: My Story* (Garden City, New York: Doubleday, 1965), 347; and Haywood S. Hansell, *The Strategic Air War Against Germany and Japan: A Memoir* (Washington D.C.: Office of the Air Force History, 1986), 217.

factories as "uniquely vulnerable," they would subsequently accord higher priority to the destruction of large industrial urban areas, asserting that residential homes were being used by Japanese clans to manufacture components, as part of Japan's larger "feeder system" of decentralised production.[150]

However, postwar analysis would subsequently affirm that the Japan's reliance on its traditional feeder system had decreased significantly by 1944, in tandem with the dispersal of its key industries away from urban centres to the rural countryside.[151] Thus, one could argue that the targeting of large factories would potentially achieve a greater impact in disrupting Japan's industrial-economic system, compared to the destruction of its dwindling feeder-home industry.[152]

In another example of how the lack of "structural knowledge" had led to the wrong choice of targets, postwar analysis also highlighted that the early bombing of the overstretched Japanese railroads would have greatly expedited Japan's collapse by cutting off supplies of food and coal to its factories and population.[153] Devoid of such knowledge, air planners were not able to dynamically recalibrate their plans but adopted a more cautious approach of sustaining bombardment operations against Japanese cities, and conducting precision bombing against factories when the weather permitted. Exacerbating the situation was the tendency by analysts to select targets based on the

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[150] Haywood S. Hansell, *The Strategic Air War Against Germany and Japan: A Memoir* (Washington D.C.: Office of the Air Force History, 1986), 142-143, 219.

[151] Michael S. Sherry, *The Rise of American Air Power: The Creation of Armageddon* (New York: Yale University Press, 1987), 285-286.

[152] *Ibid*., 286.

[153] United States, United States Strategic Bombing Survey, *United States Strategic Bombing Survey Summary Report (Pacific War)* (Washington D.C.: Government Printing Office, 1946), 19.

probability of them being successfully prosecuted. For instance, after the successful night incendiary attacks against Japan during March 1945, target analysts concluded that there were no "strategic bottlenecks in the Japanese industrial and economic systems except aircraft engine plants, but that the enemy's industry as a whole was vulnerable through incendiary attacks."[154]

In this regard, the inability to identify critical "choke points" in Japan's industrial-economic system, coupled with the technical limitations of the Superfortress could have prompted the AAF to abandon its doctrine of precision bombing in favour of indiscriminate area incendiary bombing. The B-29 lacked range. It was not until the Mariana Islands were secured that the AAF (or more specifically the Twenty-First Bomber Command) could establish a forward operating base to mass their attacks and seriously threaten Japan's industrial heartlands. Furthermore, the B-29 also lacked the equipment required to conduct precision bombing. The aircraft was after all built to operate in the European theatre and not designed for the Pacific environment.[155] Consequently, high altitude "jet streams" greatly decreased its bombing accuracy even with the use of radar, and cloud cover over Japan greatly limited the bomb delivery rates that could be achieved.[156] To circumvent the technical limitations imposed by equipment, area incendiary bombing thus became a viable alternative, especially when

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[154] Wesley F. Craven and James L. Cate, editors, *The Army Air Forces in World War II*: *Volume 5. The Pacific: Matterhorn to Nagasaki, June 1944 to August 1945* (Chicago, University of Chicago Press, 1948-1958), 624.

[155] Alvin D. Cox, "Strategic Bombing in the Pacific 1942-1945," in *Case Studies in Strategic Bombardment*, edited by R. Cargill Hall (Washington D.C.: United States Government Printing Office, 1998), 266.

[156] Curtis LeMay and MacKinlay Kantor, *Mission with LeMay: My Story* (Garden City, New York: Doubleday, 1965), 342-345.

Japanese industrial cities were uniquely vulnerable to an incendiary attack due to the "wooden" nature of their construction.[157]

Nevertheless, from an effects point of view, the use of incendiaries did indeed achieve the desired strategic outcome of compelling Japan's surrender by crushing the collective will of its people.[158] The scope, scale and intensity of the damage caused directly by the fire raids wielded a more powerful indirect psychological effect: that is to cause shock, inflict fear and instill a sense of helplessness in the minds of the general Japanese populace. Unlike Germany, where Allied strategic bombing had failed to extinguish the will of the Nazi regime, the fire raids against Japan succeeded in strengthening Emperor Hirohito's resolve to confront his military hawks and bring the war to a swift conclusion.[159] The dropping of the two atomic bombs on Hiroshima and Nagasaki subsequently precipitated the unconditional surrender of Japan, and averted a potentially costly invasion of its home islands.[160]

The same problems that have constrained the application of EBO in the European theatre thus re-manifested themselves in the war against imperial Japan. Analysts did not possess an adequate "structural knowledge" of Japan's industrial-economic structure and

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[157] Haywood S. Hansell, *The Strategic Air War Against Germany and Japan: A Memoir* (Washington D.C.: Office of the Air Force History, 1986), 177; and Curtis LeMay and MacKinlay Kantor, *Mission with LeMay: My Story* (Garden City, New York: Doubleday, 1965), 351.

[158] Curtis LeMay and MacKinlay Kantor, *Mission with LeMay: My Story* (Garden City, New York: Doubleday, 1965), 369.

[159] Alvin D. Cox, "Strategic Bombing in the Pacific 1942-1945," in *Case Studies in Strategic Bombardment*, edited by R. Cargill Hall (Washington D.C.: United States Government Printing Office, 1998), 321.

[160] For a discussion on the role of the atomic bombs as part of the strategic air war against Japan, see United States, United States Strategic Bombing Survey, *United States Strategic Bombing Survey Summary Report (Pacific War)* (Washington D.C.: Government Printing Office, 1946), 25-26; and Alvin D. Cox, "Strategic Bombing in the Pacific 1942-1945," in *Case Studies in Strategic Bombardment*, edited by R. Cargill Hall (Washington D.C.: United States Government Printing Office, 1998), 362-365.

assigned wrong attack priorities to targets. Airmen also did not possess the right tools to conduct EBO. As a result, they relied on the indirect effects of area incendiary bombing and the power of the atom to "smash" the will of the Japanese people. Although the strategic outcome of avoiding a costly invasion of the Japan home islands had been achieved, this was nevertheless bought at the price of causing widespread human suffering and devastation, some arguably unwarranted.[161] The scale of humanitarian suffering and the massive cost of rebuilding not only rekindled the innate American stigma against the indiscriminate targeting of civilians, but also sparked a concerted effort by the international community at large to regulate the use of force in the future.[162] Thereafter, the tension between limiting collateral damage and the desire in leveraging the destructive power of nuclear weapons to serve political ends would profoundly shape the substance of effects-based thinking in the decades that follow.

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[161] Alvin D. Cox, "Strategic Bombing in the Pacific 1942-1945," in *Case Studies in Strategic Bombardment*, edited by R. Cargill Hall (Washington D.C.: United States Government Printing Office, 1998), 363.

[162] This led to the creation of the United Nations in 1945 followed by the adoption of the four Geneva Conventions in 1949 and the Additional Protocols in 1977.

THE RENAISSANCE

> And it should be considered that there is nothing more difficult to handle, more doubtful of success, nor more dangerous to manage, than to put oneself at the head of introducing new orders. For the introducer has all those who benefit from the old orders as enemies, and he has lukewarm defenders in all those who might benefit from the new orders.[163]

As the destructive power wielded by the atomic bomb became clearer in the aftermath of Hiroshima and Nagasaki, the free world led by the US began a concerted effort to control the proliferation of nuclear technology in the hope that it could be purposely channelled to serve the needs of the human race, rather than to annihilate it.[164] Nevertheless, in the power vacuum left behind by the defeated Axis powers, the Soviet Union began to draw an *Iron Curtain* across the face of Europe, demarcating the world into the East, and the West. Starting from the assimilation of Czechoslovakia and the Berlin Blockade in 1948, the *Red Menace* would gradually assert its power as a counter balance to the US, culminating in the explosion of its own nuclear test device in 1949,[165] thus heralding the start of the nuclear arms race between the two superpowers and the epoch of the Cold War.

