CANADIAN FORCES COLLEGE / COLLÈGE DES FORCES CANADIENNES
CSC 30 / CCEM 30

EXERCISE/EXERCICE
NEW HORIZONS

EFFECTS-BASED OPERATIONS: AN EVOLUTIONARY CONCEPT MADE PRACTICAL ONLY RECENTLY

By /par Maj Paul Fleet

Abstract

One of the reasons for the success of the American-led coalition during the Gulf War in 1991 was a focus during development of the offensive air plan by the air planning staff on an effect vice simple attrition-based methodology. This capitalized on an ability to paralyze the system on which the adversary depended upon for control and effective employment of his military forces. Following the Gulf War, the concept of Effects-Based Operations was developed to encapsulate this effective methodology and it has been embraced by the American military as having joint application to the worldwide employment of military power in current times. This essay proposes that rather than being revolutionary in nature, EBO has a long evolutionary history and that only the conjunction of several factors has made it recently practical.

The Gulf War in 1991 against Iraq was a profound success for the American led coalition. For the Americans, it was the first true vindication of their conventional technological and organizational superiority since World War II.

One of the reasons that the air war had been so successful was a focus on an effect vice simple attrition-based methodology that was used by the air planning staff in the development of the offensive air plan. It capitalized on an ability to paralyze the system on which the adversary depended upon for control and effective employment of his military forces. The object of warfare has always been to achieve the desired effect with the minimum expenditure of resources to facilitate follow-on operations.

After the war the principal planner of the offensive air plan, then Lieutenant Colonel Dave Deptula expanded on this seemingly obvious aspect of air warfare and called it 'effects-based operations' (EBO). The current United States Joint Force Command (USJCOM) definition of EBO is:

> A process for obtaining a desired strategic outcome or "effect" on the enemy, through the synergistic, multiplicative, and cumulative application of the full range of military and nonmilitary capabilities at the tactical, operational, and strategic levels.[1]

Since the introduction of this concept, it has been embraced throughout the services as having joint utility despite the fact that it has an air force lineage. As with every new concept, there was mixed reviews to the unveiling of EBO with some claiming it was a revolutionary way of looking at warfare while others believed it was an old idea whose time had finally come. This essay proposes that rather than being revolutionary in nature, EBO has a long evolutionary history and that only the conjunction of several factors has made it recently practical.

---

[1] United States. Department of Defense. *United States Joint Forces Command – Glossary*. USJFC – Website. [Article on-line]; available from http://www.jfcom.mil/about/glossary.htm#E; Internet; accessed 30 Jan 04.

The assessment of the evolutionary nature of EBO will be made through a chronological look from post-Vietnam to the Gulf War in 1991, looking at American theorists, technology, conflicts, and influences such as political that affected its air force development. After an assessment of the factors that allowed EBO to emerge during the Gulf War, influences that permitted EBO to flourish and be embraced as a joint concept since will be reviewed.

When the Vietnam War ended, the American Army's focus shifted back to the European theatre to find that the Soviet threat had become more ominous in quantity and in quality from modernization with which the Americans had not kept pace.[2] At the same time, due to political sensitivities that a traditional defence in depth approach would relinquish too much sovereign territory and that taking the offence into eastern Germany was unpalatable, a philosophy of stopping the Warsaw Pact forces at the forward defences was adopted.[3] In 1976, the Army doctrine manual FM 100-5 outlined this philosophy as Active Defense, and recognized that "the Army cannot win the land battle without the Air Force."[4] The Army realized they would have to contribute to the attainment of Air Superiority to benefit from the close air support (CAS) required to halt a Soviet offensive due to lethal advances in anti-aircraft warfare. With a wealth of Vietnam tactical air operations experience, the Air Force was well positioned to advance the co-ordination with the Army in such areas as airspace management, air-to-ground communication, and command and control of air assets to maximize the effectiveness of CAS. Despite the

---

[2] Robert J. Hamilton, "An Examination of the Evolution of Army and Air Force Airpower Thinking and Doctrine Since the Vietnam War" (Maxwell AFB: Air University Advanced Airpower Studies Thesis, 1993), xii. [Article on-line]; available from http://www.fas.org/man/eprint/p186.pdf; Internet; accessed 30 Jan 04.

[3] Ibid, xiv.

[4] United States, Department of the Army, *FM 100-5 – Operations* (Washington, D.C.: U.S. Government Printing Office, July 1, 1976), 8-1.

continued importance of the strategic nuclear role, the realities of the European theatre ensured that the USAF continued to develop conventional Army support capabilities.

As 1980 dawned, the threat to stability and peace in the world shifted to a more global nature. The American defense White paper, published in February of that year, stated that the challenge for the US military was to "develop and demonstrate the capability to successfully meet threats to vital American interests outside of Europe, without compromising the decisive theatre in Central Europe."[5] Operation Eagle Claw, conducted in April 1980, was a joint services rescue mission for American hostages held at the embassy in Iran. It was a disaster where the lack of independent overall co-ordination was central to the inability of the four services to integrate effectively as a team in a complicated joint conventional operation.[6] This demonstrated that the US military required some adjustments before being able to fulfill their expected role.

