AIR POWER AND EFFECTS-BASED OPERATIONS: LESSONS FROM THE PAST FOR FUTURE APPLICATION

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INTRODUCTION

The concept of Effects-Based Operations (EBO), though not articulated in such precise terminology, has existed ever since mankind was involved in warfare. History is replete with examples wherein military actions were prosecuted towards producing the desired effects rather than concentrating on destruction of the enemy, especially at the expense of high casualties.[1] In modern times, the term EBO was first used during Operation Desert Storm by the USAF Centre for Campaign Planning.[2] The staff employed a mathematical and empirical construct which, coupled with other planning tools like the Centre of Gravity (COG) analysis and Operational Net Assessment (ONA), allowed the commanders to analyse the 'effects' produced from military and non-military actions. The role played by air power, in the resounding success of the campaign, propelled EBO and

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1. John T. Correll, "The Assault on EBO", *Air Force Magazine,* January 2013, https:// www. airforcemag.com /PDF/Magazine Archive/Docu/0113EBO.pdf
2. Williamson Murray, "Transformation: Volume II", in Williamson Murray, ed., *Transformation Concepts for National Security in the 21st Century*, Strategic Studies Institute, September 2002, p. 3, https://www.publications.armywarcollege.edu/pubs/1557.pdf

The role played by air power, in the resounding success of the campaign, propelled EBO and aerial targeting into prominence and awarded the combination the recognition that was being sought by proponents of air power.

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Detractors of this theory launched a scathing attack on the effectiveness of EBO after the failure of Israeli Defence Forces (IDF)—especially the Israeli Air Force (ISAF)—during the Second Lebanon War in 2006.[3] Led by General James Mattis, then commander of United States Joint Forces Command (USJFCOM), questions were raised regarding the linkages that were perceived to exist between effects produced and attainment of the objectives. Mattis vociferously stated that "USJFCOM would no longer use, sponsor or export the concepts related to EBO".[4] His arguments were contested, especially by the Air Force community, who reiterated that discarding EBO would be foolhardy and could lead to disastrous consequences in future conflicts. The tireless efforts by experts supporting and challenging EBO led to a multitude of discourses in military academic circles. The USAF subsequently reworded their doctrine and introduced the phrase 'Effects-Based Approach to Operations' (EBAO) to gain more acceptability amongst the critics. The doctrine clarified that EBAO was a way of thinking that provided guidance for designing, planning, execution and assessment of the campaign as an integral whole.[5]

The success of EBO and air power—which received unprecedented accolades after the Gulf Wars—were outcomes of campaigns where advanced and superior Air Forces were pitted against weak opponents.

3. Avi Kober, "The Israeli Defence Forces in the Second Lebanon War: Why the Poor Performance?", *The Journal of Strategic Studies*, vol. 31, no. 1 (February 2008) p. 8, https://doi.org/10.1080/01402390701785211

4. Gen James N. Mattis, "USFJCOM Commander's Guidance for Effects-Based Operations", *Joint Force Quarterly*, issue 51 (Fourth Quarter, 2008), p. 106, https://www.hsdl.org/?view&did=792444

5. US Air Force Operational Level Doctrine, Annex 3-0, updated on November 4, 2016, https://www.doctrine.af.mil

Hence, the efficacy of this perception needs to be examined and emulated with caution, lest wrong lessons are inferred. This paper, segregated into three parts, intends to rekindle the debate on the effectiveness of EBO in general and its intrinsic relationship with air power in particular. A theoretical explanation is followed by examining four air campaigns to establish the causal link between objectives, effects and aerial targeting. The last segment examines the credibility of EBO in future wars and the capacity of air power to translate aerial actions into producing the requisite effects.

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UNDERSTANDING EFFECTS-BASED OPERATIONS

Warfare, traditionally, has always concentrated on target-based operations, where military power is employed for creating physical destruction of the target. Subsequently, strategists evolved the 'objective' based philosophy which introduced linkages between strategy, objectives and action.[6] The approach relied on the assumption that a linear relationship existed between the 'action' and 'objective' and the corresponding belief that the correct action would lead to the achievement of the selected objective.[7] This was a major shortcoming of objective-based method since war is not a linear activity and military actions would definitely produce multiple reactions that are difficult to predict.[8] EBO evolved as a solution to circumvent this perceived limitation, where a Course of Action (COA) was selected after having evaluated all possible effects that could emerge from an act.

6. Lt Col Brett T. Williams, "Effects-Based Operations: Theory, Application and Role of Airpower", in *Transformation Concepts for National Security in the 21st Century*, n. 2, p. 136.
7. Ibid.
8. Ibid., p. 137.

In the early 1990s, Colonel John Warden of USAF introduced the modern conception of effects-based operations by depicting the enemy as a system comprising a network of nodes and links.[9] This network was termed as the System of Systems Analysis (SoSA) which identified and evaluated various political, social, military, economic, infrastructure and informational (PSEMII) tentacles of the adversary.[10] These systems were further dissected to identify the significant entities or nodes that were tangible elements and could be delegated as targets. According to the EBO lexicon, an action against such a node could result in four different types of effects; the predicted desired effects, predicted undesired effects, unpredicted desired effects and unpredicted undesired effects.[11]

The effects produced from an action can be direct or indirect. Direct effects, also known as 'first-order effects', are physical results of an action that are immediately recognised and can often be meaningfully quantified.[12] 'Second' or 'third' order effects, referred to as indirect effects, are offshoots of direct effects that trigger additional outcomes and generally affect the psychological and behavioural pattern of the enemy. They may be intended or unintended, are displaced in time and space and often hard to quantify or measure empirically.[13] Indirect effects that result from the aggregation of many effects are termed as cumulative effects and those effects which ripple through a system, affecting other systems, are cascading effects.[14] Evaluation of these effects enables decision-makers to identify prospective targets, consider available Courses of Action (CsOA) and formulate the targeting plan.