With its nuclear monopoly steadily eroded by the Soviet Union, the US strategic options in leveraging its nuclear arsenal to compensate for the West's conventional

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[163] Niccholò Machiavelli, *The Prince*, translated by Harvey C. Mansfield Jr. (Chicago: University of Chicago Press, 1985), 23.

[164] Michael O. Wheeler, *Nuclear Weapons and the National Interests: The Early Years* (Washington D.C.: National Defense University Press, 1989), 25-47.

[165] William E. Odom, "The Soviet Approach to Nuclear Weapons: A Historical Review," *Annals of the American Political and Social Science*, vol. 469, Nuclear Armament and Disarmament (September 1983): 121.

deficiency vis-à-vis the Warsaw Pact would become increasingly tenuous.[166] In an age

of nuclear aplenty, this had the effect of locking both superpowers in a paradigm of

"mutual vulnerability", where neither side could decisively disarm its opponent's

retaliatory capability in a first blow without risking the dire consequences of a second

strike.[167] The inherent tension between the desire to leverage nuclear weapons as rational

instruments of policy, and the need to avert national suicide at the same time would

underpin the conundrums and nuances of formulating an expedient US nuclear strategy

that could act as an effective bulwark against the Soviet Union and its surrogates.[168]

While nuclear weapons had always writ large in the strategic calculations of the

US and the Soviet Union, paradoxically, the rapid build up of nuclear arsenal on both

sides served to limit the nature and scale of conflicts between the two superpowers

instead.[169] Although an all-out war between the East and West always remained a

distinct possibility, the prospect of a total war reminiscent of the two World Wars had

become too "painful" and deemed irrational, since the unrestricted use of thermonuclear

nuclear weapons would result in unprecedented levels of devastation.[170] As such, under

the geo-political dynamics of a nuclear stalemate and the shadow of a potential nuclear

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[166] Lawrence Freedman, "The First Two Generations of Nuclear Strategists." In *Makers of Modern Strategy: From Machiavelli to the Nuclear Age*, edited by Peter Paret (Princeton New Jersey: Princeton University Press, 1986), 770-772.

[167] Robert Jervis, *The Meaning of the Nuclear Revolution: Statecraft and the Prospect of Armageddon* (Ithaca: Cornell University Press, 1989), 5.

[168] Lawrence Freedman, *The Evolution of Nuclear Strategy: Third Edition* (New York: Palgrave Macmillan, 2003), 42. Refer also to Sections 5 to 8 for a full account on the evolution of US nuclear strategic thinking from a policy of "Massive Retaliation" in the 1950s to a strategy of "Countervailing" in the 1980s.

[169] Robert Jervis, *The Meaning of the Nuclear Revolution: Statecraft and the Prospect of Armageddon* (Ithaca: Cornell University Press, 1989), 23-28.

[170] *Ibid*., 4-5.

showdown in central Europe, it was perhaps inevitable that the phenomenon of localized

proxy wars, spurred by "premeditated communist aggression" would gradually

emerge.[171]

Thus, if one could distill the impact of nuclear weapons on the global geo-

political security environment, it had made total war a less useful "tool of statecraft" and

too blunt an instrument in the conduct of international relations and settling of

disputes.[172] In its place, conflicts in the nuclear age tended to be limited in nature, both

in terms of the political objectives sought, and the geographical areas in which they were

fought.[173] As a result, past systems and structures, which were primarily geared towards

a total war, became increasingly incongruent with the strategic realities of the nuclear

age.[174] The impact of nuclear weapons on strategic thinking was more profound, for it

had made the prospect of a total war unthinkable on one hand, and had "force[d] us to

realize how total the art of strategy must be and how powerful is the influence exerted by

the various factors"[175] on the other.

Regrettably, effects-based thinking did not keep pace with the demands of the

evolving geo-political security context. The planning process that was employed by

airmen to conduct strategic bombardment during World War II remained rooted within

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[171] A. J. Bacevich, *The Pentomic Era: The US Army Between Korea and Vietnam* (Washington D.C.: National Defense University Press, 1986) 43-44.

[172] Robert Jervis, *The Meaning of the Nuclear Revolution: Statecraft and the Prospect of Armageddon* (Ithaca: Cornell University Press, 1989), 8.

[173] Lawrence Freedman, *The Evolution of Nuclear Strategy: Third Edition* (New York: Palgrave Macmillan, 2003), 91.

[174] Robert Jervis, *The Meaning of the Nuclear Revolution: Statecraft and the Prospect of Armageddon* (Ithaca: Cornell University Press, 1989), 8.

[175] André Beaufre referred these as "psychological, financial and economic" factors. See André Beaufre, *An Introduction to Strategy*, translated by R.H. Barry (London: Faber and Faber, 1965), 99.

the realm of a total war, and was further developed by the US Strategic Air Command (SAC) to crystallize its nuclear strike plans against the Soviet Union.[176] Too narrowly focussed on the prescription of airpower, it thus lacked the breadth in perspective required to integrate diplomacy, military actions and other elements of national power essential to achieve a limited victory in a bipolar world.

In this regard, the lessons from the proxy wars in Korea and Vietnam would serve to highlight the failure in elevating effects-based thinking from the operational realm of strategic bombardment to evolve a commensurate planning process that could better deal with limited, but arguably more complex proxy contingencies. In particular, for the case of Korea, the lack of synchronization between coercive nuclear diplomacy at the strategic level and military actions at the operational level fractured America's strategy to compel the Chinese and North Koreans to an early negotiated settlement. In Vietnam, an inadequate structural knowledge of the enemy would first lead the US to prescribe a wrong strategy to stop Hanoi's sponsored insurgency operations in the South. Thereafter, the lack of an all encompassing approach led to the US failure in accounting for national will as part of its wider campaign in Vietnam, culminating in the strategic defeat of the US military. Nonetheless, the foundation to realise EBO would be established in the post-Vietnam era, where the confluence of operational experiences and the threat posed by the Warsaw Pact led to a broad-based intellectual ferment, sparking a renaissance within the US military, the precursor of the RMA as we know of today.[177]

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[176] David Alan Rosenberg, "The Origins of Overkill: Nuclear Weapons and American Strategy," *International Security*, vol. 7, no. 4 (Spring 1983): 14-21.

[177] Williams A. Owens, "The Once and Future Revolution in Military Affairs," *Joint Force Quarterly*, Summer 2002, 55-56.

The Korean War

When the proxy war on the Korean peninsula broke out in on 25 June 1950, the US under the aegis of the United Nations quickly reinforced the South Korean Army in a bid to restore the pre-war boundary at the Thirty-eighth Parallel. Using the same air estimate process and target selection methodology that was developed during World War II, air planners rapidly devised a "strategic air offensive" aimed at interdicting North Korea's industrial capabilities and lines of communications.[178] In order to keep the conflict limited and not provoke intervention from the communist states of China and Russia, air bombardment operations were strictly confined within the geographical boundaries of North Korea.[179] While UN forces were able to capitalize on the success of the strategic air offensive and captured Pyongyang in less than four months, the situation took a turn for the worse when China entered the war and reinforced the North Koreans. Thereafter, the war degenerated into a three-year stalemate ground battle, with each side attempting to consolidate territorial gains before entering into armistice negotiations.[180]

The timely intervention by the Chinese in no doubt marked a critical turning point in the conflict. At the strategic level, it compelled US policy makers to adopt an even more cautious approach to avoid widening the war and triggering a nuclear confrontation

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[178] Thomas C. Hone, "Strategic Bombardment Constrained: Korea and Vietnam," in *Case Studies in Strategic Bombardment*, edited by R. Cargill Hall (Washington D.C.: United States Government Printing Office, 1998), 475-476.