The global focus of the American military led to the development of Airland Battle in 1982, a more offensive philosophy than Active Defense. This concept resulted from significant coordination and doctrinal development activities between the Army's Training and Doctrine Command and the Air Force's Tactical Air Command (TAC), which had begun as early as 1973.[7] Recognizing that future adversaries would be numerically superior, possessing Soviet equipment and doctrine, and that insufficient room would exist for traditional defense in depth philosophies, the Airland Battle was

---

[5] Dennis Stewart Driggers, "The United States Army's Long March from Saigon to Baghdad: The Development of war-Fighting Doctrine in the Post-Vietnam Era," (Doctoral thesis, Syracuse University, 1995), 175-176.

[6] Air and Space Power Course, s.v. "Operation EAGLE CLAW." [Website on-line]; available from http://www.apc.maxwell.af.mil/text/excur/intro.htm; Internet; accessed 16 March 2004.

[7] Hamilton, *An Examination of the Evolution of Army and Air Force…,* xxv.

based on manoeuvre to "gain the advantages of surprise, psychological shock, position, and momentum which enable smaller forces to defeat larger ones."[8]

As the Corps Commanders area extended in depth in the Airland Battle construct, fire coordination measures had to be adapted to reflect the beginnings of a more non-linear approach to warfare and the more interdiction related role that the air force was to play. Realized and envisioned technological advances, such as a "revolution in microprocessor, sensor and guidance technology that promised future conventional munitions would nearly equal the combat effectiveness of low-yield tactical nuclear weapons,"[9] facilitated the development of Airland Battle. However, key enablers such as the Army Tactical Missile System (ATACMS), a precise battlefield missile system with an estimated range of 300 kilometres, and a battlefield surveillance capability called JSTARS (Joint Surveillance Target Attack Radar System) were not to be fielded for almost a decade. Other envisioned capabilities were increased real-time intelligence with better all weather sensors, target acquisition systems, and the ability to integrate information automatically for greater situational awareness.[10] These technologies were aimed at providing greater control to the commander in the fluid Airland Battle environment by reducing the proverbial fog and friction of war in an attempt to make war more predicable.

Operation Urgent Fury, in October of 1983, was the American led invasion of the Caribbean island of Grenada under the guise of rescuing almost 600 American medical

---

[8] Driggers, *The United States Army's Long…*, 78.

[9] Hamilton, *An Examination of the Evolution of Army and Air Force…*, xiii.

[10] Driggers, *The United States Army's Long…*, 89.

students following a Marxist coup.[11] Although successful, the after action reports highlighted many problems between the services in the joint environment such as interoperability and command and control.[12] The problems in Grenada added fuel to the fire in certain circles looking for defense reform. Three years later, on the 1st of October 1986, President Regan signed the Goldwater-Nichols Act, as it became known, into law.[13] One of its functions was to mandate that the military services "collaborate on developing joint doctrine for the integrated employment of joint military operations"[14] effectively eliminating the major stumbling block interfering with the development of a truly effective American global military power: parochialism.

The next evolutionary step on the road to effects-based thinking in the Air Force was in 1986; the year John A. Warden III attended the National War College. A combat fighter pilot, Warden developed an examination of Alexander the Great's prowess into a study on the application of airpower.[15] Perhaps with familiarity to the Airland Battle, *The Air Campaign: Planning for Combat,*[16] as it was called, brought army centric concepts such as center of gravity (COG), offense, defence, and use of reserves to life in an

---

[11] Wikipedia, s.v. "Operation Urgent Fury." [Encyclopedia on-line]; available from http://en.wikipedia.org/wiki/Operation_Urgent_Fury; Internet; accessed 18 March 2004.

[12] Parlier, Greg H, "The Goldwater-Nichols Act of 1986: Resurgence In Defense Reform and the Legacy of Eisenhower" (Quantico: Marine Corps Command and Staff College research paper, 1989), Chapter 6 – n.p. [Article on-line]; available from http://www.globalsecurity.org/military/library/report/1989/PGH.htm; Internet; accessed 18 Mar 04.

[13] Jeffrey G. Lofgren, "The Battle over Change: The Goldwater-Nichols Act of 1986" (Norfolk: National Defense University National War College 'The Interagency Process' Paper, 2002), 11. [Article on-line]; available from http://www.ndu.edu/library/n2/n025603F.pdf; Internet; accessed 18 Mar 04

[14] Air and Space Power Course, s.v. "Goldwater-Nichols Act 1986." [Website on-line]; available from http://www.apc.maxwell.af.mil/text/excur/intro.htm; Internet; accessed 16 March 2004.

[15] David S. Fadok, "John Boyd and John Warden: Airpower's Quest for Strategic Paralysis," In *The Paths of Heaven: The Evolution of Airpower Theory,* ed Philip S. Meilinger (Maxwell Air Force Base: Air University Press, 1997), 371.

