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Synchronization of Air Power Effects -- Coming Full Circle Following A Century of Powered Flight

by

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Synchronization of Air Power Effects--Coming Full Circle Following A Century of Powered Flight presents two operational constructs for air campaign planners. There's been much rhetoric recently on effects-based operations. However, doctrine does not capture sufficiently all the complexities of effects-based operations. Moreover, many believe we have planned using effects-based operations. A perspective on both the Gulf War and Kosovo show that we're just beginning to understand how to do effects-based operations, but we haven't actually exploited its capabilities yet.

Effects-based operations incorporates systems analysis, presently done exceptionally well at the Joint Warfare Analysis Center and goes further by predicting second through fourth order indirect effects of lethal and non-lethal operations. It reinforces the need for understanding of levels of war by planners and Combat Assessment personnel, to facilitate moving the correct information in ever-tightening decision cycles.

This paper summarizes air power theory, reviews what effects-based operations mean and present the constructs Effects Wheel and Effects Vine as tools for planners, executors, and CA personnel to exploit effects-based operations in future planning efforts.

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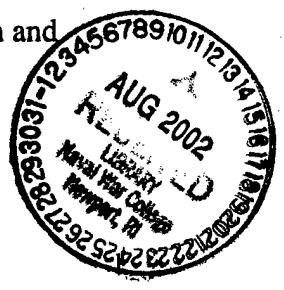
Introduction

> There is a sense of exhilaration in flying through the free air, an intensity of enjoyment, which possibly may be due to the satisfaction of an inborn longing transmitted to us from the days when our early ancestors gazed wonderingly at the free flight of birds and contrasted it with their own slow and toilsome progress through the unbroken wilderness...Men have never ceased to envy the birds and long for the day when they too might rise above the dust or mud of the highways and fly through the clean air of the heavens...Once above the tree tops, the narrow roads no longer arbitrarily fix the course. The earth is spread out before the eye with a richness of color and beauty of pattern never imagined by those who have gazed at the landscape edgewise only...The rich brown of freshly-turned earth, the lighter shades of dry ground, the still lighter browns and yellows of ripening crops, the almost innumerable shades of green produced by grasses and forests, together present a sight whose beauty has been confined to balloonists alone in the past. With the coming of the flyer, the pleasures of ballooning are joined with those of automobiling to form a supreme combination.[1]
>
> *Wilbur Wright, 1908*

Just five years after the Wright brothers opposed gravity at Kitty Hawk on December 17th, 1903, Orville Wright added his view to this of his brother saying that the airplane would be "a military proposition, and it will develop along military lines."[2] There's no surprise in the accuracy of this prediction.

For nearly a century since that first flight, many have theorized about the military contributions of the airplane and most have alluded to or directly conversed about the *effects* it might have on wartime operations. The present environment is finally the perfect soil within which to germinate the next step -- institutionalizing effects-based operational synchronization of air power within joint force operations. The beginning of the last step that remains is completing the construct by which effects-based synchronization can be planned and executed.

Effects-based operational synchronization first requires a construct by which to understand the complexities of effects-based theory, second, requires the continuing and evolving foundation of systems analysis to assist predictive capabilities when examining lethal and non-lethal force application, and, third, requires a construct and procedures by which to plan and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sustain it during execution of the air operations plan. This paper provides one method to fulfill the first and third requirements.

The Theorists and Levels of War

The following summarizes air power theorists and those of Sun Tzu and Clausewitz.

Theorist	Circa	Model	Force Application Focus	COG(s) or Points of Leverage	Mechanism
Sun Tzu	500 B.C.		War Making & War Will	Forces and will	Out-psych the enemy
Clausewitz	1780-1831		War Making	Ground Army, Capital, and Allies	Destroy the enemy army
Air Corps Tactical School	1930s	Industrial Web	War Sustainment & War Will	Vital system functions	Disable vital economic functions and destroy will
Douhet	1921		War Sustainment & War Will	Population	Attacking cities to destroy will
Trenchard	1928	Vital Centers	War Sustainment & War Will	Production, transportation, & communications	Strategic paralysis and impair morale
Slessor	1936		War Making & War Sustainment	Forces & Functions	Starve war making and interdict sustainment
Mitchell	1920s-40s		War Making, War Sustainment, & War Will	Forces & Functions	Defeat forces, cripple war industry, and destroy will
Boyd	1987	OODA Loop	War will	Multiple systems	Decision paralysis through rapid and multiple attacks
Warden	1988	5 Rings	War Sustainment & War Will	Functions	Strategic paralysis through leadership attacks
Deptula	1995		War Sustainment & War Will	Functions	Strategic paralysis through parallel attack

Table 1 - Summary of Theorist Viewpoints[3]

Sun Tzu believed the epitome of success was winning without fighting, alluding to creating a psychological effect so devastating that it resulted in adversary capitulation without battle.[4] Clausewitz was more realistic in his approach that one had to defeat the enemy army to win.[5] Air power theorists before John Warden emphasized creating operational and strategic effects, and in fact used the term paralysis well before Warden's use in 1988.[6] A commonality to these theorists is that they all predicted contributing effects of air power actions.

Unfortunately, our present doctrine doesn't support what they theorized and what we now know: lethal and non-lethal operations can create effects across the levels of war. Joint Pub (JP) 1-02, Glossary of Terms, is incomplete in its discussion of levels, actions, and effects. JP 1-02 lists the strategic level of war as:

> The level of war at which a nation...determines national or multinational (alliance or coalition) security objectives and guidance, and develops and uses national resources to accomplish these objectives. Activities at this level establish national and multinational military objectives; sequence initiatives; define limits and assess risks for the use of military and other instruments of national power..."[7]

Additionally, JP 1-02 lists the operational level of war as:

> The level of war at which campaigns and major operations are planned, conducted, and sustained to accomplish strategic objectives within theater or operational areas. Activities at this level link tactics and strategy by establishing operational objectives needed to accomplish the strategic objectives, sequencing events to achieve the operational objectives, initiating actions, and applying resources to bring about and sustain these events...and provide the means by which tactical successes are exploited to achieve strategic objectives.[8]

These definitions help somewhat by detailing that operational actions should lead to operational objectives, which should be linked to strategic objectives. However, they don't address resulting effects and their relationships with one another. Furthermore, JP 1-02 doesn't list definitions for *effects*, or mention *effects* in the strategic or operational levels of war. Lastly, although it contains an entry for *strategic air warfare*, the definition doesn't include *effects*, and there's no entry for *air warfare* or *operational air warfare*.[9]