[179] *Ibid*., 474.

[180] Robert A. Pape, *Bombing to Win: Air Power and Coercion in War* (New York: Cornell University Press, 1996), 137-139.

with the Soviet Union in Europe.[181]   At the operational level, it also greatly compounded

the challenges of interdicting North Korean lines of communications, as attacks against

targets on Chinese soil, across the Yalu River were strictly prohibited by the US JCS.[182]

Although air planners attempted to apply effects-based thinking in the conduct of the

strategic air offensive, they were to be constrained by higher political considerations and

forbidden from attacking the communists' "true" bases of power across the Yalu.[183]   And

because direct attacks against Chinese targets were prohibited, the need to rely on

diplomacy as the primary means in "neutralizing" China's military influence in the

conflict would become exceptionally critical.   Therefore, the greatest missed opportunity

was perhaps the failure to elevate effects-based thinking from the realm of air

bombardment to the strategic level, where coercive nuclear diplomacy could have been

better synchronized with developments at the operational level so as to compel the

Chinese and North Koreans to agree on an early settlement.

The lack of synchronization between the strategic and operational levels was

apparent in the events that led to the relieve of General Douglas MacArthur as

commander of the UN forces in Korea.   MacArthur obviously viewed the war as total, for

he had insinuated on several occasions that the conflict must be widened beyond the

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[181] Thomas C. Hone, "Strategic Bombardment Constrained: Korea and Vietnam," in *Case Studies in Strategic Bombardment*, edited by R. Cargill Hall (Washington D.C.: United States Government Printing Office, 1998), 474.

[182] Robert A. Pape, *Bombing to Win: Air Power and Coercion in War* (New York: Cornell University Press, 1996), 149-151.

[183] Lawrence Freedman, *The Evolution of Nuclear Strategy: Third Edition* (New York: Palgrave Macmillan, 2003), 80.

frontiers of Korea,[184] and if given the choice, he would use nuclear weapons "to bring China to its knees."[185] MacArthur's views were however diametrically opposed to President Truman's desire of keeping the conflict limited. Truman would relieve MacArthur of command on the grounds of insubordination after the General publicly threatened the Chinese in the press.   Nevertheless, in a confounding move, the President would subsequently upped the ante of coercive diplomacy by sending nine nuclear ores and more B-29s to Guam.[186]

However, by this time, the Chinese were able to call his bluff. By relieving MacArthur, they had detected an internal rift within the senior US leadership and a lack of US resolve in using nuclear weapons.[187] Moreover, Truman had also undermined his own actions by stating in a national address that it would be "wrong, tragically wrong

In contrast, the Eisenhower administration was more apt in using military actions to complement coercive diplomatic efforts against the Chinese and North Koreans. With the death of Stalin in March 1953, Soviet support for the war started to wane.[189] The Eisenhower administration, seizing the opportunity thus began to apply coercive nuclear diplomatic pressure on the Chinese. Firstly, to make its threat credible, the US communicated its intention to use nuclear weapons to the Chinese leadership via four separate diplomatic channels in May 1953.[190] In parallel, a "pattern of escalation in force" was also established on the ground, culminating in the destruction of the dams at Toksan which had previously been off-limits to air bombardment.[191]

To accentuate the escalation pattern and its effects on the communists, contingency plans involving the use of nuclear weapons "on a sufficiently large scale" were also approved.[192] Without the extended nuclear deterrence from the Soviet Union, and noting that America's threats would now be probably backed up by deeds as well, the Chinese and North Koreans finally caved in to the pressure and agreed to an armistice in July 1953. It was through the synchronization of coercive diplomatic pressure and military actions at the strategic and operational levels of war that ultimately achieved the desired effect on the Chinese and North Koreans and secured a political victory for the US.

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[189] Robert A. Pape, *Bombing to Win: Air Power and Coercion in War* (New York: Cornell University Press, 1996), 172.

[190] *Ibid.*, 166.

[191] Thomas C. Hone, "Strategic Bombardment Constrained: Korea and Vietnam," in *Case Studies in Strategic Bombardment*, edited by R. Cargill Hall (Washington D.C.: United States Government Printing Office, 1998), 490.

[192] Robert A. Pape, *Bombing to Win: Air Power and Coercion in War* (New York: Cornell University Press, 1996), 165.

The Sting of Vietnam

Ten years after Korea, the US would find itself in a catch twenty-two situation in Vietnam. Concerned that the civil war in Indochina might be the harbinger of a larger global effort by the communists to challenge the free world, the US lent its support to the government of South Vietnam in the hope that the unrest could be quickly stabilized and the situation returned to normalcy.[193] Haunted by the ghost of Korea, Vietnam was perceived as a proxy war between political ideologies, a conflict which must be kept limited in order not to provoke an intervention by the Chinese and spark a larger nuclear confrontation with the Soviet Union in Europe.[194] As such, the US had only deployed forces necessary to strengthen and ensure the long term viability of its political ally in Saigon, and not to achieve a swift and decisive victory over the communists.[195]

Yet Vietnam was also arguably different from Korea. Although nuclear weapons always writ large in the US strategic calculations, it nevertheless did not resort to the use of coercive nuclear diplomacy as a means of securing a peace settlement.[196] Instead, the US sought to compel the communists to enter into cease-fire negotiations with Saigon by containing its insurgency operations in the South, and by progressively destroying the North Vietnamese industrial-economic capability and will to sustain the war through air

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[193] Henry Kissinger, *White House Years* (Boston, Massachusetts: Brown & Company, 1979), 64.

[194] Harry G. Summers Jr., *On Strategy: The Vietnam War in Context* (Washington D.C.: US Army War College, 1981), 37-38, 55.

[195] *Ibid*., 55-56.

[196] Robert A. Pape, *Bombing to Win: Air Power and Coercion in War* (New York: Cornell University Press, 1996), 174.

interdiction.[197] While effects-based thinking had underpinned the formulation of this grand strategy, unfortunately, the American's limited knowledge of the enemy and the US administration's failure to properly account for national will as part of its campaign would ultimately result in a strategic defeat for the US military.

The US lack of structural knowledge on the North Vietnamese was evident from the air interdiction strategy pursued under the Johnson administration. In their analysis of the adversary, the North Vietnamese were viewed as conventional foes in a total conflict, whose industrial-economic structures and lines of communication were vulnerable to strategic interdiction.[198] Such a mindset was wrong.   Contrary to US expectations, destruction of the North Vietnamese industry base did not gravely hurt the communist regime at Hanoi, since it was only in its embryonic stages of development, and its contribution to Hanoi's war effort was thus limited.[199]   Although civilian morale was affected by the bombing, it was not shaken, since more than ninety percent of the North Vietnamese population resided in rural areas away from urban industrial centres.[200]

Furthermore, the North Vietnamese brand of insurgency operations in the South was also not vulnerable to disruption in lines of communications. The Viet Cong were after all living in a "sea of popular support" and could easily infiltrate supplies via jungle

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[197] *Ibid.*, 174-176.

[198] Robert A. Pape, *Bombing to Win: Air Power and Coercion in War* (New York: Cornell University Press, 1996), 177-181; and Thomas C. Hone, "Strategic Bombardment Constrained: Korea and Vietnam," in *Case Studies in Strategic Bombardment*, edited by R. Cargill Hall (Washington D.C.: United States Government Printing Office, 1998), 503.