[16] John A. Warden III, *The Air Campaign: Planning for Combat* (Washington, DC: National Defense University Press, 1988), n.p.. [Book on-line]; available at http://www.au.af.mil/au/awc/awcgate/warden/ward-toc.htm; Internet; accessed 21 January 2004.

aviation context. After identifying that there are COGs at all levels of war, he focused on command as the most valuable COG to target. He used a description of 1982 Israel operations against the command elements of Syrian air forces to illustrate the effectiveness of this target set. With the statement that the success was due to the "effective attack on all elements of Syrian command,"[17] Warden was foreshadowing his later theories involving parallel attack and paralysis of the enemy's system. Warden searched for a way to relate the applicability of the concept of COGs to airpower, and in 1998 developed a five-ring model shaped like a target with concentric COGs of fielded forces, population, infrastructure, and organic essentials in increasing priority and decreasing size leading towards the most important COG located in the centre of the target, leadership.[18]

As the 1980's unfolded, the world political landscape began to change significantly as the Soviet Union began to look increasingly inward due to economic troubles. They made overt indications to the United States about decreasing tensions, which would also allow them to decrease their military expenditures. This desire to decrease expenditures was mirrored in the United States, with the Air Force especially vulnerable owing to the sizeable portion of their budget tied to Strategic Air Command (SAC) and defending against the Soviet menace. Perhaps after reflection on the 1986 American bombing of Libya as punishment for its support to terrorism, the Air Force issued a white paper in June of 1990 entitled *The Air Force and US National Security:*

[17] Ibid, 48-50.

[18] Fadok, John *Boyd and John Warden: Airpower's Quest*…, 373.

Global Reach – Global Power. [19] One of the primary architects of the paper was Major David A. Deptula, a future Effects-based Operations theorist, who focused on the unique characteristics and capabilities that airpower contributes to the joint service support of national security strategy.[20] These fundamental drivers, a change in the international security environment and budget pressures, permitted Deptula to articulate a vision of the Air Force that would be the institutional impetus to eventually divorce the terms strategic and tactical from platforms. August of 1990, designated as Global Reach – Global Power month, saw a large exercise between TAC and SAC planned to demonstrate these Air Force attributes until the invasion of Kuwait by Iraq overtook events.[21]

CENTAF, the United States based Air Force headquarters assigned responsibility for the southwest Asian region, was the prime air planner for what would become known as Desert Shield and Desert Storm. As this headquarters was busy with deployment and initial defence planning, the Commander-in-Chief of United States Central Command (CENTCOM), General Schwarzkopf, who was responsible for the overall campaign, asked the US Air Staff in the Pentagon to devise the offensive air plan.[22] Col John A. Warden, head of the Air Staff Planning cell, used this opportunity to develop a plan based on his personal view on the use of airpower, which aimed to paralyse enemy COGs in

---

[19] United States. Department of the Air Force. *Global Reach--Global Power: The Air Force and U.S. National Security*. Washington, D. C.: Department of the Air Force, 1990.

[20] Barbara J. Faulkenberry, "Global Reach – Global Power: Air Force Strategic Vision, Past and Future" (Maxwell AFB: Air University - Advanced Airpower Studies Thesis, 1996), 16. [Article on-line]; available from http://www.maxwell.af.mil/au/aul/aupress/SAAS_Theses/SAASS_Out/Faulkenberry/faulkenberry.pdf; Internet; accessed 19 Mar 04.

[21] Ibid, 18.

[22] Richard T. Reynolds. *Heart of the Storm: The Genesis of the Air Campaign Against Iraq* (Maxwell AFB: Air University Press, 1995), *27.*

order to directly achieve strategic versus traditional tactical objectives.[23] When later proposed to General Schwarzkopf, the objectives of the plan, code named Instant Thunder, were to "isolate Saddam Hussein, incapacitate national leadership, destroy Iraq's strategic offensive and air defense capabilities; and minimize damage to the Iraqi economy to enhance rebuilding after the war."[24]

Back at CENTAF, the planning continued with Lieutenant Colonel Deptula, a Warden disciple, as the principle offensive air campaign planner. Although additional target sets such as the Republican Guard and SCUD missiles would elevate in priority, Deptula was convinced that the ultimate goal was to achieve paralysis through simultaneous operations on target sets that would directly effect the Iraqi centers of gravity, especially that of command. Even with the significant coalition aviation assets, over 2,500 on the eve of the war, [25] air superiority to allow unhindered operations in Iraq considering the substantial anti-air threat would be problematic but essential. The Iraqi air defence consisted of fully integrated ground and air based assets that were described as "denser than the most heavily defended Eastern European target at the height of the Cold War, and seven times as dense as Hanoi's defenses before Linebacker II in 1972."[26]

On the 16th of January, 1991, the day after the expiration of the United Nations ultimatum expired, the air war commenced and television images from Baghdad captivated audiences around the world for the next 39 days until the beginning of the

---

[23] Paul T. Mitchell. *The Persian Gulf War* (Toronto: Canadian Force College, 1999), A-7/26.

[24] Hamilton, *An Examination of the Evolution of Army and Air Force…,* xxxv.