The theory explained is recounted with an example. Insurgency in Kashmir was gaining momentum in 2015 and one of the primary reasons

9. Gary H. Cheek, "Effects-Based Operations: The End of Dominant Manoeuvre?", in *Transformation Concepts for National Security in the 21st Century*, n. 2, p. 74.
10. "*Commander's Handbook for an Effects-Based Approach to Joint Operations*", US Joint Warfighting Centre (Suffolk, February 2006), Chapter 2, p. 2.
11. Williams, n. 6, p. 140.
12. US Air Force Doctrine, vol. 3, chapter 2, Annex 3-0, n. 5.
13. Ibid.
14. Ibid.

was the widespread support it received from the local population. The objective was to abate militancy and the task identified was to degrade the prevalent support to the belligerents. An objective-based assessment led to identification of Burhan Wani, commander of the Hizbul Mujahideen, as a significant entity in the environment. Armed with a charismatic personality and technological knowledge he was exploiting his charm and the social media to garner support. It was perceived, through the strategy-objective-task triangle of objective-based targeting, that elimination of this young and flamboyant leader would diminish the local support for militancy. Interestingly, following his killing in July 2016, Burhan Wani became a cult hero and more renowned than when he was alive. The valley witnessed unprecedented reactions and thousands thronged to have a last glimpse of the militant at his funeral. In the ensuing clashes with security forces, 16 civilians were killed and the entire development attracted unwanted international attention.[15] The most significant and concerning effect of this action was the spike in the number of youth joining militancy in Kashmir, a figure which rose from 66 in 2015 to 191 in 2018.[16] The presence of educated youth in this spike exponentially increased the severity of the indirect effects. The objective-based action could not achieve the end state because of undesired effects, both cascading as well as cumulative.

In an effects-based planning, analysis would have identified leadership, romanticising militancy, radicalisation of educated youth and exploitation of social media as some of the key contributory factors influencing the local populace. During the evaluation, Burhan Wani would have emerged as a key node with strong linkages to other nodes in the operating environment. Security forces would have determined the effects required to achieve the specified objective of abating militancy, and having done so, the benefits accruing from various desired effects would have been compared with the

15. Qadri Inzamam and Haziq Qadri, "The Funeral of Burhan Wani and the Unrest that Followed", *The Caravan*, July 10, 2016, https:// www.caravanmagazine.in

16. Tahir-ul Gani Mir, "From Scholars to Teenagers—What makes Kashmiri Youth to Join Militancy?", *Social and Criminology—Open Access*, vol. 7, issue 2, October 2019, https:// www.longdom.org/sociology-and-criminology.html

drawbacks emanating from the undesirable effects. In the final evaluation for determining the best COA, the dominance of undesirable effects and high probability of unpredictable effects would have forced the planners against conducting a direct action against Burhan Wani. They would have been coerced to search for other options, including non-kinetic operations, against other nodes and linkages in the environment. The intent of subsequent actions would have been directed towards creating effects to diminish the popularity and dilute the significance of Wani. A direct action, when his popularity was low, would have provided reasonable assurance on lesser prospects of unpredictable and undesirable effects. To summarise, 'effects' in campaign planning may be described as the conditions that need to be established, or avoided, within the operating environment to achieve the end state.[17]

CRITIQUE OF EBO

The criticism against EBO gained momentum after the debacle of IDF during the Second Lebanon War. Post conflict assessment concluded that over-reliance on EBO was one of the primary contributory factors for the perceived defeat.[18] In his highly controversial memorandum, General Mattis claimed that EBO assumes a high level of unachievable predictability, necessitates unattainable knowledge of the enemy, discounts human dimensions of war and promotes micromanagement.[19] He argued that EBO and aerial targeting are effective against closed systems like road networks, power grids and railway infrastructure that permit a thorough examination of likely outcomes and possible consequences can be conceived. Mattis contested that war is a complex adaptive system laced with variables and any planning construct attempting to provide certainty and predictability in such an uncertain environment

17. *"Commander's Handbook for an Effects-Based Approach to Joint Operations"*, n. 10, chapter 3, p. 5.
18. Kober, "The Israeli Defence Forces in the Second Lebanon War", n. 3, pp. 32-33.
19. Mattis n. 4, p. 106.

is fundamentally at odds with the nature of war.[20] He concluded by stating that use of 'effects' in campaign planning has confused what was previously a well derived process to determine 'ends'.[21] An article, featuring in the *Australian Army Journal*, backed this thought process with the authors emphasising that "a chaotic and complex activity like war is not amenable to reductive scientific deductions".[22]

Milan Vego, the veteran professor at the US Naval War College, has argued that using mathematical models to assess unquantifiable aspects of warfare portrays it more as a science rather than an art, which is against the ethos of operational art.[23] He contested that tasks are assigned to achieve objectives and inserting effects between objectives and tasks complicates the mechanics of campaign planning.[24] Vego echoed the statement made by Mattis regarding the difficulty to predict the effects of own actions on the enemy's political or military leadership.