[199] Robert A. Pape, *Bombing to Win: Air Power and Coercion in War* (New York: Cornell University Press, 1996), 189.

[200] *Ibid.*, 195.

trails and waterways that were not vulnerable to air attacks.[201] Moreover, the wanton

bombing of Vietnamese villages and destruction of the rural infrastructure by US forces

also tarnished its image adversely, and had the effect of strengthening the indigenous

support for the North while further eroding American public support for the war.[202] The

failure to win "hearts and minds" would subsequently profoundly affect the outcome of

the war.

The shortcomings of the Johnson administration were to be corrected by the

Nixon administration, which employed diplomacy and direct military actions to regain

the strategic initiative. Noting a growing rift between China and the Soviet Union, the

Nixon administration began to isolate the North Vietnamese politically by cultivating its

relations with China and the Soviet Union.[203] Apprehensive that the support from its

sponsors would evaporate in the near future, the North Vietnamese were thus galvanized

to launch large-scale conventional operations in January 1972 in an effort to seize

territory and bring about the rapid collapse of the Saigon government.[204]

In response, the Nixon administration followed up with Operations

LINEBACKER I and II to stop North Vietnamese Army's (NVA) advance by

interdicting its troop concentration areas and lines of communications.[205] Supported by

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[201] *Ibid.*, 192.

[202] Harry G. Summers Jr., *On Strategy: The Vietnam War in Context* (Washington D.C.: US Army War College, 1981), 23.

[203] Thomas C. Hone, "Strategic Bombardment Constrained: Korea and Vietnam," in *Case Studies in Strategic Bombardment*, edited by R. Cargill Hall (Washington D.C.: United States Government Printing Office, 1998), 505-507.

[204] Robert A. Pape, *Bombing to Win: Air Power and Coercion in War* (New York: Cornell University Press, 1996), 195.

[205] *Ibid*., 195.

the latest electronic warfare equipment and equipped with laser guided bombs, LINEBACKER was able to penetrate the NVA's formidable array of air defence systems, and dealt a decisive blow to the NVA's combat capabilities and re-supply system.[206] The North Vietnamese conventional might gradually attenuated under the punishment of US airpower, obliging them to sign the Paris Accords in 1973.

The synchronization of effects at the strategic and operational levels was therefore key to the achievement of Paris.   The Nixon administration had leveraged diplomatic power to compel the North Vietnamese to act in a manner that made them vulnerable to the effects of strategic air interdiction.[207] Nevertheless, the peace was to be short-lived. The Nixon administration failed to account for a key factor in its Vietnam campaign: the will of the American people. Furthermore, Nixon's conduct of the war using secret diplomacy, covert missions, violations of both domestic and international laws,[208] also made national will all the more problematic. After fifteen years of combat, public opinion against America's further involvement in Vietnam finally weighed in, precipitating the withdrawal of US forces and eventual abandonment of Saigon when the NVA violated the Paris agreements in 1975.

Therefore, while the US had always attempted to adopt an effects-based approach to resolve the conflict in Vietnam, it was frustrated first by its lack of structural

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[206] Thomas C. Hone, "Strategic Bombardment Constrained: Korea and Vietnam," in *Case Studies in Strategic Bombardment*, edited by R. Cargill Hall (Washington D.C.: United States Government Printing Office, 1998), 508-512.

[207] Robert A. Pape, *Bombing to Win: Air Power and Coercion in War* (New York: Cornell University Press, 1996), 175-176.

[208] William Shawcross, *Sideshow: Kissinger, Nixon , and the Destruction of Cambodia Revised Edition* (New York: Cooper Square Press, 2002), 19-35.

knowledge on the enemy, and ultimately by the absence of an all encompassing approach that could "integrate" national will, a source of power in its own right, with other elements of national power as part of its "limited" campaign in Vietnam.[209] Although the sting of Vietnam had crushed the morale and confidence of the US military (notably the US Army), yet out of this shattering experience would usher in a period of intellectual innovation and a revitalization of the operational art.[210] Unbeknownst to these pioneers, their efforts would lay the foundation to realise EBO in the future.

Laying the Foundation for EBO

After the debacle in Vietnam, the US Army began a period of "soul-searing self-analysis" to rebuild an organization that had lost its self-confidence and support of the American public at large.[211] Besides disintegrating "into an undisciplined organization without tactical or organizational standards," its perceived effectiveness was to be further eroded in the light that the Warsaw Pact had modernized its conventional forces to pose an even more formidable threat in central Europe.[212] Yet against this gloomy backdrop, the *Yom Kippur* War also ushered in a sense of optimism, consolidating a belief among the US Army leadership that armed with the proper doctrine, training and technology,

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[209] Harry G. Summers Jr., *On Strategy: The Vietnam War in Context* (Washington D.C.: US Army War College, 1981), 7-12.

[210] Richard M. Swain, "Filling the Void: The Operational Art and the U.S. Army," In *The Operational Art: Developments in the Theories of War* (Canada: Praeger Publishers, 1996), 148.

[211] Alvin Toffler and Heidi Toffler, *War and Anti-War: Survival at the Dawn of the 21st Century* (Canada: Little, Brown & Company (Canada) Limited, 1993), 45-55.

[212] Richard M. Swain, "Filling the Void: The Operational Art and the U.S. Army," In *The Operational Art: Developments in the Theories of War* (Canada: Praeger Publishers, 1996), 148.

small forces could still fight outnumbered and win.[213] Faced with these challenges,

change was no longer a given, it had become essential to initiate the reconstruction of the

US Army.[214]

To spearhead the rebuilding process, the US Army Training and Doctrine

Command (TRADOC) was thus established in 1976, and charged with the responsibility

of developing a new doctrine to mould the organization into a modern and effective

fighting force. By increasing training standards, doctrine was perceived as the antidote

that could stem the malaise in morale and bolster professionalism among its personnel.[215]

In its journey to evolve a new doctrine for the US Army, the intellectual renaissance at

TRADOC would lead to two significant developments that percolated effects-based

thinking throughout the organization: the conception of the AirLand Battle and

formalization of the operational art as part of official doctrine.

A concept that was developed from the ground up, AirLand Battle was the US

Army's operational solution against a numerically more superior Warsaw Pact.   Instead

of the traditional focus on the close-in battle along the Forward Line of Own Troops

(FLOT), AirLand Battle conceptualised future engagements as extended in terms of depth

and time, where close co-operation between the Army and the Air Force would be

essential in achieving "unified employment of a wide range of systems and organizations

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[213] Harold R. Winton, "An Ambivalent Partnership: US Army and Air Force Perspectives on Air-Ground Operations, 1973-90," in *The Paths of Heaven: The Evolution of Airpower Theory*, edited by Philip S. Meilinger (Maxwell Air Force Base: Air University Press, 1997), 405-406.

[214] Alvin Toffler and Heidi Toffler, *War and Anti-War: Survival at the Dawn of the 21st Century* (Canada: Little, Brown & Company (Canada) Limited, 1993), 46.