[25] Federation of American Scientist – Military Analysis Network, s.v. "Reaching Globally, Reaching Powerfully: The United States Air Force in the Gulf war – A Report – September 1991; [Article on-line]; available from http://www.fas.org/man/dod-101/ops/docs/desstorm.htm; Internet; accessed 19 March 2004.

[26] Ibid.

ground offensive. Within one hundred hours of the commencement of the ground offensive, the war was over, Iraqi forces were defeated, and Kuwait liberated. As total coalition fatalities numbered less than 400 with only 42 aircraft lost during the entire war, the planning and execution of the war against a not insignificant foe can be seen as remarkable. It is instructive to review some of the factors that facilitated this achievement and their applicability to future EBO.

Since the beginning of airpower theory, the prime desire of appliers of airpower has been to paralyse the enemy, which Deptula desired to do through simultaneously attacking the enemy's systems or COGs as described by Warden. As traditional strike packages consisted of a large number of aircraft performing various complementary roles to ensure protection for the bombers, this meant that surprise and paralysis would be difficult to achieve even with the multitudes of coalition aircraft available. The solution was the F-117A, a low-observable stealth aircraft, which was designed to penetrate integrated air defences without detection and operate without the large volume of support aircraft required by conventional strike aircraft, as "air superiority to a degree is inherent in the nature of stealth itself."[27]

The advancement of precision-guided munitions (PGM) was also an important contributor to success of the air war. Although used in Vietnam, advances had been continual so that " a single aircraft and one PGM during the Gulf War achieved the same result as a 1000-plane raid with over 9000 bombs in World War II – and without the associated collateral damage."[28] When precision is combined with stealth, the sum is

[27] David A. Deptula, *Effect-Based Operations: Change in the Nature of Warfare* (Arlington: Aerospace Education Foundation, 2001), 16.

[28] Ibid, 9.

truly greater than the two parts as indicated by the fact that F-117 aircraft, which flew less than two percent of the total combat sorties, attacked 43 percent of the targets of the master attack list.[29]

The most significant advances in warfare exhibited during the Gulf War were in the fields of management and command and control. The services of the United States military had made large strides in operating in a joint environment since the introduction of the Goldwater-Nichols Act of 1986. This was especially evident at the senior level where for the first time the joint command structure was exercised in time of war. This structure, which adapted well to absorb coalition partners, had a Joint Force Commander (JFC) supported by a Land (LCC), Maritime (MCC) and Air (ACC) Component Commander.

Despite some service centric misgivings, the ACC became responsible to satisfy theatre wide JFC air objectives through centralized control of all air assets. The Air Operations Center (AOC) produced an Air Tasking Order (ATO) that contained details of the approximately 1000 aircraft sorties each day along with other pertinent information to ensure maximum situational awareness. Although there were some issues including problems transmitting the ATO to the Navy, the ATO process was essential to the prosecution of the air war. This evolutionary process had focused airpower to maximize its efficiency and predictability of outcome.

The Gulf War was remarkable for technology, much of which received its first real comprehensive operational use. Although the air war still involved the use of men and aircraft, their efficacy was greatly enhanced by the use of revolutionary sensor and

---

[29] Ibid, 9.

computer technology. In addition to its surveillance role, the Airborne Warning and Control System (AWACS) was instrumental in the conduct of the air war for its ability to act as a surrogate command and control facility from, and through which, the AOC could execute the day's ATO. This provided flexibility to the ATO, often criticized for its rigidity, to respond to urgent operational needs or allow for unforeseen circumstances. The Joint Surveillance Target Attack Radar System (JSTARS) was an experimental system, using Doppler shift theory to detect movement, which was deployed and used operationally for the Gulf War.[30] Primarily used to detect the movement of ground vehicles, it provided near real time information of the battlefield for the commander. Although requiring other sensors to determine specifics such as friend or foe[31], it was extremely useful to help anticipate enemy moveipate enem

list"[32] approach. The approach chosen would later become known as Parallel Operations in reference to basic electrical theory.[33] Parallel Operations entail attacking targets that support the enemy COGs almost simultaneously to foster cascading effects causing paralysis to effectively control the systems from which the enemy gains power and influence.[34] This has been the desire of every air commander since the beginning of aviation but, due to the strength of air defences and the lack of ability to precisely hit targets, it had previously been unobtainable.

With a normal attrition approach to warfighting, there would always be more targets than the ability of an assembled force to destroy, even a force as strong as that amassed in the Gulf. The key to causing paralysis was the recognition that control not destruction was the desired effect on the enemy's system. It was the effect that an attack had on the enemy's system that was important, and how that contributed to the overall theatre objectives.

An example will serve to illustrate the importance this effects-based philosophy. Early in the air planning for the Gulf War, it would be necessary to destroy two major air sector operations centers (SOCs) controlling Iraqi air defences, each consisting of two underground hardened bunkers. It was assessed that to destroy these bunkers all of the F-117s available would be required. Later it was determined that there were actually four SOCs and each had three to five satellite operations centers.[35] The destruction of these

---

[32] David A. Deptula, "Firing for Effects." *Air Force Magazine.*Vol. 84, Issue 4 (April 3001): 51. [Magazine on-line]; available from http://www.afa.org/magazine/april2001/0401effects.pdf; Internet; accessed 30 January 2004.