The primary reason for the criticism against EBO originates from the fact that air power, often, has been visualised as the focal and most potent means of producing the envisaged effects. It has been emphasised by senior USAF officers that "precision air attack is the best way to exploit effects-based operations and Air Force should be the decisive element of American military power".[25] Over the years, nations have felt the need to graduate from attrition and annihilation forms of warfare to efficient and economical methods of conducting wars. The emergence of precision guided munitions (PGMs), coupled with real-time intelligence, allowed nations to exert their will on another by employing air power and, importantly, without the need to commit their ground forces into action. This paved the way for negotiated settlement of conflicts without

20. Ibid., p. 107.

21. Ibid.

22. Justin Kelly and David Kilcullen, "Chaos Versus Predictability: A Critique of Effects-Based Operations", *Australian Army Journal*, vol. ii, no. 1, Winter 2004, p. 90, https:// www.search.informit.com.au

23. Milan N. Vego, "Effects-Based Operations: A Critique", *Joint Force Quarterly*, Issue 41 (Second Quarter, 2006), p. 51, https://ndupress.ndu.edu/portals/68/Documents/jfq/jfq-41.pdf

24. Ibid., pp. 52-53.

25. Williams, n. 6, p. 134.

unnecessary collateral damage and loss of life.[26] In such a situation, EBO and air power emerged as the ideal arrangement as a counter to attrition and annihilation types of warfare.

EBO AND AIR POWER

Lt Col Edgar S. Gorrell, of the US Army Air Service, wrote the first paper regarding strategic bombing by air power during World War I.[27] The paper highlighted the fact that there were indispensable economic targets without which Germany could not fight the war and this assessment laid the foundation for the intrinsic, complicated and debatable relationship between objectives, effects and targeting by air power. During the inter-war period, air power theorists Giulio Douhet and Billy Mitchell projected their views on aerial bombardment as an instrument to paralyse the economy and break the resolve of the enemy. The Royal Air Force (RAF), led by Air Marshal Hugh Trenchard, argued that the psychological effects of bombing outweighed the physical effects. However, unlike Douhet, Trenchard believed that directly attacking local population was morally and militarily questionable and reasoned that disruption of normal life, as a result of rising unemployment and disruption of essential services, would force the population to demand peace. During the war, while the US Army Air Force wanted to bomb factories to destroy the nation's capability to wage a conflict, the RAF sought to bomb infrastructure to destroy the national will.[28]

STRATEGIC BOMBING OF GERMANY BY BRITAIN

Clausewitz had written that the COG is always found 'where the mass is concentrated most densely' and identified the adversary's army as the COG.[29] Few theorists have contradicted this definition of COG and advocated

26. Arjun Subramaniam, "Strategic Role of Air Power: How We Need to Think, Train and Fight in the Coming Years", *Air Power Journal*, vol. 1, no. 2, Winter 2006 (October-December), p. 15.
27. Philip S. Meilinger, "The Origins of Effects-Based Operations", *Joint Force Quarterly*, issue 35 (Third Quarter, 2004), p. 117, https://ndupress.ndu.edu/portals/68/Documents/jfq/jfq-35.pdf
28. Ibid.
29. Carl von Clausewitz, "On War", ed. and transl. by Michael Howard and Peter Paret (Princeton,

that military objectives cannot be achieved if the population continues to display resilience and it is the will of the people that is more important than the army.[30] In all probability, it is this belief that convinced the British Bomber Command to conduct area bombing of Germany during World War II. Air Marshall Arthur Harris, the brain behind the campaign, reasoned that bombing cities would lead to high civilian casualties and destruction of infrastructure.[31] The ensuing indirect effect, according to him, would be disruption of urban life which would have a devastating and decisive effect on the German morale, and would play a crucial role in ending the war. However, contrary to this belief, the persistent bombing by the RAF ignited the patriotic sentiments of the German population rather than dampen their morale. Despite the physical damage to industrial plants, loss of working hours due to continuous air raid alarms and migration of more than two million people, German industrial production rose by three times between 1941 and 1944.[32]

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At the operational level, the unpredicted behavioural pattern displayed by the German military leadership led to significant desirable effects for the Allied forces. The persistent bombing produced a notable change in the outlook of the German leaders, forcing them to shift from an offensive mindset to a defensive one. The need to keep a large number of aircraft within Germany weakened

NJ: Princeton University Press, 1984), p. 485, https:// www.antilogicalism.com/wp-content/uploads/2019/04/on-war.pdf

30. Joseph Strange and Richard Iron, "Centre of Gravity: What Clausewitz Really Meant", *Joint Force Quarterly*, issue 35, 2005, pp. 25-26, https:// www.theforge.defence.gov.au/sites/default/files/adfwtc06_strange_and_iron.pdf

31. Philip S. Meilinger, "Air Strategy: Targeting for Effects", *Aerospace Power Journal*, Winter 1999, p. 52, https:// www. apps.dtic.mil/tr/fulltext/u2/a515118.pdf

32. Richard Overy, "The Air War in Europe, 1939-1945", in *A History of Air Warfare*, ed. John Andreas Olsen (New Delhi: Vij Books, 2010), p. 49.

During World War II, military experts did not have the wherewithal to predict the likely effects during the planning stage and, most importantly, the means to measure the effectiveness of their actions during the execution phase. Therefore, based on the effects produced, modifications in strategies could not be injected as remedial measures during the progress of the campaign.

the capacity of the army to fight effectively at most of the major European fronts.[33] By January 1944, 68 percent of German fighters were defending the homeland and only 17 percent were available to escort the bombers supporting the ground offensive in the eastern front.[34] Additionally, the need for more fighters had an impact on the production of bomber aircraft. In 1942, over 50 percent of combat aircraft produced were bombers which reduced to 18 percent over the next two years and had adverse ramifications on the conduct of air-land operations in support of the ground campaign.[35] To enhance the air defence capabilities to counter the bombardment, the Germans diverted their technological research programme towards the infamous terror weapons—the V-1 unmanned flying bomb and the V-2 rocket bomb. Analysts have concluded that the revenue siphoned off for this expensive project could have been utilised to produce 24,000 aircraft.[36] The bombing produced effects which were undesirable for the British at the strategic level but the unpredicted desirable second-order effects at the operational level had strategic implications.