Milan Vego sheds different light to the levels of war, defining the Operational level as:

> [the] level at which military and nonmilitary sources of power are employed to accomplish military-strategic or theater-strategic objectives through the planning, preparation, and execution of a single campaign; sometimes the same objective could be accomplished by conducting a major joint or combined operation; this level of war is conducted in a given theater of operations.[10]

In contrast, he defines the Tactical level as:

> [the] level at which tactical actions are planned, prepared, and conducted; this level of war is almost exclusively focused on physical combat--applying military force to achieve a series of tactical objectives.[11]

He goes on to explain that the theater-strategic level is that which encompasses "several campaigns...each aimed to accomplish a single theater-strategic objective."[12] Ironically, he does not include *Strategic level* in his glossary, but does comment that there are two strategic sub-levels; national-strategic and theater-strategic. Unfortunately, his definitions help only slightly by making the link between operational actions and theater-strategic objectives, but his terms national-strategic, theater-strategic and military-strategic add confusion. Additional confusion is created when looking at the JP 1-02 definition for strategic air warfare:

> Air combat and supporting operations designed to effect, through the systematic application of force to a selected series of vital targets, the progressive destruction and disintegration of the enemy's war-making capacity to a point where the enemy no longer retains the ability or the will to wage war. Vital targets may include key manufacturing systems, sources of raw materials, critical material, stockpiles, power systems, transportation systems, communication facilities, concentration of uncommitted elements of enemy armed forces, key agricultural areas, and other such target systems.[13]

This definition covers nearly all air to ground attack options, overstates what is really strategic in nature, and confuses recently used terms of war-will, war-sustaining, and war-making aspects of the enemy.[14]

The Air Force discusses the levels of war with only slight improvement in clarity in Air Force Doctrine Document Two (AFDD-2) *Air Force Organization and Employment*:

> The focus at a given level of war is not on the specific weapons used, or on the targets attacked, but rather on the desired effects...Effects at the strategic level of war include destruction or disruption of the enemy's center(s) of gravity (COGs) or other vital target sets, including command elements, war-production assets, and key supporting infrastructure that impairs the

> enemy's ability or will to wage war or carry out aggressive activity...In general terms, the strategic level of war addresses the issues of WHY and WITH WHAT we will fight and WHY the enemy fights against us.[15]

This definition includes *effects*, but confuses actions of destruction and disruption as strategic effects. Destruction and disruption are more often first-order operational effects, *that result in additional, indirect, follow-on strategic effects.* Air Force doctrine goes on to offer an explanation of operational level with:

> Operational effects such as theater air superiority, command and control (C2) decapitation, and battlefield isolation are the tools with which the operational air commander supports the overall strategy. In terms of aerospace operational employment and targeting, planning at the operational level of war determines WHAT we will attack, in WHAT order, and for WHAT duration.[16]

Moreover, Strategic Attack, as defined in AFDD 1-2, Air Force Glossary, is nearly identical to the Strategic Attack entry in JP 1-02:

> Military action carried out against an enemy's center(s) of gravity or other vital target sets including command elements, war production assets, and key supporting infrastructure in order to effect a level of destruction and disintegration of the enemy's military capacity to the point where the enemy no longer retains the ability or will to wage war or carry out aggressive activity.[17]

Unfortunately, AFDD 1-2 does not include entries for strategic, operational, and tactical levels of war and does not discuss further actions at these levels, objectives, or effects (accept for level of destruction/disintegration). In his Five Rings model, John Warden professed that his central rings of leadership, system essentials, and infrastructure constituted the strategic level of air operations.[18] In contrast, JP 1-02 defines the operational level as activities that "ensure the logistic and administrative support of tactical forces"[19] This would imply that a nation's transportation infrastructure is not strategic, but operational in nature. Moreover, even in cases where "strategic effects" were referenced, as in the case of the term *strategic bombardment* during World War II (WWII), effects were actually seen in the operational level of war, not the strategic level.[20] In the end, there's insufficient clarity in Air Force and Joint doctrinal publications on the levels of war, as they related to effects.

In summary, theorists have and continue to offer theories on the contributing effects of air power, but we still do not clearly capture in doctrine the relationship between operations across the spectrum of levels of war and associated effects. It's clear, however, that tactical and operational actions are linked indirectly to the strategic level. Therefore, it's important to understand that strategic operations are those operations that have the potential to directly create strategic effects, *although they may in reality be tactical or operational in nature and never create those strategic effects.* Moreover, operational actions can also lead indirectly to strategic effects. The implication is that proper procedures for planning, directing, and Combat Assessment (CA) of air operations need to incorporate this *across-the-spectrum/indirectly-linked* dynamic.

Recent Effects-Based Theorizing and Doctrine

In the past eight years, there have been many noteworthy efforts out of the School of Advanced Aerospace Studies (SAAS) at Maxwell Air Force Base (AFB) that detail the complexities of effects-based operations and the impact for air operations planning. Beagle (2000), Fadok (1995), Kreighbaum (1998), Walker (1998), and Williams (1994) all reinforce the idea that operations across the spectrum of levels of war can create effects across the spectrum. These effects are classed as first, second, third, and fourth order effects and predicting them becomes increasingly complex as we move from first to fourth. First order effects, or direct effects, are easier to comprehend, easier to evaluate, and are the most thoroughly incorporated in our military planning and execution processes. These authors surmise that we have to better understand the complexities of second through fourth order effects to take the next evolutionary jump to more effective and more synchronized effects-based air operations.[21]

Many others believe capabilities of precision, stealth, and continuous (day/night) flying operations brought together in Operation DESERT STORM (ODS) afforded us the opportunity to take the next step to more effective and synchronized air operations. In 1995, then Brigadier General David Deptula summarized this belief in his Aerospace Education Foundation article *Effects-Based Operations -- Change in the Nature of Warfare.* In it he states that precision and stealth enabled effects-based operations by redefining the concept of mass and allowing the coalition to strike more targets in one day than all targets combined in 1942 and 1943 in WWII.[22] He suggests that effects-based targeting took place because planners hypothesized that reducing the bombs per target would still be disruptive enough to create the needed effects.[23] However, this misses the point, since planners took a bottom-up approach on effects, without considering synchronization, and were forced to assign the available F-117s across all known operation centers in the air defense system. They did not have the luxury of numbers to assign sufficient jets across each target to destroy the air defense centers more permanently, but resigned to reattack targets if needed effects were not created or sustained.[24] He also takes the effects-based discussion too far in suggesting that the legitimacy of force structure might be better served by analyzing a force's ability to create effects -- in other words, using a measure of "*desired effect per unit of lift.*"[25] This postulation misses the actual complexities of effects-based theory, suggesting that strategic, non-linear, psychological effects of specific forces could actually be measured. Although it is important to understand that true effects-based operations are planned top-down from the objectives which define the effects required of lethal or non-lethal force application, the salient point in his discussion is that "Systems-based intelligence analysis is critical to the application of effects-based operations."[26] Effects-based operations require a foundation of thorough systems analysis, and then promise increased value by recommending the

best effects to create and the proper timing of those effects--timing which in turn might create additional synergistic effects.