[215] Richard M. Swain, "Filling the Void: The Operational Art and the U.S. Army," In *The Operational Art: Developments in the Theories of War* (Canada: Praeger Publishers, 1996), 149.

in a battlefield."[216] Rooted in effects-based thinking, AirLand Battle aimed to induce

collapse in an enemy's fighting system by interdicting his high value assets and

uncommitted second echelon forces in the depth, while holding a defence line to fix his

forward assault elements simultaneously.[217] By dynamically synchronizing near and far

field effects, commanders could then seek to create windows of opportunities to seize the

operational initiative and bring about the enemy's decisive defeat.[218]

In advancing the new fighting concept as doctrine, AirLand Battle also indirectly

established the planning processes and staff structures necessary to support EBO, albeit at

the operational level of war. For instance, to aid planners in identifying the enemy's set

of critical capabilities, the "target value analysis" (TVA) process was developed and

incorporated as part of operational level planning.[219] To prioritise targets, TVA not only

considers the anticipated enemy's strategy, but also accounts for the possible

permutations in enemy responses to friendly actions.[220]

Moreover, by introducing the taxonomy of neutralize, degrade, delay and disrupt

into official targeting lexicon, AirLand Battle also compelled Army planners to think in

terms of desired outcomes rather than be fixated on the destruction of en enemy. To

strengthen the staff linkages to intelligence agencies and the Air Force, supporting

structures in the form of Targeting Cells were also established from Brigade-level HQs

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[216] Donn A. Starry, "Extending the Battlefield," *Military Review*, January 1997, 2.

[217] *Ibid.,* 3-4, 11.

[218] William R. Richardson, "FM 100-5: The AirLand Battle in 1986," *Military Review*, March 1986, 7.

[219] Allen W. Batschelet, "Effects-Based Operations for Joint Warfighters," The U.S. Army Professional Writing Collection, 3; article online; available from http://www.army.mil/professionalwriting/volumes/volume1/june_2003/6_03_3.html; Internet; accessed 28 January 2005.

[220] *Ibid.,* 4.

upwards.[221]   In terms of the means required to support EBO, AirLand Battle also brought

about the development of the Joint Surveillance and Attack Radar System (J-STARS) and

the Multiple Launch Rocket System (MLRS), greatly bolstering the US military

capability to maintain situational awareness on Iraqi force dispositions and conduct deep

strike operations during the Gulf War.[222]

Nevertheless, the most significant contribution of AirLand Battle to EBO was

perhaps the broad based conversations it had generated within the US Army with regards

to the operational art. In crystallizing the doctrine of AirLand Battle, the US Army

would gradually come to the conclusion that AirLand Battle in itself was a means to an

end.[223] The ensuing debate between doctrine writers and practitioners led to the explicit

definition of the operational art and the operational level of war in the 1986 edition of

Field Manual 100-5 Operations (FM 100-5). With these concepts in place, the

overarching campaign planning framework linking the strategic, operational and tactical

levels of war was thus established. Besides serving as a doctrinal template where

linkages between tactical actions and strategic ends could be established, FM 100-5 also

provided the conduit to stimulate broader inter-service co-operation.[224]   JFCOM would

subsequently leverage the foundation laid by the US Army and elevate EBO as a higher

form of operational art writ large at the strategic level of war.[225]

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[221] Donn A. Starry, "Extending the Battlefield," *Military Review*, January 1997, 13-14.

[222] Alvin Toffler and Heidi Toffler, *War and Anti-War: Survival at the Dawn of the 21st Century* (Canada: Little, Brown & Company (Canada) Limited, 1993), 54.

[223] Richard M. Swain, "Filling the Void: The Operational Art and the U.S. Army," In *The Operational Art: Developments in the Theories of War* (Canada: Praeger Publishers, 1996), 161-164.

[224] *Ibid.*, 166.

To better support the Army's AirLand Battle doctrine, the US Air Force Tactical Air Command (TAC) would subsequently forge a close partnership with TRADOC, culminating in "the development of thirty-one initiatives" between the two services.[226] Nevertheless, armed with its own lessons from Vietnam, the US Air Force leadership began to see technology as the critical enabler to realise the pre-eminent role of airpower envisioned by Douhet and Mitchell.[227] Thus far, airmen had to rely on "mass" and engage in battles of attrition to compensate for the inaccuracy of aerial delivered bombs as well as to mitigate the threat posed by enemy air defence systems.[228] To attack selected points in the enemy's system with mass, speed and precision, the US Air Force embarked on a technological renaissance, advocating the use of stealth aircraft, precision guided munitions (PGMs) and electronic warfare equipment to wage "Parallel Warfare," to enable the "simultaneous application of force (in time, space, and at each level of war) against key systems to effect paralysis on the subject state or organization's ability to function."[229]

An extension of effects-based thinking, parallel warfare essentially seeks to "control" the enemy's system towards achieving one's objective by effecting successive

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[225] United States, United States Joint Force Command, *The Effects Based Operations Process Concept of Operations (CONOPS) Version 0.61 (Draft)* (Norfolk Virginia: Joint Experimentation Directorate, 4 November 2004), 3.

[226] Harold R. Winton, "An Ambivalent Partnership: US Army and Air Force Perspectives on Air-Ground Operations, 1973-90," in *The Paths of Heaven: The Evolution of Airpower Theory*, edited by Philip S. Meilinger (Maxwell Air Force Base: Air University Press, 1997), 415.

[227] Walter J. Boyne, *Beyond the Wild Blue: A History of the U.S. Air Force* (New York: St. Martin's Griffin, 1997), 255-256.

[228] David A. Deptula, "Parallel Warfare" What Is It? Where Did It Come From? Why Is It Important?" In *Eagle in the Desert: Looking Back on U.S. Involvement in the Persian Gulf War,* edited by William Head and Earl H. Tilford, Jr. (United States: Praeger Publishers, 1996), 130.

[229] *Ibid.*, 135.

levels of paralysis, physically and cognitively. Total destruction of the enemy's system was therefore not an end unto itself, if the desired outcome had been achieved.[230] While the high tech means required to conduct parallel warfare were available, the supporting operational processes were ironically only developed and implemented successfully during Operation Desert Storm by a special planning group known as the "Black Hole".[231] Among the analytical tools employed by the black hole planners to gain insights into the enemy's system was the "Five Rings", which identified Iraq's centres of gravity as "Saddam Hussein's government, Iraq's national communications system and its internal security forces."[232]

The contribution of parallel warfare to EBO is significant in at least two respects. Firstly, it enriched the theory of EBO by emphasising the need to apply power in an integrated and iterative manner until the desired "controlling" effects could be observed. This again underscores the paramount requirement to know the enemy, and the need for EBO to be supported by a comprehensive sensor and information network that could ubiquitously collect and analyze all source intelligence. Secondly, parallel warfare also yielded a comprehensive system of capabilities that could impose a variety of effects against selected targets with precision, incisiveness and speed, thus greatly expanding the suite of means to enable EBO in the modern complex operating environment.

Meanwhile, the US Navy kept the Soviet maritime threat in check by adopting a forward defence posture and developed a sophisticated defensive system against the

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[230] *Ibid.*, 146.

[231] *Ibid.*, 141-145.

[232] John A. Warden III, *The Air Campaign* (New York: toExcel, 1998), 146-147.

menace of Soviet anti-ship missiles based on a collaborative engagement architecture.[233] To enhance the survivability of its platforms, ships were distributed in space but designed with the capability to mass effects as a system at a time and place of choosing. To this end, the US Navy devoted considerable investments in the areas of long-range data communications, information-networking systems and sensors. Collectively, these developments would lay the foundation for Network Centric Warfare (NCW), which envisioned that advances in modern information, communication and sensor technologies would enable future forces to fight as a system of systems, and achieve information superiority, shared awareness, adaptability, speed of command and dynamically self-synchronize.[234]

In this regard, it could be argued that NCW directly supports the achievement of EBO. NCW's tenets of information superiority, shared awareness are synonymous with EBO's paramount pre-requisite of knowing the enemy. In addition, like EBO, NCW emphasised the need to dynamically adapt and synchronize friendly actions in response to an enemy's behaviour. Thus, while parallel warfare had provided the engagement means to enable EBO, it could be argued that NCW had provided the conceptual command and control framework to support EBO planning and execution.