The USAF doctrine states that in the struggle between being efficient or effective for successful implementation of effects-based operations, the latter takes precedence.[37] The British selected an efficient option of employing air power which proved ineffective because the campaign managed only partial

33. Robert Pois and Philip Langer, Winston Churchill, Arthur Harris and British Strategic Bombing", in *Command Failure in War: Psychology and Leadership* (New Delhi: KW Publishers Pvt. Ltd., 2011), p. 156.
34. Overy, n. 32, p. 49.
35. Ibid., p. 50.
36. Williams, n. 6, p. 156.
37. US Air Force Doctrine, vol. 3, ch. 2.

achievement of the objectives at the cost of 300,000 German civilian lives and 70,000 aircrew of the RAF.[38] During World War II, military experts did not have the wherewithal to predict the likely effects during the planning stage and, most importantly, the means to measure the effectiveness of their actions during the execution phase. Therefore, based on the effects produced, modifications in strategies could not be injected as remedial measures during the progress of the campaign, a capability which is comparatively more accessible in the present scenario.

JAPAN'S ATTACK ON PEARL HARBOUR

The Pearl Harbour attack is an appropriate example to illustrate the difference between effects-based and target-based air operations. The Japanese objective at the strategic level was to "cripple the American fleet with a single blow as a prelude to operations designed to capture the oil areas of Southeast Asia".[39] At the operational level, their objective was to destroy the US Pacific Fleet to impede US naval dominance in the Pacific theatre. Admiral Isoroku Yamamoto, the chief architect of the plan, had spent much of his military career developing air tactics for aircraft carriers and wrote, "it is necessary to have a powerful Air Force to strike deeply at the enemy's heart at the very beginning of the war and thus deal a blow from which enemy will not be able to recover for some time."[40]

Yamamoto believed that the COG for the US Navy in the Pacific region was the fleet of destroyers and carriers. This thought, apparently, was a fallout of the fascination Japanese naval officers had for the views propounded by sea power theorist Mahan, who emphasised on "the need to target enemy fleets by amassing overbearing power that swept opposing navies from important

38. Pois and Langer, n. 33, p. 172.

39. James E. Hazuka, "An Operational Analysis of the Pearl Harbour Attack", Thesis submitted at US Naval War College, Newport on June 17, 1993, p. 3, https://www.apps.dtic.mil/tr/fulltext/u2/a263962.pdf

40. David C. Gompert, Hans Binnendijk and Bonny Lin, "Japan's Attack on Pearl Harbour,1941", in *Blinders, Blunders, and Wars: What America and China Can Learn* (Santa Monica: Rand Corporation, 2014), p. 101, https://www.rand.org/pubs/research_reports

At the operational level, the Japanese failed to identify the effects that had to be produced at the tactical level to attain operational and strategic objectives. They concentrated their efforts on destroying capital ships and omitted the shore-based support facilities.

expanses".[41] Consequently, on December 7, 1941, two waves of 353 Japanese aircraft, attacked and damaged all eight battleships docked at Pearl Harbour.[42]

At the strategic level, the effects produced were undesirable and unpredicted. The perceived treacherous nature of the attack, loss of American battleships and the high death toll united the public opinion in USA against Japan. As a result, President Roosevelt was able to mobilise the economic and industrial might of the USA to defeat Japan and Germany.[43] This validates the arguments by Mattis and Vego that enemy reactions cannot be predicted and anticipating the same entails unattainable knowledge of the enemy.

At the operational level, the Japanese failed to identify the effects that had to be produced at the tactical level to attain operational and strategic objectives. They concentrated their efforts on destroying capital ships and omitted the shore-based support facilities, which were later utilised to reconstitute the US Pacific Fleet.[44] Pearl Harbour had no source of supply for oil and the same was transported from the mainland, approximately 2,000 miles away. The oil was stored in tanks which did not have bomb proof covers, were susceptible to small calibre bullets and were clearly visible to the naked eye from the air.[45] At the time of attack, these tanks stored 4.5 million barrels of oil and destruction of this critical fuel reserve would have

41. James R. Holmes, "Why Didn't Japan Finish Job?", *The Diplomat*, October 23, 2011, https:// www.the diplomat.com/2011/10

42. Ibid.

43. James Bowen, "The Pacific War from Pearl Harbor to Guadalcanal", Pacific War Historical Society, https://www.Pacificwar.Org.Au

44. Hazuka, n. 39, p. 17.

45. Patric H. Donovan, "Oil Logistics in the Pacific war: In and after Pearl Harbour", Thesis submitted at Air Command and Staff College, Alabama on April 1, 2001, p. 21, https://www. pdfs. semanticscolor.org/c9fb/e645b6cb575f282cef905cb6944.pdf

immobilised every ship based at Pearl Harbour and would have driven the US Pacific Fleet back to the west coast.[46] The ensuing fire in the island, as a result of the inferno, would have produced additional indirect effects.