The Air Force has captured some of this in its more timely, and therefore more relevant, "Doctrine Watch" articles available at the Air Force doctrine web site. In Doctrine Watch article #13, *Effects-Based Operations,* dated 30 November 2000, the point is restated that doctrine does not yet sufficiently capture the details and definitions of effects-based operations. Moreover, it emphasizes that objectives need to enable effects-based operations.[27] It argues this is done by stating objectives using effects terminology, for example *rendering 50% of the brigade ineffective*, as opposed to *destroying 50% of brigade armor.* While this begins to illuminate the problem, it's more important to understand the effects created by actions, whether the actions are based upon perfectly worded objectives or not . Given the distrust evident during ODS on the actions of the Joint Force Air Component Commander (JFACC), I believe we're decades away from cross-service acceptance of JFACC determinations of how to best reach an effects-worded objective. While we continue to refine our grip on effects-based operations, we can help manage task-oriented objectives by asking the question "what effect are we trying to reach with this task?" Other services have incorporated this concept by training to verbal orders that include both Task and Purpose[28].

How does this match up with doctrinal references beyond the basic definitions already covered? In JP 2-0, Doctrine for Intelligence Support to Joint Operations, relevant discussions cover the levels of war, the perishability of tactical intelligence, the importance of synchronizing with operations planners, and the critical nature of identifying high value and high-payoff targets.[29] However, the publication is insufficient in its coverage of the overlapping and interrelated nature of tactical, operational, and strategic intelligence actions. It discusses one

central Priority Information Requirement (PIR) process and doesn't make clear that surveillance operations and analysts should be sensitive to the intelligence impact across each of the levels to facilitate the rapid movement of tactical and operational intelligence. For example, intelligence operations exploiting a UAV loitering over a weapons storage facility should feed immediate tactical intelligence back for battle damage assessment, should look for operational capability left in the site through movement of military personnel and materials, and should look further for civilian activity or casualties for strategic consequences or negative effects from force application operations. The implication is that intelligence systems, personnel, and procedures need to evolve to fully incorporate execute effects-based operations and the requirements of the different level of operations.

The Methodologies

The Joint Doctrine Air Campaign Course (JDACC) at Maxwell AFB, Alabama instructs in the process of designing a Joint Air and Space Operations Plan (JAOP, or JASOP as still reflected in some manuals). The process is depicted in Figure 1 and details the sequences of getting tasks(s) and guidance, Operational Environment Research (OER), Objective Determination, Center of Gravity Identification, Strategy Development, and JOAP Development. OER, considered by many synonymous with intelligence preparation of the battespace, provides the analysis on individual systems and the foundation for further work on deducing Centers of Gravity (COG), Critical Capabilities (CC), Critical Requirements (CR), and Critical Vulnerabilities (CV) under the COG Identification stage. The Air Campaign Course handbook outlines characteristics of the process, emphasizing important aspects of natural iteration; being open to starting at any point in the process, although strategy development normally should follow objective and COG determinations; and phasing as the key overall.[30] For all its value, the

Air Campaign Handbook also misses the concept of synchronizing operational joint effects. By missing this key of synchronization, it also lacks any discussion on additional indirect effects this synchronization could produce.

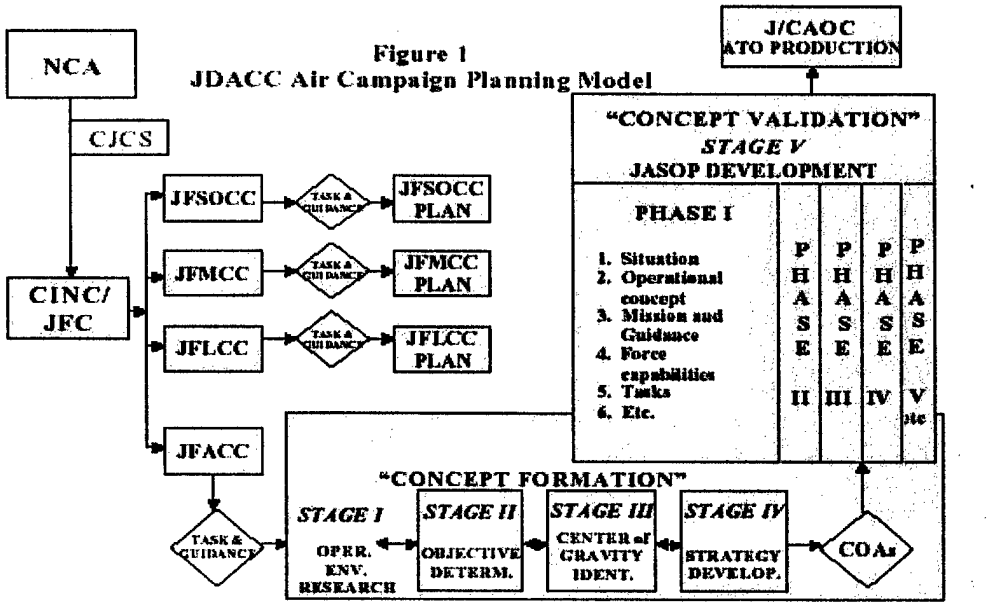

Figure 1 - JDACC Air Campaign Planning Model[31]

Another publication that offers an methodology adaptable to Air Campaign Planning is The Joint Targeting Publication published by the Air, Land, Sea Applications (ALSA) Center at Langley AFB. It contains a general depiction of the targeting process,[32] (Figure 2) and it's obvious that both cycles in this depiction greatly generalize the planning process. If we were to force Effects Synchronization into this Joint Targeting Process, it fits most appropriately on the portion of the circle where we find the target development and weaponeering assessment phases. More specifically, however, this model should change to replace target development and weaponeering assessment to Operational Environment Research (which would include systems analysis, weaponeering analysis, and effects predictions) followed by Joint Effects Synchronization.