The foundation to evolve EBO within the US military was therefore established by the three services, albeit galvanized out of their own unique experiences and in an "uncoordinated" manner. The US Army contributed in terms of intellectual capital,

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[233] Williams A. Owens, "The Once and Future Revolution in Military Affairs," *Joint Force Quarterly*, Summer 2002, 56.

[234] Arthur K. Cebrowski, "Network-Centric Warfare: An emerging Military Response to the Information Age," *Military Technology*, May 2003, 17-19.

establishing the doctrinal framework that linked tactical means to strategic ends, and percolated effects-based thinking to the "lower" levels in the form of AirLand Battle doctrine. The US Air Force collaborated with the US Army to make EBO possible at the operational level of war, and developed the necessary planning tools and means to conduct EBO with greater incisiveness, precision and speed in the modern complex combat environment. In advancing NCW, the US Navy also laid the remaining cornerstone vital to support EBO in the information age: the conceptual command and control framework based on knowledge and collaboration. Nevertheless, despite the key building blocks to achieve EBO being in place prior to the Gulf War, it would subsequently take the fundamental geo-strategic changes brought about by the end of the Cold War to spark the intellectual RMA within the US military, and begin the formal process of codifying EBO.

OPPORTUNITIES AND CHALLENGES

> On the other hand, the less intense the motives [for war], the less will the military element's natural tendency to violence coincide with political directives. As a result, war will be driven further from its natural course, the political object will be more and more at variance with the aim of ideal war, and the conflict will seem increasingly political in character.[235]

By focussing on the desired policy outcome and using all elements of national power to influence an adversary's behaviour towards that end, EBO seeks to provide a more holistic framework to conduct warfare in the information age. Enabled by technological advances in fledging fields of information systems, artificial intelligence, precision strike and sensors, EBO could potentially become a reality in the near future and significantly shape how the military conduct its business in the future. Nevertheless, as in any conceptual construct, the successful implementation of EBO would be contingent on a number of pre-requisites being met.

This section will discuss three of these pre-requisites and address how they might potentially limit EBO's utility in contemporary operations such as coalition warfare and MOOTW. Firstly, the requirement for clarity on the desired end-state to be achieved in order to drive the EBO planning processes, as well as the addendum political will to carry out the plan. Secondly, the need for an intricate knowledge of the operational context that could provide insights on how an enemy's behaviour could be shaped and if adaptation of own actions would be necessary. Thirdly, the existence of "high payoff" nodes or centres of gravity that could be expediently neutralized to yield rapid and decisive victories.

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[235] Carl von Clausewitz, *On War*, edited and translated. Michael Howard and Peter Paret (Princeton: Princeton University Press, 1976), 88.

Clarity and Maintenance of Aim

As EBO employs a top down planning process, it necessitates the desired policy outcome to be identified first, before determining the most expedient way and effective set of means that could best achieve it.[236] Thus, the desired policy end state not only drives the EBO planning process, it also serves as the basis for the selection of ways, means and ends. In this respect, clarity of the policy end state would be quintessential for the successful conduct of EBO. Furthermore, articulation of the policy end state must be explicit enough as to provide sufficient strategic guidance, while not being too prescriptive as to preclude the use of certain instruments of power from the onset and constrain own freedom of action.

Vague and shifting policy objectives could therefore potentially limit the effectiveness of EBO, especially within the context of coalition operations. An examination of NATO's air war in Kosovo, Operation Allied Force (OAF) would aptly illustrate this point. Prior to its intervention in Kosovo, NATO had stated that its political objective for OAF was to ". . . halt the violence and support the completion of negotiations on an interim political solution", adding that it ". . . is ready to take whatever measures necessary" to ensure that the Serbian and [Albanian] Kosovar leadership comply with its demands so that the burgeoning humanitarian crisis could be averted.[237] Yet despite its political rhetoric, the use of ground forces would be ruled out by NATO

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[236] United States, United States Joint Force Command, *The Effects Based Operations Process Concept of Operations (CONOPS) Version 0.61 (Draft)* (Norfolk Virginia: Joint Experimentation Directorate, 4 November 2004), 10-11.

[237] North Atlantic Treaty Organization, *Statement by the North Atlantic Council on Kosovo 30 January 1999*; available from http://www.nato.int/docu/pr/1999/p99-012e.htm; Internet; accessed 20 March 2005.

from the onset.[238] Furthermore, while it stated that it was willing to take whatever measures necessary to halt the violence, NATO would later vacillate between diplomatic posturing and exacting a heavy price on Serbia. As a result, two air campaign plans would subsequently emerge out of this bold but vague policy assertion.

The first air campaign plan was arguably rooted in effects-based thinking. Formulated by Lieutenant-General Mike Short, NATO's Air Component Commander for OAF, it advocated using airpower to strike the "head of the snake" from the onset. This entailed destroying Serbia's centres of gravity (such as electrical grids and key military capabilities) in Belgrade.[239] By exacting a heavy price on Serbia, it was thought that this would immediately halt Serbia's propensity to continue its policy of ethnic cleansing in Kosovo, thereby compelling President Slobodan Milosevic to seek an early political settlement.[240]

The second air campaign devised by NATO planners was arguably more cautious. To allay the humanitarian concerns voiced by some of the Alliance's members such as Germany, Greece, Hungary and Italy, it advocated adopting a graduated and deliberate approach, that was dovetailed with wider ongoing diplomatic initiatives.[241] In the final crunch, the incremental air campaign devised by NATO planners was adopted as it was deemed more acceptable and could better accommodate the disparate nationalistic

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[238] Derek S. Reveron, "Coalition Warfare: The Commander's Role." In *Immaculate Warfare*, edited by Stephen D. Wrage (Westport, Connecticut: Praeger Publishers, 2003), 56.

[239] Don D. Chipman, "General Short and the Politics of Kosovo's Air War," *Air Power History*, Vol. 49, no. 2, (Summer 2002), 32.

[240] Ivo H. Daalder and Michael E. O'Hanlon, *Winning Ugly: Nato's War to Save Kosovo* (Washington D.C.: Brookings Institution Press, 2000), 25.

[241] Derek S. Reveron, "Coalition Warfare: The Commander's Role." In *Immaculate Warfare*, edited by Stephen D. Wrage (Westport, Connecticut: Praeger Publishers, 2003), 53-55.

demands of a splintered NATO.[242] Yet when it failed to produce the desired results, and on the contrary had prompted the Serbs to step up their ethnic cleansing of Albanian Kosovars, NATO would revert to the plan that was proposed by General Short earlier. However, NATO had acted too little too late. Up to 800,000 Albanian Kosovars were forcefully displaced by the Serbs and up to 10,000 murdered when NATO decided to act decisively.[243] Although a negotiated political settlement was ultimately achieved in the end, the very humanitarian crisis that had so absorbed NATO was never averted.

The experiences of OAF showed that vague and shifting policy objectives could potentially limit the effectiveness of EBO, especially in the context of coalition warfare. Fortuitously, General Short was right and NATO had a fall back plan to rely on. One could not assume that this would be the case for future operations. Underscoring the complexity of coalition operations, OAF also brought into focus the need to garner political will and domestic support as pre-requisites to conduct EBO.[244] One must therefore be mindful that expediency of an effects-based approach might need to be balanced against the unique nationalistic agendas of coalition partners. Thus, under such scenarios, what could be most effective might not always be the most acceptable.

Knowing the Enemy

One of the tenets of EBO is that it aims to influence an adversary's behaviour and subject him to our will. As the adversary can adapt in response to both friendly and

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[242] *Ibid*., 51.

[243] Ivo H. Daalder and Michael E. O'Hanlon, *Winning Ugly: Nato's War to Save Kosovo* (Washington D.C.: Brookings Institution Press, 2000), 3.