[33] Deptula, *Effect-Based Operations: Change…,* 3.

[34] Deptula, *Firing for Effects…,* 48.

[35] Deptula, *Effect-Based Operations: Change…, 12*.

operations centers was considered essential to improve the air superiority situation and allow follow-on attacks from other non-stealth platforms. Necessity being the mother of invention, air planners realized it was the effect, or the paralysis of the operations centers, that was important, which allowed the same number of F-117s to strike 38 times more than the originally planned number of targets within the first 24 hours of the Gulf War. [36] The change from total destruction to desired effect enables precious resources to be husbanded and used elsewhere.

The close of the Gulf War sees EBO in an embryonic state. Military air planners had re-focused on effects, made possible by technological advances, to more efficiently use the resources allocated for the task. Like many airpower theories of the past such as Douhet's,[37] they sought to use airpower to directly affect the adversary through paralysis. As this was nothing new, why did this evolutionary concept metamorphose into the concept of EBO that we know today and why was it embraced so comprehensively? There were many drivers that accelerated the evolution of EBO and enhanced its palatability: changes to the political landscape, various pressures on the application of American military power, continual technological advancements, and institutional transformation. These will be discussed in turn.

At the end of 1991, the USSR ceased to exist and the political environment was irrevocably altered. For the next decade, world politics were dominated by lengthy regional conflicts surfacing from under the restraints of a bi-polar world. Although the national survival of the United States was not in question, continued globalization had

---

[36] Ibid*, 12*.

[37] Philip S. Meilinger, "Giulio Douhet and the Origins of Airpower Theory," In *The Paths of Heaven: The Evolution of Airpower Theory,* ed Philip S. Meilinger (Maxwell Air Force Base: Air University Press, 1997), 15.

linked the economies of the world and thus American interests were at risk. At the same time the international community was increasingly looking to the United States for solutions that only they, the unrivalled remaining superpower, could deliver.

Pressures mounting at home for a peace-dividend resulted in downsizing of the military at the same time that deployments in this new world order of global engagement increased.[38] The attention of the international media at all the world's hot spots ensured that 24 hour television coverage was available for any conflict in which the Americans might get embroiled. This magnified the desire to solve these conflicts with little to no collateral damage or loss to military forces. It was also the desire of the government to solve these issues quickly to ensure the support of the population during the entire operation was retained. With the new reduced force structure, an ability to produce a speedy resolution to a crisis would also promise the illusion of no long-term commitments of troops to tie the government's hands in responding to a future crisis of more importance. Most importantly, a quicker result would mean that expenditures would be minimized. However, in this new uni-polar world order, foreign governments were more likely to restrict American forward basing rights as nationalistic interests led them on paths divergent from the United States. This meant that build up time would be an issue if a ground campaign were envisioned. In this new-world order it was also apparent that, unlike the past, decisive victory or unconditional surrender of the adversary was not the only way to achieve the desired national objectives.

All of these pressures pushed the United States towards a smaller more efficient military that was still able to rapidly deploy worldwide, deliver a significant precise

---

[38] David A. Deptula, "Embracing Change," *Armed Forces Journal International* Vol. 139, Issue 3 (October 2001): 69.

application of military power, and achieve the desired political effect with minimum casualties or collateral damage. The political realities were placing the focus on the capabilities of the USAF and the concept of EBO. As the capabilities of the USAF were proving directly useful to the government, the other services were quick to demonstrate that they also had the ability to deliver precise effects by embracing the concept and technologies of EBO.

Although focusing on the unique characteristics of airpower, the writings of Deptula, now a Major General, made it clear that the desired effect, not the service or platform achieving them, were the goal of EBO. Since then, students in American military colleges have adapted this concept to their own services and their own unique abilities to add to the joint effects-based fight. This body of academic work has also evolved the concept to the use of non-lethal force to achieve effects and the link from military power to other types of national power. In this manner, EBO was effectively broadened from an Air Force to a joint concept, which made it more appealing to a wider range of interests.

Technological advances since the first Gulf War have made effects-based methodologies even more attractive for politicians and military alike by making capabilities that "replace the meat cleaver of the past with a finely honed scalpel."[39] Intelligence, Surveillance, and Reconnaissance (ISR) information is being increasingly automatically fused into a common operating pictures (COP) available at all levels of command, significantly increasing situational awareness. Uninhabited Aerial Vehicles (UAV) have been developed into effective tactical surveillance platforms possessing a

[39] Dennis J. Gleeson, Gwen Linde, Kathleen McGrath, Adrienne J. Murphy, and Murray, Williamson, New *Perspectives on Effects-Based Operations: Annotated Briefing,* Report for Joint Advanced Warfighting Program (Alexandria, Va: Institute for Defense Analyses, 2001), 5.

variety of sensors that are capable of employment in high threat areas. The real-time information that the UAV provides allows commander a view of the battlefield previously unobtainable. This facilitates the informed decisions necessary to fine tune tactical actions, especially in response to enemy reactions, to ensure achievement of desired effects to further promote paralysis. This technology has shortened the proverbial 'sensor-shooter' link facilitating more rapid delivery of precise military force.