The ship repair and servicing installations at the harbour were overlooked as potential targets. Out of the eight ships damaged, six were repaired at this dockyard and returned to service later during the war.[47] In May 1942, the aircraft carrier USS *Yorktown* received serious damage during the Battle of Coral Sea but the carrier was expeditiously repaired at Pearl Harbour. Interestingly, had the repair facilities been destroyed by Japan in the aerial attack six months earlier, there was a possibility that USS *Yorktown* would not have been repaired in such a short time frame and may have been out of action during the Battle of Midway in June 1942. Analysts believe that the absence of USS *Yorktown* from Midway would likely have altered the course of the Pacific War in Japan's favour.[48]

This ability of air power, to circumvent the strengths of the enemy and attack his vulnerabilities, enables aerial action to produce the effects that can undermine the critical capabilities of the adversary's COG.

The effects that were required to be produced were ignored by the flawed Japanese doctrinal precepts which had an overwhelming bearing over their strategies. The US Naval ships would have been identified as the COG since they provided the 'critical capability' to project US presence in the Pacific Ocean. Examination of the capabilities would have revealed the need for continuous replenishment of oil and infrastructural facilities for repairing the ships as 'critical requirements' for the US Navy to sustain prolonged operations. Further evaluation of the critical requirements would have led to identification of the fuel storage dump and repair dockyard as the 'critical vulnerabilities'. This ability of air power, to circumvent the strengths of the

46. Ibid.

47. Hazuka, n. 39, p. 20.

48. Bowen, n. 43, p. 3.

enemy and attack his vulnerabilities, enables aerial action to produce the effects that can undermine the critical capabilities of the adversary's COG.

Another probable reason for the Japanese action flows from the notion that offensive action by air power often provides instant perceptible first-order effects, which receives prompt recognition and attracts widespread reverence for the act. The LGB attack on Tiger Hill during the Kargil conflict, the Israeli air attack on the nuclear plant at Osirak in 1981 and the recent Balakot strike substantiate this viewpoint. The Japanese action was influenced by the need for immediate glory and they failed to visualise that destruction caused by air power is not an 'end' by itself but 'means' to produce desirable effects at the operational and strategic levels of war. To be fair to the Japanese, unavailability of methods to forecast 'effects' and dominance of their myopic fixation towards physical destruction of ships might have compelled them to select this COA. These two issues were addressed during Operation Desert Storm by exploiting the capabilities of air power to conduct effects-based operations.

OPERATION DESERT STORM

Operation Desert Storm highlighted the views of John Warden that technology, coupled with an effects-based approach, would allow USAF to discard the erstwhile sequential nature of bombardment to impress effective control over the enemy.[49] The postulation was formally institutionalised in the campaign planning process by retired Lt Gen David Deptula of USAF who, as a Colonel, was a member of the joint planning team during the operation. He convinced his superiors to change the targeting paradigm and concentrate on the 'effects' instead of target destruction. Deptula firmly believed that technological developments in the field of aviation, stealth aircraft and PGMs could be exploited to produce the obligatory effects during the campaign. In the opening hours of Desert Storm, more than 50 separate targets were attacked

49. John Warden III, "The Enemy as a System", *Airpower Journal*, vol. ix, no. 1, Spring 1995, p. 54, https://www.airuniversity.af.edu/portals/10/ASPJ/volumes-09

which enabled reasonable control over the enemy forces without the requirement for massing surface forces.[50]

An interesting example, narrated by Deptula, is presented to elaborate this thought process. Towards achieving air superiority, there was a requirement to incapacitate the Iraqi Integrated Air Defence System (IADS). Traditional operations would have focused on physical attacks aimed at destroying missile launchers, radars and the control centres. During the planning process, four major Sector Operations Centres (SOCs) were identified, all fortified with underground command and control bunkers. Experts concluded that adequate force level was not available to attain the operational objective through destruction-based targeting. The consequent plan that evolved did not focus on physical damage, but was designed towards producing 'effects' to render the air defence system ineffective. Employing half the number of aircraft, persistent bombing from stand-off distances produced psychological effects on the personnel operating the systems, which translated into functionary paralysis of the entire operating network. The objectives were achieved by creating the desired effects while employing fewer aircraft and less ammunition.[51]

The success of EBO and air power during Op Desert Storm should be viewed critically from an unbiased perspective. At the strategic level, the operation witnessed massive disparity between the military and the technological capabilities of the opposing forces, and victory for the coalition forces was a known reality. Iraq was aware of this fact and planned to conduct a warfare of attrition, in an attempt to bend and break the will of the mighty enemy.[52] Gen Norman Schwarzkopf, commander of the coalition forces, adopted a strategy which adhered to Sun Tzu's philosophy of "attacking the enemy's plan to save lives and money". Though the factor of time was not a constraint for initiating the campaign, it assumed great significance

50. Brig Gen Deptula, "Effects-Based Operations: Change in the Nature of Warfare", *Defense and Airpower Series* (Arlington: Aerospace Education Foundation, 2001), pp. 5-17.

51. Ibid.

52. Colin S. Gray, *Airpower for Strategic Effect* (Maxwell, Alabama: Air University Press, 2012), p. 212, http://aupress.au.af.mil

once operations commenced to counter the Iraqi design. Therefore, the preparatory time was utilised by the trained staff, equipped with newly developed computer-based programs, to analyse the effects that needed to be produced to achieve the objectives. To ensure that these objectives were achieved quickly and with minimal casualties after operations commenced, EBO and air power emerged as the appropriate, visionary and out-of-the-box solution.

At the operational level, the campaign fuelled the dichotomy with regard to the contentious relationship between COG analysis, application of EBO and aerial targeting. Unlike the theory expounded by Clausewitz and Mahan—which is widely accepted by surface and marine military commanders—air power theorists proved that attacking critical vulnerabilities reaped greater benefits than targeting the source of strength.