[244] *Ibid*., 182-192, 204-206.

hostile actions, EBO also stresses the need to maintain a holistic knowledge of the operational context so as to enable dynamic recalibration of follow-on efforts.[245] Such a proposition would at least demand an intimate knowledge of the enemy, in terms of the physical elements that enable his freedom of action, as well as the cognitive elements that motivate and drive his behaviour.[246] To permit adaptation, planners must also have the capability to observe, measure, analyse and assess the impact achieved on an adversary's behaviour after "friendly" power have been judiciously applied on his system. In so doing, the adversary's behaviour vis-à-vis own actions can then be established over time to yield a discernable pattern of sufficient confidence as to warrant a change in own courses of action.

In this regard, the ability to acquire and maintain holistic knowledge of the enemy could potentially be the Achilles heel of EBO. While advances in computing and simulation technologies could permit future adversaries to be modelled as a complex "system-of-systems,"[247] the accuracy of such models and the fidelity they can provide would ultimately be limited by the inputs used. Therefore, to employ such models as the basis for EBO planning, intelligence must be collected during peacetime to yield a set of credible inputs, as well as to facilitate model validation on a continual basis. By constantly uncovering and filling-in intelligence gaps, EBO planners could then avoid the trap of mirror-imaging that had engulfed airmen during World War II.

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[245] United States, United States Joint Force Command, *The Effects Based Operations Process Concept of Operations (CONOPS) Version 0.61 (Draft)* (Norfolk Virginia: Joint Experimentation Directorate, 4 November 2004), 3.

[246] *Ibid.,* 3.

[247] *Ibid*., 6-8.

Nevertheless, such complex simulation models, even when "accurately" constructed based on the most updated inputs would only be useful as a planning tool during operations, after all, one could not assume that the enemy would always behave in a consistent and rational manner.[248] The output from these models must therefore be further corroborated with actual "evidence" collected by intelligence agencies so as to imbue commanders with the confidence that the enemy's behaviour had indeed changed, and a corresponding adjustment to own courses of action would be necessary.[249] As such, the collection and fusion of intelligence for EBO is anticipated to be highly complex. While it would be relatively easy to observe and assess the potential effects of a kinetic attack, extrapolating its impact on the enemy's cognitive system would pose greater challenges. In addition, considerable difficulties would be associated with assessing the effects of non-kinetic attacks, since the impact of such attacks would not normally be directly observable, or could take time to manifest in the enemy's larger cognitive system.

Hence, to know the enemy would not only necessitate a holistic knowledge of the physical and cognitive elements that constitute his system, it also require a ubiquitous intelligence collection and analysis support structure where the effects achieved, both kinetic and non-kinetic could be observed, measured, analysed and assessed in a timely and comprehensive manner. Until the challenges in these areas are resolved, the full potential of EBO would not be unleashed nor its benefits fully harnessed. In this regard,

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[248] Paul K. Davis, *Effects-Based Operations (EBO) : A Grand Challenge for the Analytical Community* (Santa Monica, California: RAND, 2001), 21-18.

[249] Desmond S. Newton and Aaron B. Frank, "Effects-Based Operations: Building the Analytic Tools," *Defense Horizons*, no. 19 (October 2002): 8; Article online: available from http://www.ndu.edu /inss/DefHor/DH19/193-619_DH19.pdf; Internet; accessed 11 November 2004.

the US JFCOM establishment of the Standing Joint Force Headquarters (SJFHQ) to develop a "pre-crisis knowledge base of an adversary's systems and capabilities"[250] is a bold attempt in overcoming these challenges.[251]

Resolving Centres of Gravity

An idea that is closely intertwined with EBO is the concept of "centre of gravity" or "high payoff nodes."[252] According to US JFCOM, such nodes could be identified by performing a holistic analysis of the enemy's PMESII system,[253] vis-à-vis the desired outcome that own forces seek to create in the operational context.[254] A very similar concept was employed during Word War II, where air planners targeted selected "vital centres" in the German industrial-economic system, believing that their destruction would rapidly collapse Germany's ability to sustain the war. During Operation Desert Storm, the concept of "centre of gravity" was similarly applied to the Iraqi Republican Guard. It was thought that by destroying the Republican Guard, Saddam Hussein's power base would be shattered, and this would precipitate his inevitable fall from

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[250] United States Joint Force Command, "JFCOM Empowers Warfighters by setting up Standing Joint Force Headquarters," http://www.jfcom.mil/newslink/storyarchive/2004/pa031104.htm; Internet; accessed 9 April 2005.

[251] United States, United States Joint Force Command, *The Joint Warfighting Centre Joint Doctrine Series Pamphlet 7: Operational Implications of Effects-Based Operations (EBO)* (Suffolk Virginia: J7 Joint Training, 17 November 2004), 3-4.

[252] *Ibid.*, 14.

[253] PMESII refers to Political, Military, Economic, Social, Infrastructure and Information System. *Ibid.*, 31.

[254] *Ibid.,* 12.

power.[255] Consequently, the campaign plan entailed the use of strategic deception to fix the "target" in Kuwait City, while the main effort performed a "left-hook" in an attempt to entrap and effect the destruction of the Republican Guard in the Iraqi desert.

The concept of centre of gravity is a powerful one, as it could serve to focus EBO planning. Nevertheless, it could also inculcate a "silver bullet mentality" that such nodes always exist, and their successful prosecution would always lead to high payoff results relative to the efforts invested.[256] "Critical points" could very well exist in the context of a total war, where every element of an adversary's PMESII system is mobilized and highly interconnected.[257] Hence, disproportionate results could possibly be achieved, since destruction of these critical points could seriously undermine the integrity and overall cohesiveness of the adversary's PMESII system.

However, in limited scenarios such as MOOTW, where political objectives would typically be more narrowly focussed, such "high payoff nodes" might actually be intangible in nature, such as the ideology that unites the members of a terrorist organization, or the hearts and minds of the indigenous population. Furthermore, these "nodes" might not always be directly accessible.[258] To "neutralize" such centres or nodes would demand the application of non-kinetic forms of national power, besides direct military action, and would thus require significant time, effort and resources.

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[255] Mark Cancian, "Centers of Gravity Are A Myth," *U.S. Naval Institute Proceedings*, Vol. 24, no. 9, (September 1998), 31.

[256] *Ibid.*, 33.

[257] Antulio J. Echevarria II, "Center of Gravity: Recommendations for Joint Doctrine," *Joint Force Quarterly*, Issue 35, 14-15; http://www.dtic.mil/doctrine/jel/jfq_pubs/0535.pdf; Internet; accessed 18 November 2004.

[258] *Ibid.*, 16.

Moreover, it is highly questionable if "centres" such as the extremist Islamic ideology preached by Al Qaida could be decisively neutralized at all. Thus, to label these nodes as "high payoff" would not only be a misnomer, but also perpetuate the cult that EBO would always lead to quick, cheap and casualty-free victories.

Nonetheless, the existence of centres of gravity or high payoff nodes does not really affect the substance of EBO. By addressing cause and effect relationships in a comprehensive and holistic manner, EBO conditions planners to be more sensitised to the nature of the operational context, thus putting them in a better position to take early precautionary actions to mitigate the potential risks posed by "nodes" not directly accessible by any form of power. Whether such nodes could be adequately neutralized at all would be a second order question. Identifying them and recognising that they exist would be at least the first step in the right direction.