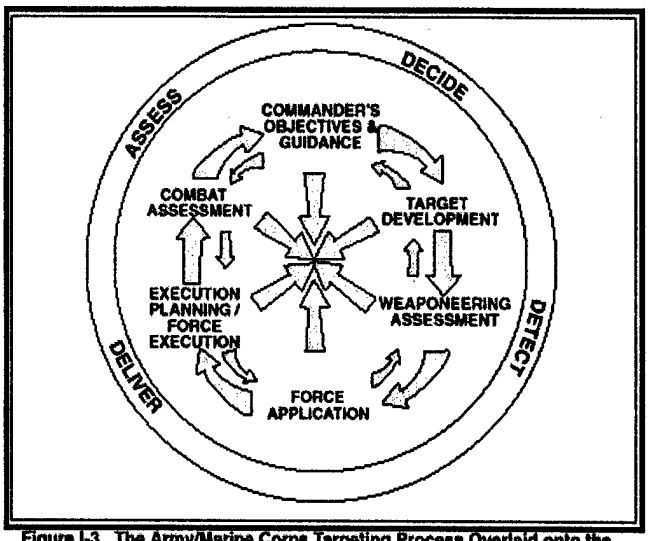

Figure I-3. The Army/Marine Corps Targeting Process Overlaid onto the Joint Targeting Process

Figure 2 - The Army/Marine Corps and Joint Targeting Process[33]

Listed steps within the targeting part of this process (or new OER step) could remain in the publication: "(a) Establish information requirements, (b) Identify potential target systems, (c) Identify critical nodes and their activities and functions, (d) Develop target system models and utility measures, (e) Validate targets and "No-Hit" lists, and (f) Define production requirements,"[34] but should incorporate the earlier mentioned concepts of COG, CC, CR, and CV, with the critical foundation of OER.

An immense contribution to OER is accomplished at the Joint Warfare Analysis Center (JWAC) established in May of 1994 and located at Dahlgren, VA. A Navy-sponsored Joint command, "JWAC develops and adapts modeling and simulation technologies for analysis, computation and the presentation of options to combatant commands, the Joint Staff and other customers. Furthermore, JWAC assesses strategic and operational planning."[35] JWAC uses systems analysis to determine a nation's industrial and military strengths, interdependencies, critical requirements, CVs, and COG(s). The databases built help air operations planners

determine how force application can bring about the necessary effects to meet military objectives. As Doctrine Watch #13 states, "For years the Air Force has used JWAC products to assist targeting to achieve effects-based operations at the tactical level of war."[36] Sustaining the JWAC process is critical to future effects-based operations, but they must also expand to offer potential indirect effects of tactical and operational actions against the systems analyzed and postulate how synchronization could produce additional, synergistic effects.

The "Effects Wheel" Construct

A key requirement of incorporating effects-based operations is having a construct by which to understand, train to, and explore its complexities. Warden's Five Rings model mentioned earlier generally spans the spectrum from tactical to strategic across the rings as one moves from the outermost ring to the innermost ring. If inverted, we end up with the tactical in the center and strategic in the outermost ring. With rings emanating from the tactical center to the strategic outside, this construct can be compared with ripples on a pond, capturing the concept that some tactical actions emanate into operational and strategic effects. If further evolved this model into a three dimensional tube, we can make the model (see Figure 4) representative of other

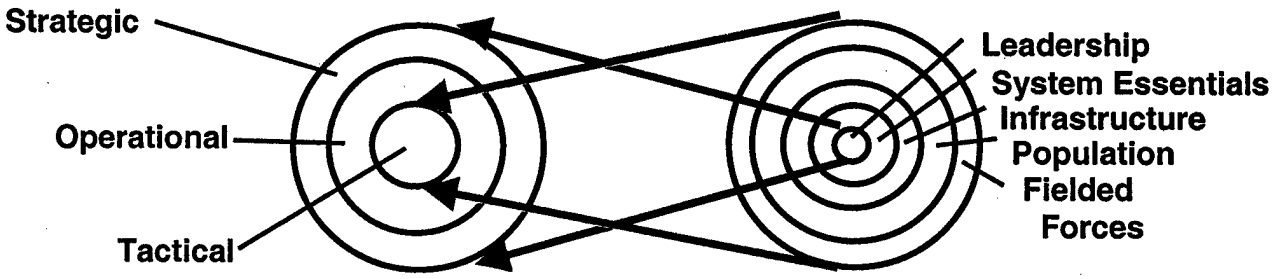

Figure 3 - John Warden's 5 Rings Inverted

relationships across the tactical to strategic spectrum. Applying the assumption of constant volume of air flow through the tube, while applying Bernoulli's principle, it follows that the

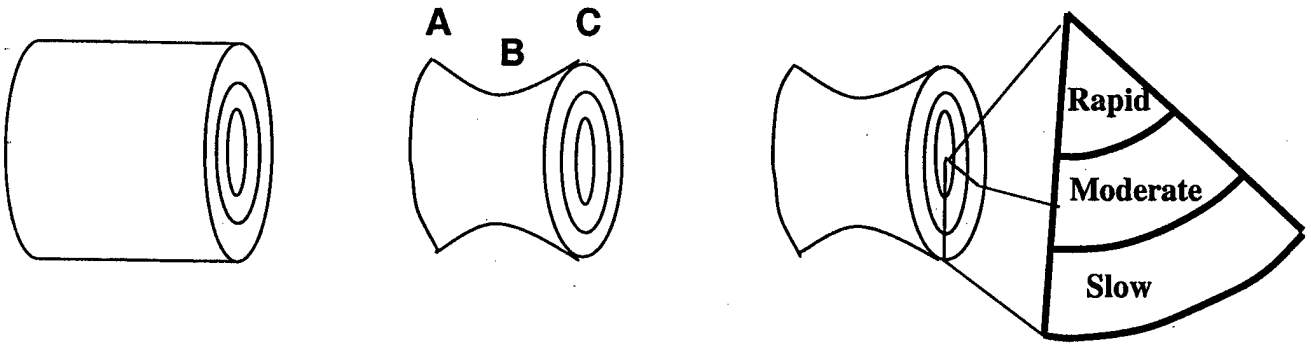

Figure 4 - Bernoulli's Principle For Analogy Of Speed of Operations

speed of the mass of air would be fastest at point B where the tube is pinched down to a smaller area, or most closely aligned with the tactical area. This visualization provides an abstraction of speed of operations, decision loop requirements, and speed of creating effects, since generally tactical actions are more rapid, need tighter Observe, Orient, Decide, and Assess (OODA)[37] loops, and create effects more quickly.