However, most notably, the campaign proved that EBO provided maximum dividends when the risk factor was least. In effects-based operations, risk is measured by the potential for an action to produce unpredicted outcomes. If the probability of unpredicted effects is low, risk is low.[53] During the planning phase of Operation Desert Storm, the preponderance of technological and information superiority enjoyed by the coalition forces enabled the staff to paint a comprehensive canvas comprising all possible effects that were likely to emerge from various military actions. In doing so, they reduced the emergence of unpredictable effects which empowered the commanders to identify the likely effects that aerial action needed to generate to modulate the enemy's behavioural pattern. A significant corollary of this analysis is that parity between contesting forces would increase the risk factor because the operational outcome is less certain. Additionally, the campaign highlighted that prediction of effects is easier when the opponent is weak and unmotivated in comparison to an adversary who is competent, innovative and adaptive. The US-led coalition forces realised this during Operation Allied Force in Kosovo and the Israeli Air Force during the Second Lebanon War.

53. Williams, n. 6, pp. 141-42.

SECOND LEBANON WAR

On July 12, 2006, a raid by the Hezbollah along the border between Lebanon and Israel resulted in the capture of two Israeli Defence Forces (IDF) soldiers and killing three others. The 34-day military campaign was one of the most intriguing air offensives undertaken by the Israeli Air Force (ISAF) in their accomplished history wherein the ISAF flew a total of 18,900 combat sorties and struck some 7,000 targets, at an average rate of 340 sorties a day. The operations witnessed the release of 24,000 air-delivered munitions, a figure comparable to the 29,500 weapons released by the coalition forces during Operation Iraqi Freedom in 2003.[54] But surprisingly, for the first time in its many trials by fire since 1948, the operation ended up being one of the most inconclusive performances by the IDF and a major confrontation ended without a clear military victory on Israel's part.[55] Though military experts have identified numerous reasons for the questionable performance, this paper will deliberate on issues pertaining to EBO and air power.

The war showcased the nebulous nature of future wars where boundaries between political and military objectives are likely to be obliterated. The IDF's new operational doctrine, issued three months before the outbreak of the war, relied heavily on technology and stressed the ascendancy of firepower over manoeuvre. It also highlighted the acceptance of the 'post-heroic' style of warfare, which strongly advocated avoidance of own fatalities and prevention of civilian casualties.[56] ISAF opined that aerial targeting would minimise own casualties by creating battlefield conditions to ensure that land forces would not be exposed to any resistance.[57] Milan Vego, in an article, has opined that air power on its own cannot win campaigns and the reason for the failure of IDF was their inability to synchronise the use of massive air attacks with operations on ground.[58] The emerging lesson is that, unlike

54. Benjamin S. Lambeth, *Air Operations in Israel's War Against Hezbollah: Learning from Lebanon and Getting It Right in Gaza* (Santa Monica: Rand Corporation, 2011), p. xviii, http://www.rand.org
55. Ibid.
56. Kober, n. 3, p. 7.
57. Ibid., p. 17.
58. Milan N. Vego, "Major Joint/Combined Operations", *Joint Force Quarterly*, issue 48 (First Quarter, 2008), p. 116, https://www.hsdl.org/?view&did=792434

Success of EBO hinges on the ability to evaluate the progress of actions towards achieving the effects, which entails constant adaptation to balance 'ends' with 'means' and likely costs with potential benefits.

Operation Desert Storm, air power and technology may not always be able to create the desired effects when employed in isolation, especially during unconventional and asymmetric warfare against a highly ideological, motivated and determined enemy.

Second, the operation highlighted that effects-based operations do not follow the principle of replicability where the same inputs always yield the same outputs. The IDF has long been known for its willingness to adapt foreign conceptions to meet their specific requirements.[59] The IDF and the ISAF were enamoured by the role played by air power in the success of Operation Desert Storm and the doctrinal changes were a result of the strong conviction that EBO and air power could always recreate the same success story, irrespective of the governing factors and operating conditions. The present USAF doctrine stipulates that unknown and uncontrolled variables make replication of results impossible. Hence, EBO necessitates thorough examination of the operating environment, relating the effects to the objectives and thereafter identifying the role for air power.

Lastly, effects-based operations came under attack as having failed to meet the test of combat conditions. After the success of Operation Desert Storm, the IDF Institute for Campaign Doctrine Studies developed an alternative doctrine for military thinking, replacing traditional military terminologies like 'objective' and 'subjugation' with new phrases like 'campaign rationale' and 'conscious-burning of the enemy'. The doctrine was designed to influence the perception of the enemy, rather than destroying it physically.[60] Subsequent to the war, a senior army officer of IDF commented that apart from the confusion created by the literature, EBO failed in translating the 'effects' enunciated by the higher echelons to the mandatory actions at the

59. Russell W. Glenn, *All Glory Is Fleeting: Insights from the Second Lebanon War* (Santa Monica: Rand Corporation, 2012), p. 19, http://www.rand.org

60. Ibid., p. 21.

operational level. He added that precious time was wasted by the staff to evaluate the effects and the means to achieve them.[61]

The campaign proved that correct and continuous measure of effectiveness determines modification and alterations in plans at the tactical and operational levels to generate the desired effects.[62] On realising that the effects were not being attained and the difficulty encountered in measuring the effectiveness of their actions, IDF made the cardinal mistake of reviewing the 'effects', rather than modifying their strategies.[63] The military leaders failed to understand the fact that success of EBO hinges on the ability to evaluate the progress of actions towards achieving the effects, which entails constant adaptation to balance 'ends' with 'means' and likely costs with potential benefits.