The advance in munitions technology continues in an unrelenting fashion. Joint Direct Attack Munitions (JDAMs)[40], due to their low cost, pinpoint accuracy and ability to be re-programmed in flight, will revolutionize warfare as existing platforms are adapted to carry them. Coupled with stealth these new all-weather munitions are nothing less than awe inspiring, as indicated during the successful test flight on September 10th, 2003, of a USAF B-2 that dropped 80 JDAMS, each with its own precise target, in one 22 second pass.[41] Non-lethal munitions have been designed and used operationally as in EBO it is the effect that is truly important. During the air action in Kosovo in 1999, allied aircraft dropped munitions that used spools of treated wire to temporarily cut off 70% of the Serbian electricity, as politically the collateral damage to civilian infrastructure was unpalatable at the time.[42] EBO will continue to benefit from the technological development of munitions, especially those munitions of a non-lethal nature or smaller precision munitions to reduce collateral damage.

---

[40] Joint Direct Attack Munitions are a GPS guided family of bombs that are created by adding a relatively inexpensive guidance kit to existing old-fashioned dumb bombs. See Boeing Website – Joint Direct Attack Munition. [Website on-line]; available from http://www.boeing.com/defense-space/missiles/jdam/jdam_back.htm; Internet; accessed 21 Mar 04.

[41] Boeing Website – news release – Sept 17, 2003. [Website on-line]; available from http://www.boeing.com/defense-space/missiles/jdam/jdamnews.htm; Internet; accessed 21 Mar 04.

[42] Benjamin S. Lambeth, *NATO's Air War for Kosovo: A Strategic and Operational Assessment* (Santa Monica, CA: RAND, 2001), 40-41.

All of these technological advances increase future predictability of military operations much to the pleasure of politicians, as from their point of view civilian control of military operations is always desirable.

There can be many reasons for organizational change. In military circles this tends to be the result of a change in mission, resource allocations, technology, or operating methodology. American transformation is currently affected by all of these issues. The political pressure to increase efficiency and relevance in the new security environment, while decreasing the budget, is healthy for the American services and has forced the development of true joint military capabilities. An effects-based methodology enables the new mission to be accomplished effectively and efficiently within the resources allocated using technology as an edge.

This transformational period has involved real change to force structure as services adapted to a more capabilities based approach for organization. An example of this in the USAF was the change of TAC, SAC, and Military Airlift Command into two more flexible organizations in June of 1992: Air Combat Command and Air Mobility Command.[43] This re-organization of the Air Force continues unabated as shown in the *U.S. Air Force Transformation Flight Plan* published in November, 2003, which emphasizes the move towards an expeditionary capabilities-based air force using a transformational process that "concentrates on desired battlespace effects vice specific platforms."[44]

---

[43] David A. Deptula, "Air Force Transformation – Past, Present, and Future," *Aerospace Power Journal* Volume XV, No. 3 (Fall 2001): 86. [Journal on-line]; available from http://www.airpower.maxwell.af.mil/airchronicles/apj/apj01/fal01/phifal01.html, Internet; accessed 30 October 03.

[44] United States. Department of the Air Force. *The U.S. Air Force Transformation Flight Plan* (Washington D.C.: HQ USAF/XPXC, 2003), v.

Organizational change occurred at the American Unified Command level as well with Atlantic Command being transitioned into USJFCOM in October, 1999. This organization has transformation, experimentation, joint training, interoperability, and force provision as published roles for the Department of Defence.[45] With a view of bringing EBO to utility, USJFCOM uses it as an inherent component of the experimentation process and as the overarching concept for transformation.[46]

From the end of the Vietnam War, EBO developed in an evolutionary manner as the USAF adapted to remain relevant in an ever-changing global environment and was only made practical recently with the conjunction of several factors.

The Cold War, and the threat posed by the Soviet Union, was the primary focus of the Americans following the Vietnam War. With the realization that attrition based warfare against the Soviets in the European theatre would be ineffective, the Americans developed Airland Battle designed to use a manouverist approach aided by technology to gain an advantage. This led to increased Army-Air Force coordination in the development of technological and procedural advances designed to manage the complex nature of warfare and make it more predicable.

Over the next few decades the political landscape changed with ever increasing rapidity as economic stresses forced the collapse of the Soviet Union and the end of the Cold War. Budgetary pressures forced the American military to greater efficiencies and smaller economies of scale at the same time as political exigencies drove increasing

---

[45] United States. Department of Defence. *United States Joint Forces Command – About Us.* [Website on-line]; available from http://www.jfcom.mil/about/about1.htm; Internet; accessed 20 March 2004.

[46] Ibid.

deployments. The USAF was driven to transform into a Global Reach-Global Power organization.