Adding additional 'pie slices' within our model, we can replicate other characteristics of the spectrum that spans the levels of war and pertain to effects. The following table summarizes eleven different, but related relationships across this spectrum.[38]

Levels of War	Tactical	Operational	Strategic
Complexity	Simplest	Moderately Complex	Complex
Speed of Operations	Rapid	Moderately Rapid	Slowest
Speed of Effects	Quickest	Moderately Quick	Longest to Gain
Duration of Effects	Shortest	Moderately Short	Longest
Forecast Reliability	Most Reliable	Moderately Reliable	Least Reliable
Resistance Mechanism	War-making	War-Sustaining	War-Will
Associated Effects	Physical	Systemic	Psychological
Systemic Makeup	Forces	Functions	Metaphysics
Leverage Makeup	Material	Mix of Both	Non-material
Abstraction	Least	Moderately So	Most

Table 2 - Summary of Effects Characteristics Across The Levels of War

Admittedly, exceptions can be found within all these categories, most notably the strategic bullet fired from a sniper's rifle that assassinates a nation's dictator. Generally, however, the strategic level, in comparison to the operational and tactical level, has these characteristics: operations are more complex, operations are slower to execute, effects take the longest to create, duration of

effects is longer, forecast reliability of effects is the lowest, resistance to our force application is of the war-will type, associated effects are more of the psychological type, force application intent is against the metaphysical aspects of the enemy, force is applied against non-material aspects of the enemy, and this level contains the most abstraction. If we take these characteristics and create pies as in Figure 4 with *speed of operations*, we can place these 'effect pies' back into our model and get the final version, the Effects Wheel of Figure 5.

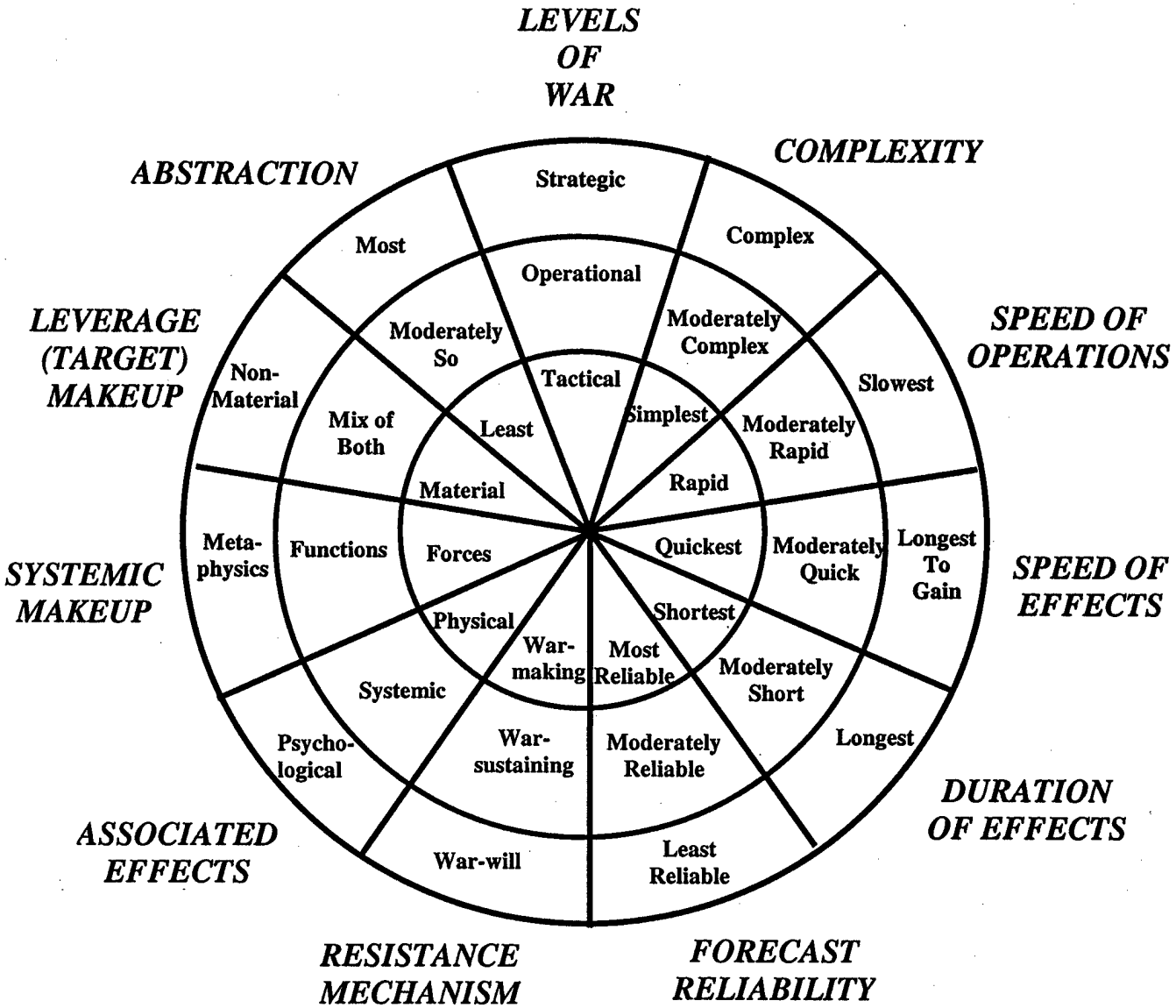

Figure 5 - Final "Effects Wheel" of Relationships

This Effects Wheel model captures nearly all of the concepts detailed in the most recent literature on the complexities, abstractions, and characteristics of effects-based operations. If we take this further and liken it to an interior designer's "Color Wheel," we can capture a few more themes of the Effects Wheel.