CONCLUSION

Effects-based thinking is not new. From the writings of sea power theorists, advocates of airpower to the architects of the German *Blitzkrieg*, the annals of history is replete with examples of how military planners have attempted to apply effects-based thinking in the search for greater combat efficiencies and expediency, albeit at different levels of war. Nevertheless, with a paradigm shift in the geo-political security environment brought about by the end of the Cold War, there has been renewed interests in EBO, particularly on how it could be applied to low intensity conflicts such as the fight against terrorism and military operations other than war (MOOTW). Accordingly, effects-based thinking expanded from a narrow focus on the application of military power, to a more inclusive concept that seeks to integrate all elements of national power in achieving directed policy goals over a broader spectrum of operations.

While effects-based thinking is not new, EBO concepts have nevertheless evolved over the years, shaped by prevailing strategic geo-political imperatives, as well as pressing operational challenges.   The perennial struggle in bringing effects-based thinking into fruition could be attributed to at least three key factors. Firstly, the lack of a comprehensive array of delivery means that could inflict the desired effects on targets. Secondly, the inability to "know the enemy" due to difficulties in acquiring and maintaining a "structural knowledge" of the operational context. Thirdly, the absence of a holistic planning process and structure necessary to integrate all elements of national power, and directing them synergistically towards achieving desired policy aims.

Resurgence in effects-based thinking was galvanized out of the bloody stalemate trench warfare experience of World War I and "powered" by the advent of combat

aviation. To avert fighting costly wars of attrition on the surface, airmen began to advocate a new form of warfare, where the inherent flexibility and reach of airpower could be used to directly and decisively destroy an opponent's source of war-making potential. In so doing, this would terminate future conflicts with greater economy of effort and over shorter periods of time. Against this backdrop, airmen at the US Army Air Corps Tactical School began to develop a doctrine for strategic bombardment, where airpower would be used to destroy "critical choke points" of an adversary's industrial-economic to cause rapid strategic paralysis, as well as to collapse the will of its people. These concepts were to be put to the test during World War II, in the Allied strategic air campaign against Nazi Germany and Imperial Japan.

However, the experiences during World War II would accentuate the practical difficulties of conducting effects-based type operations. Even though an air estimate process was established to rationalize the selection of targets, planners were constrained by the inability to gain and maintain a "structural knowledge" of the German and Japanese industrial-economic systems. Thus, they resorted to "mirror-imaging" when intelligence was unavailable and prescribed attack priorities according to the "gut feel" of commanders, or to solve pressing operational problems. Notwithstanding the use of "state of the art" Norden bombsights, planners also lacked the delivery means required to conduct effects-based type operations as aerial delivered bombs lacked precision and lethality. The confluence of these operational challenges, coupled with a presumption that the bomber would always get through resulted in the *Combined Bomber Offensive* against Germany degenerating into an air war of attrition, and the bombing of Japan

shifting away from "precision" attacks against selected industrial-economic targets to a preference for indiscriminate night area incendiary bombing of cities.

Nevertheless, the arrival of the atomic bomb would profoundly alter the strategic geo-political context and shape the substance of effects-based thinking. While the destructive power of the atomic bomb had precipitated the unconditional surrender of Japan on one hand, it also sparked a concerted effort by the international community to regulate the use of force and according civilians with greater protection on the other. In the power vacuum left by the Axis powers, the Soviet Union would assert itself as a counter balance to the US first by drawing an *Iron Curtain* across Europe, and subsequently by eroding US nuclear monopoly. In an age of nuclear aplenty, this had the effect of locking both superpowers in a paradigm of mutual vulnerability, where neither side could decisively disarms its opponent's retaliatory capability in a first blow without risking a reprisal second strike.

Overall, the strategic nuclear stalemate had the effect of making total war too blunt an instrument for the settling of international disputes. As a result, past systems and structures, which were primarily geared towards a total war became increasingly incongruent with the strategic realities of a bipolar world order. While the probability of a total war between the two super powers had receded, this was replaced by the phenomenon of localized proxy wars fought along narrower political and ideological objectives. Regrettably, effects-based thinking remained within the context of a total war, and was not elevated to the strategic level to evolve a commensurate planning process that can leverage all elements of national power to better deal with limited, but arguably more complex proxy contingencies.

For instance, in Korea, the lack of synchronization between coercive nuclear diplomacy at the strategic level and military actions at the operational level fractured America's strategy to compel the Chinese and North Koreans to an early negotiated settlement. In the case of Vietnam, an inadequate structural knowledge of the enemy would first lead the US in employing a wrong strategy to halt Hanoi's sponsored insurgency operations in the South. Thereafter, the lack of an all encompassing approach led to the failure in accounting for national will as part of its wider campaign, culminating in the strategic defeat of US forces.

Although Vietnam had crushed the morale and confidence of the US military, out of this shattering experience would usher in a period of broad based intellectual renaissance that would subsequently lay the foundation to realise EBO. In its journey to rebuild itself, the US Army rediscovered the operational art and established the doctrinal framework to strengthen the linkage between ends, ways and means. It also percolated effects-based thinking throughout the organization by advancing the doctrine of AirLand Battle. While supporting the US Army in realising AirLand Battle, the US Air Force also developed the concept of Parallel Warfare and backed it up with a comprehensive set of planning tools and means (such as advanced precision guided weapons, stealth aircraft and electronic warfare). This allowed planners to conduct EBO type operations with greater precision, incisiveness and speed during Operations Desert Storm. Finally, the US Navy pioneered the development of collaborative engagement systems in the form of Network Centric Warfare and established the conceptual knowledge-based command and control to enable EBO in the information age.

With the ongoing RMA and rapid pace of technological advances, EBO could potentially become a reality in the near future. Nevertheless, as in any conceptual construct, the successful implementation of EBO in contemporary operations such as coalition warfare and MOOTW would be contingent on a number of pre-requisites being met. Firstly, the desired end-state to be achieved must be clearly articulated to provide strategic guidance for EBO planning, while not being too prescriptive as to unduly constrain own freedom of action. In this regard, NATO's air campaign in Kosovo would also underscore the need to garner political will as a pre-requisite to conduct EBO, especially within the context of coalition operations, where the expediency promised by an effects-based approach might need to be balanced with the various nationalistic agendas of coalition partners. Thus, what could be most effective might not always be the most acceptable.

Secondly, as evident from the experiences of World War II, the ability to acquire and maintain a holistic knowledge of the enemy remains the *sine qua non* of EBO. While advances in computing and simulation technologies could permit potential adversaries to be modelled as a "system of systems", the utility of these models would ultimately be limited by the inputs used. Moreover, the effects achieved on the enemy's system, both kinetic and non-kinetic, must be reliably observed, measured, analysed and assessed to facilitate the adaptation of follow-on actions. To realise EBO, it must therefore be ably supported by a intelligence collection and support system during peacetime, as well as in war.

Finally, in limited scenarios such as MOOTW, it must be noted that "high payoff" nodes in an enemy's system could be intangible in nature. As such, they might not be

directly accessible, nor could be decisively neutralized using any form of national power, kinetic or non-kinetic. Therefore, one must be mindful that EBO is not a panacea, nor will it always guarantee cheap, quick and casualty-free victories. Moreover, EBO is also a challenging and complex enterprise. Nonetheless, by addressing cause and effect relationships in a comprehensive and holistic manner, EBO could imbue planners with the foresight necessary to take precautionary measures upfront, and mitigate the potential risks posed by these nodes. Thus, EBO as a higher form of operational art should be leveraged for the insights it would provide, rather than pursued as an end unto itself.

In conclusion, although effects-based thinking is not new, the perennial struggle in operationalizing EBO in the past could be attributed to the lack of adequate delivery means, the absence of a planning process and supporting structure, and challenges associated with knowing the enemy.   Therefore, if one were to learn from the past with a view of revolutionalizing the future, these areas should be the foci for further research and development. In this way, the transcendence of EBO from concept to reality can be further quickened.

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