In response to demonstrated inter-service interoperability problems, the Goldwater-Nichols Act was instrumental in the development of an effective American joint military capability. The introduction of a truly joint command structure permitted an efficacy and efficiency necessary for success in this new world environment with the budgetary realities of the day.

In recognition that attrition would not be the most effective style of warfare, American theorists began to look for alternate ways to defeat the enemy. After the invasion of Kuwait by Iraq in 1991, the response of the American led coalition permitted a Warden style approach to be used by Deptula during development and execution of an offensive air plan. Limitations in resources required a control- vice destruction-based approach at the tactical level to achieve the desired strategic outcome. This approach was only realized because advances in technology had made warfare at the tactical level more predictable and advances in management had made possible a more efficient use of those assets available. Without recent advances in precision munitions, stealth, battle management, intelligence gathering, command and control, and communications, this effects-based approach would have been unachievable.

Following the Gulf War, there have been many drivers that have accelerated the acceptance of EBO as a joint concept. After it was formally advanced as a concept through the writings of Deptula, various war college students broadened EBO to a joint context by adapting it to their particular service. With the collapse of the USSR and the end of the Cold War, regional conflicts flared requiring the attention of the United States as the sole remaining superpower. At the same time, national political pressures forced

the military to become more financially efficient while retaining the ability to rapidly deploy credible, global military power. With the worldwide power of the media over populations through instantaneously transmitted images, politicians desired quick solutions to military problems with minimal collateral damage. These pressures all made EBO and the capabilities of the USAF attractive to politicians forcing the other military services to adapt their capabilities to be applicable to joint effects-based operations.

Technology continued to advance making the application of EBO more precise and predictable. All weather precision munitions of various sizes were developed to ensure targets essential to the success of an effects-based campaign could be targeted at will. Non-kinetic munitions were also developed to permit the attack on targets previously unpalatable owing to the collateral damage expected with existing munitions. Technology has also reduced the fog and friction of war with the development of advanced intelligence gathering, battle management, and command and control technologies.

The utility of EBO to the modern world political environment has been recognised at the highest levels of the American military and has driven substantial organizational change to the point that it is now used as the overarching concept for transformation within USJFCOM. This high level acceptance of EBO has ensured the rapid progression towards true joint military capabilities that are effective in the current international climate.

Bibliography

Air and Space Power Course, s.v. "Goldwater-Nichols Act 1986." [Website on-line]; available from http://www.apc.maxwell.af.mil/text/excur/intro.htm; Internet; accessed 16 March 2004.

Air and Space Power Course, s.v. "Operation EAGLE CLAW." [Website on-line]; available from http://www.apc.maxwell.af.mil/text/excur/intro.htm; Internet; accessed 16 March 2004.

Batschelet, A.W. "Effects-Based Operations," USAWC Strategy Research Project, U.S. Army War College, 2002. [Article on-line]; available from http://www.iwar.org.uk/military/resources/effect-based-ops/ebo.pdf; Internet; accessed 30 Jan 04.

Beagle, T.W. "Effects-Based Targeting: Another Empty Promise," Advanced Airpower Studies Thesis, Air University, Maxwell, 2001. [Article on-line]; available from https://research.maxwell.af.mil/papers/ay2001/saastheses/beagle.pdf; Internet; accessed 30 Jan 04.

Bingham, Price T. "Transforming Warfare with Effects-Based Joint Operations." *Aerospace Power Journal* Vol. XV, No.1 (Spring 2001): 58-66.

Boeing Website – Joint Direct Attack Munition. [Website on-line]; available from http://www.boeing.com/defense-space/missiles/jdam/jdam_back.htm; Internet; accessed 21 Mar 04.

Boeing Website – news release – Sept 17, 2003. [Website on-line]; available from http://www.boeing.com/defense-space/missiles/jdam/jdamnews.htm; Internet; accessed 21 Mar 04.

Crowder, Gary L. "Effects Based Operations Briefing," United States Department of Defense – News Transcript (19 March 2003). [Transcript on-line]; available from http://www.defenselink.mil/news/Mar2003/t03202003_t0319effects.html; Internet; accessed 30 Jan 04.

Crowder, Gary L. "Effects-Based Operations: The Impact of Precision Strike Weapons on Air Warfare Doctrines." *Military Technology.* 6/2003: 16-25.

Deptula, David A. "Air Force Transformation – Past, Present, and Future." *Aerospace Power Journal* Volume XV, No. 3 (Fall 2001): 85-91. [Journal on-line]; available from http://www.airpower.maxwell.af.mil/airchronicles/apj/apj01/fal01/phifal01.html, Internet; accessed 30 October 03.

Deptula, David A. "Embracing Change." *Armed Forces Journal International* Vol. 139, Issue 3 (October 2001): 69-72.

Deptula, David A. "Firing for Effects." *Air Force Magazine*. Vol. 84, Issue 4 (April 3001): 46-53. [Magazine on-line]; available from http://www.afa.org/magazine/april2001/0401effects.pdf; Internet; accessed 30 January 2004.

Bibliography

Deptula, David A. *Effect-Based Operations: Change in the Nature of Warfare.* Arlington: Aerospace Education Foundation, 2001.