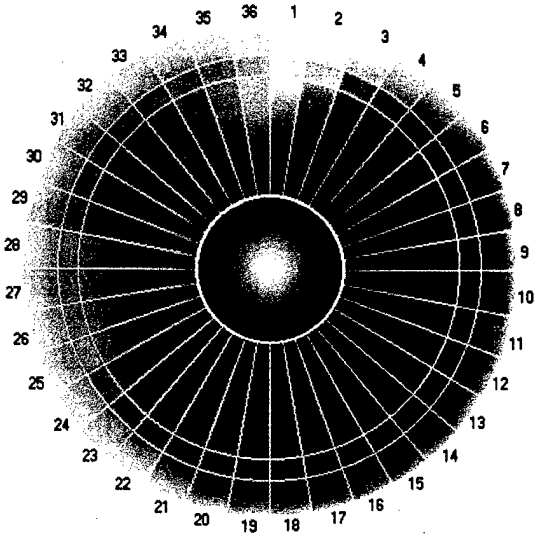

Figure 6 - Interior Designer's Color Wheel

Specifically, an interior designer's color wheel captures the relationships of colors across the spectrum with colors side by side defined as "analogous" and colors opposite each other across the circle defined as "complimentary." Colors equidistant from each other around the circle, like the primary colors, form a "triad" of blend. The ring around the interior of the circle defines the pure colors with interior areas forming *tints* and exterior areas providing *shades*.[39] This wheel helps interior designers understand complimentary colors and decide on color combinations.

determine what lethal and non-lethal actions, be they tactical, operational, or strategic, would create the required effects. From the actions we take to create the effect, we create two additional requirements; first, what do we monitor to determine action effectiveness, and second, what do we monitor to determine when our effect has been met. The former is a Measure of Effectiveness (MOE) and the latter we'll call "Effects Measures." The further we move from the process of tactical actions creating tactical effects, the further MOEs and Effects Measures move apart as separate entities. As noted earlier, sometimes effects are physical, systemic, or metaphysical, so we'll move from a simple example to a more complex example.

An objective of air superiority requires supporting effects of no (or inconsequential) surface-to-air missile air defense capability, no air breathing air defense capability, and no offensive air capability. Therefore, one part of creating the effect of air superiority is lethal or non-lethal disabling of air defense acquisition and tracking RADARs. An example MOE is *RADAR systems disabled,* where our Effects Tracking could be very similar to our MOE or termed as *Adversary ability to RADAR track friendlies.* Contrasting with this tactical example, where the MOE is very similar to the Effects Measure, another example would be the strategic effect of creating hopelessness within the adversary's psyche.[40] One MOE might be disabling all leadership C2 capability. Our MOE would be *Degradation of Enemy C2* where our Effects Tracking would monitor any/all possible indications of the adversary's mental state for the effect of *Isolation and Paralysis of the Leadership.* As noted earlier, as we move to the strategic level, our MOEs become more distinct from our Effects Measures.

The following construct, the "Effects Vine," captures the elements of actions, MOEs, Effects Measures, and Effects (Figure 7). As we execute tactical events (A) we continually assess effectiveness of that action through MOEs (B) and continue, increase, decrease, stop, or refine