EBO, AIR POWER AND FUTURE WARS

The Gerasimov Doctrine—enunciated by Russia in 2013—scripted the background for Grey Zone warfare and exemplifies the ambiguous and complex nature of future conflicts where disinformation, political influence and economic coercion would be the primary non-military means to achieve security goals.[64] According to historian Hal Brands, this type of warfare is designed at achieving objectives and end states without escalating to overt warfare and crossing the stated red lines.[65] In future, strategies would be adopted that would seek to prevent full-fledged wars and the threat of employment of force—especially air power—would be overtly demonstrated for projecting coercion or deterrence strategies. Coercion is *"persuading an adversary to change his behaviour through the use of force"* while

61. Ibid.
62. Williams, n. 6, pp. 144-45.
63. Kober, n. 3, p. 33.
64. Kathleen H. Hicks, "Russia in the Gray Zone", Centre for Strategic and International Studies, July 25, 2019, https://www.csis.org/analysis/russia-gray-zone
65. Hal Brands, "Paradoxes of the Gray Zone", Foreign Policy Research Institute, February 5, 2016, http://www. fpri.org/article/2016/02/paradoxes-gray-zone

Deterrence by denial, which is defensive in character, advocates denying the adversary the ability to achieve his military and political objectives. On the other hand, deterrence by punishment threatens imposition of severe penalties or wider punishment, like all-out war or even nuclear escalation through aggression.

deterrence is *"preventing a specific behaviour by the adversary"*.[66] Both the strategies aim at producing effects to regulate the behaviour of the adversary, with deterrence aimed towards prevention and coercion towards enforcing a change.[67] Deterrence can be imposed through either denial or punishment. Deterrence by denial, which is defensive in character, advocates denying the adversary the ability to achieve his military and political objectives. On the other hand, deterrence by punishment threatens imposition of severe penalties or wider punishment, like all-out war or even nuclear escalation through aggression.[68]

The drone attack by the US at Baghdad, in January 2020, that eliminated General Qassem Soleimani and the Balakot strike by IAF demonstrated the capability of air power to inflict deterrence by punishment. The effects produced, both desired and undesired, would have been assessed and the desired outcomes would have outweighed the undesired effects in the cost-benefit analysis. Unlike the killing of Soleimani, the Balakot strike was symbolic in nature and the primary intent was not blowing up a building or killing some terrorists, but to demonstrate that India had the political gumption to attack targets inside Pakistan.[69] In both cases, the weaker states were forced to exhibit a rather conservative and inhibited response which, ostensibly, was to satisfy their respective domestic

66. Robert A. Pape, *"Bombing to Win: Air Power and Coercion in War"* (New York: Cornell University Press, 1996), p. 12.

67. Ibid.

68. Michael J. Mazarr, "Understanding Deterrence, Perspectives", Rand Corporation, 2018, https://www.rand.org/content/dam/rand/pubs/perspectives/PE200/PE295/RAND_PE295.pdf

69. Rajesh Rajagopalan "The Deterrence Implications of Killing Soleimani", Raisina Debates, January 29, 2020, ORF, http://www.orfonline.org.expert-speak/the-deterrence implications of killing soleimani-60483/

audience. In the Indian context, a significant effect of the strike was that IAF shattered the long held conservative perception that employment of air power is escalatory in nature. Over the years, this impression had evolved based on the presumption that air power expands the stature of destruction and held a high risk of escalating the conflict.[70] Additionally, the strike also busted the myth portrayed by Pakistan of a direct connection between any Indian military action and their retaliation with tactical nuclear weapons.[71] These indirect effects, which were unpredictable yet desirable, will have a significant influence on the employment philosophy of air power in the Indian subcontinent in future.

Another recent operation, in the realms of asymmetric warfare, highlights the innate relation that air power shares with EBO. The Saudi Aramco oil facilities were attacked by eighteen drones and seven cruise missiles on September 14, 2019.[72] At the tactical level, the impact points were the separation towers in the extraction facility, where oil and gas are segregated for stabilising the crude oil.[73] The damage created the anticipated effects with almost 50 percent of the Saudi oil production destroyed, which accounted for nearly 5 percent of global oil production. The cumulative effects, over the next few days, led to a hike in the crude oil prices by nearly 15 percent. This further led to destabilisation of the world energy market and adversely affected the financial business all over the globe, including a drop in Sensex and Nifty in India.[74] The abovementioned examples reveal that, in future, political resolve, advancements in battlefield transparency, proliferation of unmanned platforms and accuracy of stand-off weapons would provide air power the required tenacity and assertiveness to produce the preferred consequences.

70. Manpreet Sethi, "Air Power at Balakot: Exploiting Flexibility for Strategic Effect", *Air Power Journal*, vol. 14, no. 3, Monsoon 2019 (July-September), p. 10.

71. Ibid.

72. Editor's Note, *Air Power Journal*, vol. 14, no. 3, Monsoon 2019 (July-September).

73. Ibid.

74. Maj Gen Ajay Kumar Chaturvedi (Retd), "Impact of Attack on Saudi Aramco Facilities on India", Vivekananda International Foundation, September 25, 2019, http://www.vfindia.org/article/2019/september/25/impact-of-attack-on-saaud-aramcottack-on-sud-aramaco-facilities-on-india

Needless to say, every action will produce an effect, especially if the action is produced by air power. The exploitation of these effects, towards achieving the objective, should be the premise of EBO when fighting in a joint environment.