Driggers, Dennis Stewart. "The United States Army's Long March from Saigon to Baghdad: The Development of War-Fighting Doctrine in the Post-Vietnam Era," Doctoral thesis, Syracuse University, 1995.

Dunnigan, James F. and Austin Bay. *From Shield to Storm: High-Tech Weapons, Military Strategy, and Coalition Warfare in the Persian Gulf.* New York: William Morrow and Company, Inc, 1992.

Endersby, Gary, and Barry Fulbright. "Effects-Based Airpower." *Airpower Journal* Vol. 12, Issue 4 (Winter 98): 89-98.

Fadok, David S. "John Boyd and John Warden: Airpower's Quest for Strategic Paralysis." In *The Paths of Heaven: The Evolution of Airpower Theory,* ed Philip S. Meilinger, 357-398. Maxwell Air Force Base: Air University Press, 1997.

Faulkenberry, Barbara J. "Global Reach – Global Power: Air Force Strategic Vision, Past and Future." Advanced Airpower Studies Thesis, Air University, Maxwell, 1996. [Article on-line]; available from http://www.maxwell.af.mil/au/aul/aupress/SAAS_Theses/SAASS_Out/Faulkenberry/faulkenberry.pdf; Internet; accessed 19 Mar 04.

Federation of American Scientist – Military Analysis Network, s.v. "Reaching Globally, Reaching Powerfully: The United States Air Force in the Gulf war – A Report – September 1991; [Article on-line]; available from http://www.fas.org/man/dod-101/ops/docs/desstorm.htm; Internet; accessed 19 March 2004.

Gleeson, Dennis J., Gwen Linde, Kathleen McGrath, Adrienne J.Murphy, and Murray, Williamson. New *Perspectives on Effects-Based Operations: Annotated Briefing.* Report for Joint Advanced Warfighting Program. Alexandria, Va: Institute for Defense Analyses, 2001.

Hamilton, Robert J. "An Examination of the Evolution of Army and Air Force Airpower Thinking and Doctrine Since the Vietnam War." Advanced Airpower Studies Thesis, Air University, Maxwell, 1993. [Article on-line]; available from http://www.fas.org/man/eprint/p186.pdf; Internet; accessed 30 Jan 04.

Lambeth, Benjamin S. *NATO's Air War for Kosovo: A Strategic and Operational Assessment.* Santa Monica, CA: RAND, 2001.

Lofgren, Jeffrey G. "The Battle over Change: The GoldwatersGoldwater-Nichols Act of 1986." Norfolk: National Defense University National War College 'The Interagency Process' Paper, 2002. [Article on-line]; available from http://www.ndu.edu/library/n2/n025603F.pdf; Internet; accessed 18 Mar 04.

McNicoll, Iain. "Effects Based Air Operations: Air Command and Control and the Nature of the Emerging Battlespace." *Royal United Services Institute (RUSI) Journal* Vol. 148, Issue 3 (June 2003): 38-45.

Meilinger, Philip S. "Giulio Douhet and the Origins of Airpower Theory." In *The Paths of Heaven: The Evolution of Airpower Theory,* ed Philip S. Meilinger, 1-40. Maxwell Air Force Base: Air University Press, 1997.

Mets, David R. *The Air Campaign: John Warden and the Classical Airpower Theorists*. Maxwell AFB, Alabama: Air University Press, 1999.

Mitchell. Paul T. *The Persian Gulf War.* Toronto: Canadian Force College, 1999.

Myers, Gene. "Effects-based operations: Everything old is new again, as concept reveals." *Armed Forces Journal* (June 2003): 47-49.

Parlier, Greg H. "The Goldwater-Nichols Act of 1986: Resurgence In Defense Reform and the Legacy of Eisenhower." Quantico: Marine

Bibliography

United States. Department of the Army. *FM 100-5 – Operations.* Washington, D.C.: U.S. Government Printing Office, July 1, 1976.

United States. Department of the Army. *FM 100-5 – Operations.* Washington, D.C.: U.S. Government Printing Office, May 5, 1986.

Warden III, John A. *The Air Campaign: Planning for Combat*. Washington, DC: National Defense University Press, 1988. [Book on-line]; available at http://www.au.af.mil/au/awc/awcgate/warden/ward-toc.htm; Internet; accessed 21 January 2004.

Wikipedia, s.v. "Gulf War." [Encyclopaedia on-line]; available from http://en.wikipedia.org/wiki/Persian_Gulf_War; Internet; accessed 14 March 2004.

Wikipedia, s.v. "JSTARS." [Encyclopaedia on-line]; available from http://en.wikipedia.org/wiki/JSTARS; Internet; accessed 18 March 2004.

Wikipedia, s.v. "Operation Urgent Fury." [Encyclopaedia on-line]; available from http://en.wikipedia.org/wiki/Operation_Urgent_Fury; Internet; accessed 18 March 2004.

Williams, Brett T. "Effects-Based Operations: Theory, Application, and the Role of Airpower." Carlisle Barracks: U.S. Army War College Strategy Research Paper, 2002.