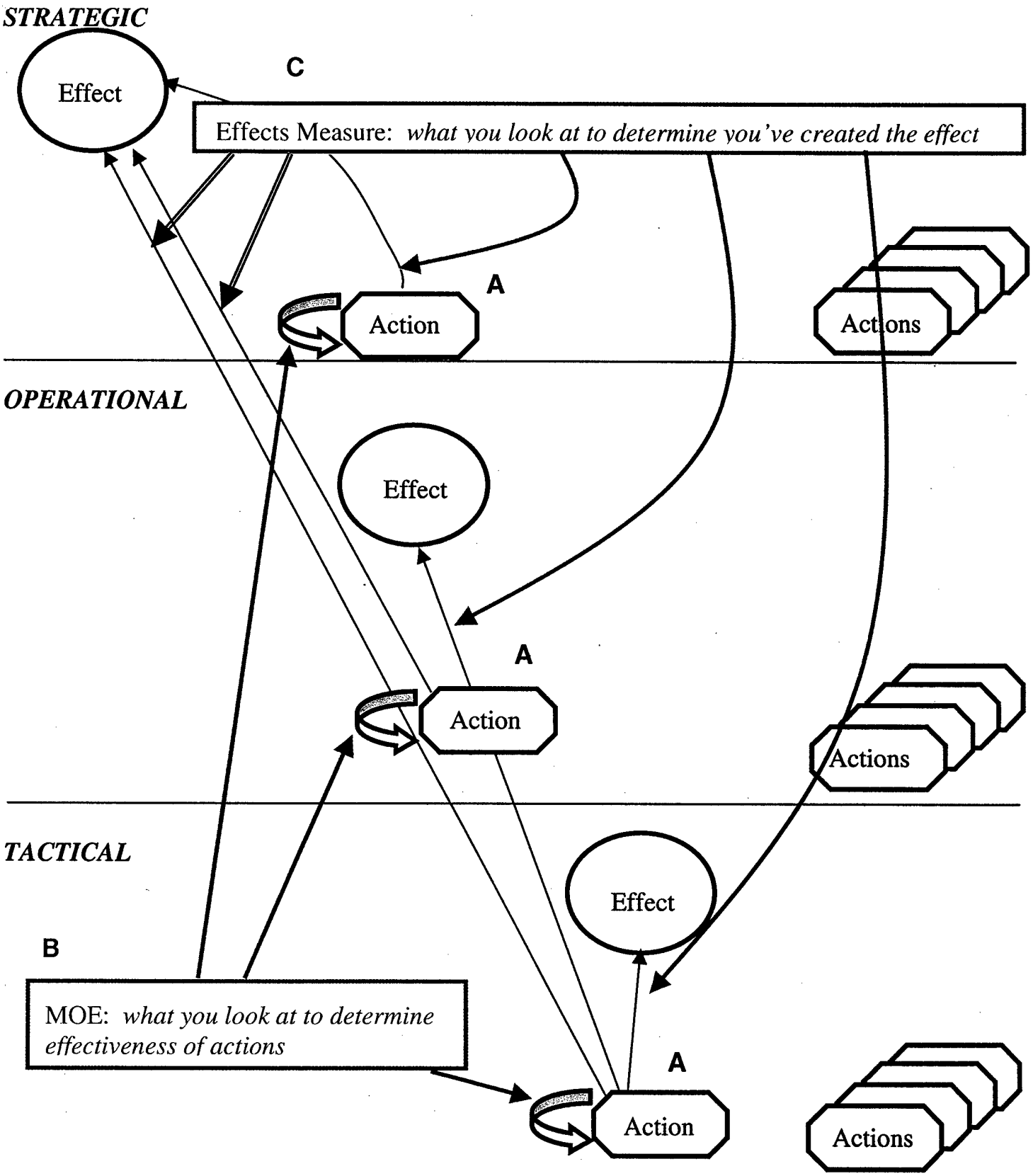

Figure 7 - Effects Vine Operational Construct

those actions. Separate tactical events can also lead to operational and strategic effects. In general, our MOE process executed within CA is tasked only to look at effectiveness of those actions at their respective levels and does not sufficiently addressed effects at higher levels.[41] This construct can reinforce for planners, executers, and CA personnel the multiple effects of actions and help them track those intended and prepare for those that are unintended and negative.[42] Part of our planning, execution, and CA process needs to incorporate this Effects Measure (C) to refine the focus of our planning efforts, our C2 efforts during execution, and our CA efforts, *so we're planning the right actions at the right times, we're tracking the right things during execution, and all CA personnel, processes, and systems are monitoring and reporting on the right things at the right speeds throughout*. Additional action boxes are listed to emphasize that multiple actions may lead to, or be required to create, higher level effects.

Final Synchronization of Effects

With this Effects Vine construct in mind, the following two figures illustrate how it can capture the essence of synchronization. Figure 8 is a depiction of two separate tactical events, executed sequentially, which lead to individual direct effects. Synchronization of effects can be

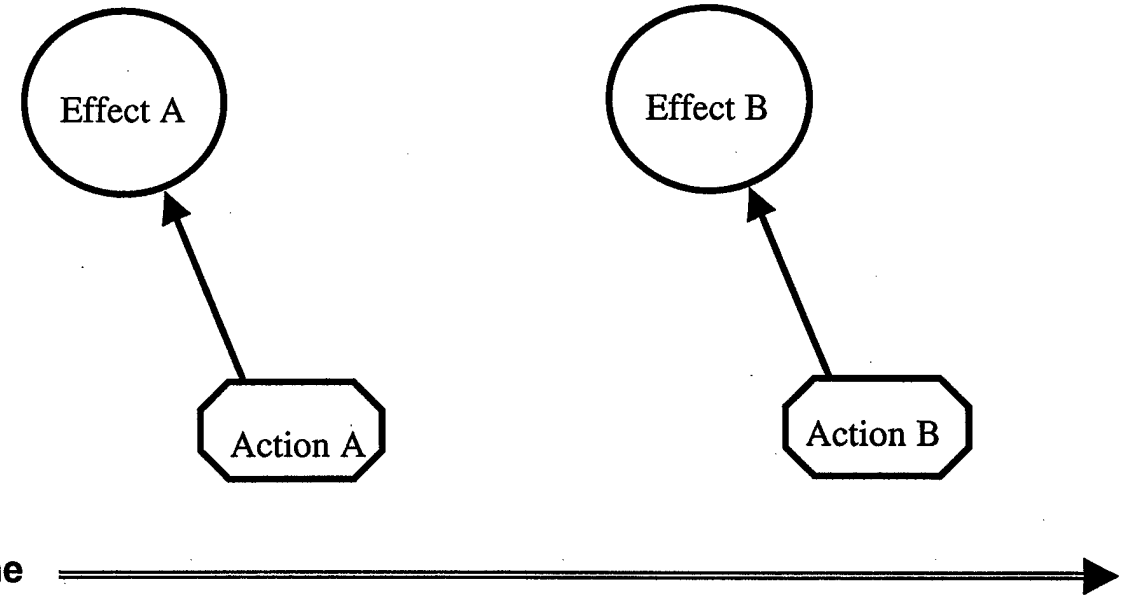

Figure 8 – Sequential Actions Leading To Separate Tactical Effects

planned by wargaming the timing of individual actions which are required to create direct effects. By taking these events and exploring sequences, including A first, then B, and vice versa, and also exploring what additional effects we might create by simultaneous action, we can project the most effective synchronization of air power actions.[43] The creation of higher level effects by simultaneous action is the basis of Warden's (and Deptula's) strategic paralysis[44] and a part of Alberts, Garstka, and Stein's "strategic lockout."[45] There was much touting that precision and stealth gave us a new capability in 'parallel attack' during the ODS. Unfortunately, like in many cases previous and since, expectations were overestimated.[46] Below is a depiction of possible higher level effects from lower level actions executed simultaneously. Although a simple construct, using a planning model similar to this one would: 1) help to synchronize air operations for desired CJTF effects, 2) better help planners, executers, and CA personnel understand and incorporate potential indirect effects, 3) better help joint forces understand the