In the Indian context, the stated political end states and military objectives that need to be achieved would determine how campaigns would be planned and battles fought. However, in future, synchronisation of EBO and air power would be surrounded by discrete caveats which would entail serious understanding of the concept to ensure its successful implementation. At the politico-strategic level, it should be understood that despite the changing nature of warfare, fundamentals of war will remain all-pervasive. Effects-based operations would ensure that the basic principles of war like maintenance of aim, concentration of force, economy of effort, surprise and flexibility are neither overlooked nor compromised. The amorphous nature of future wars means that this approach would not hinge on application of military power alone and will have to be seamlessly orchestrated in concert with other elements of national power. Therefore, emphasis should be towards a holistic assessment to interpret the 'effects', and not the means, that need to be produced at the tactical and operational level so as to force the adversary to behave differently. While doing so, if air power emerges as an effective and potent instrument, the same needs to be employed.

Second, critiques of EBO claim that the myriad variables omnipresent in war, coupled with the uncertainty of human behaviour, makes evaluation of effects a cumbersome, complicated and equivocal task. This thought process is an outcome of the predicament encountered in identifying the 'effects' against an unknown adversary with an alien political structure, economic set-up, cultural background and religious mindset. However, against adversaries with whom India has fought wars in the past, the political, military, economic and social environment would be subjected to continuous evaluation of 'effects' and examination of available options at the strategic, operational and tactical levels to achieve these effects. Harmonising the

existing capabilities of air power towards achieving the wanted effects, while avoiding the undesired effects, would enable military planners to identify targets for aerial engagement during peacetime. For example, globalisation and the growing mercantile reliance between nations has intertwined the world economy. This implies that infrastructural establishments in enemy territory can no longer be presumed as the sole property of the adversary, and, targeting them, especially by overt aerial action, could evoke international repercussions and may provoke neutrals. EBO would ensure that such restrictions, emerging from extraneous political compulsions, are identified in the planning process and incorporated in the target plan.

Thirdly, effects-based operations, as a doctrinal precept, should not be shrouded in vocabulary wherein semantics overshadow its tangible application. Needless to say, every action will produce an effect, especially if the action is produced by air power. The exploitation of these effects, towards achieving the objective, should be the premise of EBO when fighting in a joint environment. One of the facets of effects-based operations is that it allows far-reaching evaluation of a range of effects, both, the effects required to achieve the objectives and the effects that are likely to emerge from an action. Comprehensive analysis of these effects and linking them with objectives would assist campaign planners in identifying targets, resource allocation and, importantly, prioritising the sequence of targeting. For example, if the effects are to cut off the supply chain to the enemy ground forces fighting at the front, then destroying a critical bridge, through aerial action, might produce the necessary results. However, destroying an inconsequential bridge in enemy territory, because the capability exists, would mean that critical resources are frittered away in attacking targets that do not lead toward attainment of the end state. Similarly, if a logistics node is to be destroyed to choke the enemy, the attack should be timed in a manner to ensure that the sudden absence of resupply creates the effects and impacts the combat potential of the adversary, both physically and mentally. A premature attack on the logistics node might produce the same damage but would enable the enemy to find mitigating solutions to make certain that the effects do

In future, prior to employment of air power, political and military leaders would need to examine the predictability of effects, both direct as well as indirect, link these effects to the desired objectives, deduce the time required for these effects to fructify, extrapolate the risk factor and compare it with the desirability quotient.

not permeate towards the frontline. Joint planning and effects-based operations will ensure that air assets are exploited optimally and employed judiciously towards achieving the objectives.

Lastly, if the factors of space and time dictate restrictions at the political and military echelons, then employing air power towards producing second and third-order effects would find reduced acceptability in the planning stage. This thought process needs to be contested because second-order effects, when produced through aerial action, have the propensity to generate unproportionable outcomes. The 16 aircraft raid on Japan in 1942, led by Lt Col Jimmy Doolittle, achieved minor effects at the tactical level but produced second and third-order effects which had ramifications at the grand-strategic level. The fear created amongst the populace changed the thinking of the Japanese and transformed their war-fighting philosophy. Their offensive in China was halted and the national military effort was altered and shifted towards the Pacific region, a decision which proved decisive in their overall defeat.[75] Employment of air power, in a calculated and calibrated manner, has the capacity and audacity to rapidly change the perceptions of the adversary, as was witnessed after the attack on the Governor's House in Dhaka during the 1971 war. In future, prior to employment of air power, political and military leaders would need to examine the predictability of effects, both direct as well as indirect, link these effects to the desired objectives, deduce the time required for these effects to fructify, extrapolate the risk factor and compare

75. The Doolittle raid has been discussed in the USAF Doctrine, twice, to elucidate the efficacy of air power towards producing effects. The aerial action has been used to explain the input versus output proportionality factor and subsequently to highlight the implications of unpredictable effects.

it with the desirability quotient. An analysis of such order would enable the architects of a campaign to formulate cogent CsOA that would facilitate effective and optimum employment of air power.

CONCLUSION

EBO is a theory that emerged because of the changing character of war. For centuries one has traditionally measured victory or defeat in terms of armies destroyed, soldiers slain and territory captured because these standards are quantifiable and widely recognised.[76] EBO contests this thought process by arguing that military action need not always be in the realms of physical destruction and could be intended towards creating psychological effects that would serve the overall military aim. The manifestation of these 'effects', in terms of credibility and effectiveness, has often been linked to the ability of air power to transcend boundaries and produce immediate results, while promising minimal losses. EBO and air power, therefore, will continue to be viewed as the potent combination which conjoins political objectives with military options. However, EBO is not a silver bullet and would necessitate military strategists to undertake an extensive and impartial appreciation of this concept and its symbiotic relation with air power. Understanding the essence of effects-based operations, articulating the doctrines accordingly and leveraging the capabilities of air power towards producing the desired effects would decide whether this combination sinks or swims on its own merit.

76. Meilinger, n. 31, p. 60.