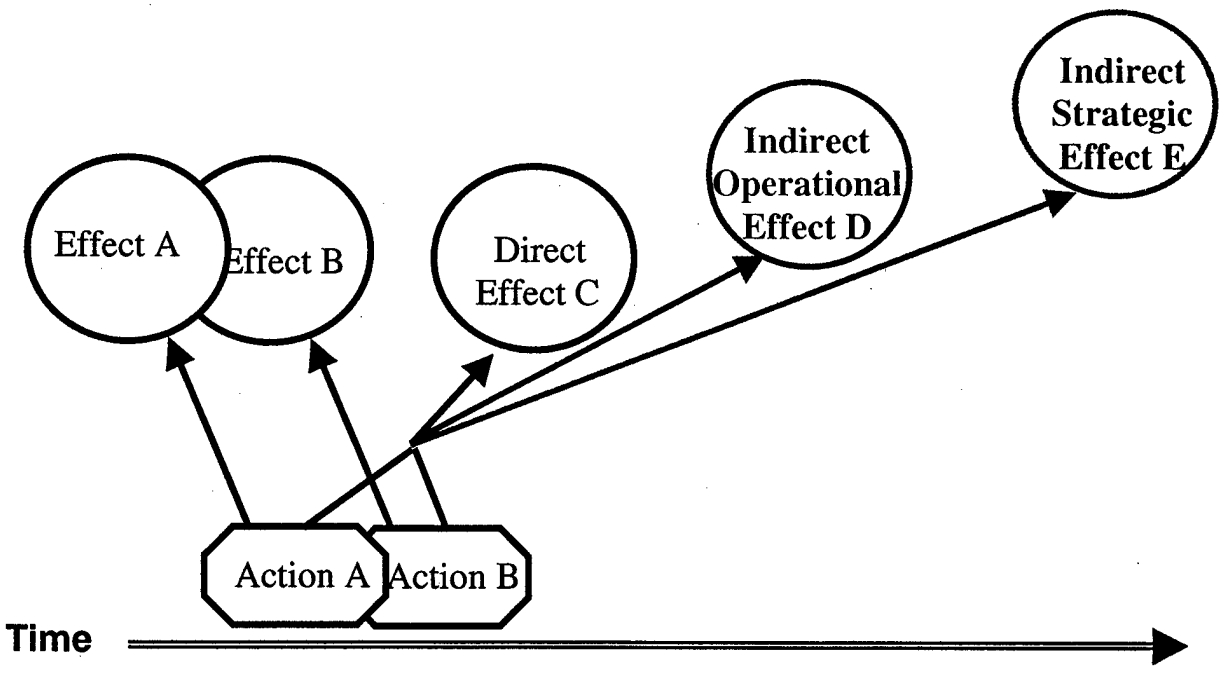

Figure 9 – Simultaneous/Near-Simultaneous Actions Leading To Separate Tactical Effects PLUS an Additional Tactical Effect and Operational and Strategic Effects

air operation synchronization requirements and contributions, 4) better help joint forces synchronize lethal AND non-lethal force application efforts across the entire JTF, 5) better clarify the need for predictive analysis beyond the present JWAC systems analysis[47], and 6) better help leaders predict and prepare for unintended effects.

Historical Support

A review of two historical examples will help complete the rationale for effects-based operational synchronization.

Gulf War

As mentioned earlier, many believe the Gulf War was transformational and incorporated effects-based operations. However, since the Air Tasking Order (ATO) executed was based upon Warden's original INSTANT THUNDER plan, the JFACC executed air attacks into Baghdad on the first ATO. With the intention of creating strategic paralysis by striking leadership, C2, and infrastructure targets, near simultaneous attacks were executed by joint forces.[48] In many cases, we performed these attacks BECAUSE WE COULD, not because the resulting effects were the quickest way to meeting the objectives. The ATO didn't address the Republican Guard divisions, a critical part of Hussein's power base, until day three and only because the Commander in Chief demanded strikes on them from day one on. Moreover, there's no indication any senior leader discussions took place that addressed the negative impact of greatly degrading Hussein's ability to receive damage reports from his fielded forces.[49] Also, although some were exploitable, many C2 work-arounds were certainly in place prior to the ground phase of ODS. Wouldn't the effect of cutting off all or most of Iraq's C2 infrastructure *just prior to* the ground movements in preparation of the ground offensive have created a more synchronized effect? With improved synchronization of air operations against Iraq's C2

infrastructure, we would have had the aircraft available for constant attacks against the Republican Guard divisions and would have gained the added effect of Hussein view first hand the destruction of his fielded forces. This improved timing and focus would have better synchronized the psychological effect of massed strikes and the shutting down of his ability to "see" and command and control forces closer to the ground phase, further improving operational security and chance of success on the ground. Fewer and more synchronized air strikes into downtown Baghdad may have also prevented some of the negative effects generated by the attacks on dual use targets.[50] In the end, we achieved great success, but came about many effects because of the massive numbers of aircraft available, and not because we used a top-down, effects-based approach to synchronize all joint forces.

Allied Force

Eight years after ODS, NATO was executing an air campaign in Operation ALLIED FORCE that sought to coerce another nation's leader to reverse his actions. The air operations plan for Allied Force was again overoptimistic and unsynchronized, as far as joint force effects are concerned. Although a long-standing problem area, leaders were torn on military options to take to coerce Milosevic to withdraw his forces and stop Serbian attacks on Kosovars. Moreover, although an objective was to " (1) demonstrate the seriousness of NATO's opposition to Belgrade's aggression in the Balkans...and (3) damage Serbia's capacity to wage war against Kosovo in the future or spread the war to neighbors by diminishing or degrading its ability to wage military operations,"[51] even the Supreme Allied Commander, Europe (SACEUR) only considered a limited, 2-day strike option.[52] As opposed to ODS where we executed a massive number of attacks to the wrong target sets at the wrong times, in Allied Force, we planned too few attacks for too short a time period to create the effects we needed to meet strategic

objectives. Moreover, it took a month of time to pass after initial air strikes for leaders to intensify air operations and strike military-industrial infrastructure, certainly a target set critical to creating effects to bring about objective (3)[53] The last key from Allied Force which lays further argument for effects-based operations is that decision loops were tightened up through senior leader Video-Teleconferences (VTC). With the interconnectedness and speed of Allied Force an expected reality for the future, it's incumbent on planners to have thorough knowledge through OER databases and wargamed effects-based synchronized options to offer leaders. Some goods news includes that revisions are in place at the NATO Air Operations Plan Planning and the Hulburt Field C2W course that include thorough discussions on effects-based operational planning[54] and with additional constructs and planning tools, synchronization can't be far behind.

Conclusion

Many theories have been offered over the years on what effects air power could achieve in war. Effects, however are complex and span the levels of war, so education of military planners remains critical. The Effects Wheel and Effects Vine operational constructs can help planners, executors, and CA personnel alike understand the complexities of effects and offers a simple construct by which to wargame synchronizing lethal and non-lethal actions for greatest impact. JWAC efforts remain as a required foundation of effects-based operations and need to evolve to add predictive capabilities for higher order effects of operational actions. Decision loop dynamics will continue to challenge warfighters and civilian leaders alike, demanding more thorough 'analysis homework' than ever before. Also, Joint Doctrine, as always, needs to adapt rapidly to incorporate new capabilities of stealth, precision, and near real time C3 and propel our efforts to exploit these capabilities through a true top-down, effects-based operational effort.

ENDNOTES

[1] Jakab and Young, Editors, The Published Writings of Wilbur and Orville Wright (Washington, DC: The Smithsonian Institution Press, 2000), 195.

[2] Ibid., 196.

[3] Sun Tzu, The Art of War (New York, NY: Oxford University Press, 1963), 77, 79. Throughout this book, the author explains the way to success in war is through deception, decisive operations against adversary armies, and through intimidation where victory is granted without fighting. Also, Carl Von Clausewitz, On War (Princeton, NJ: Princeton University Press, 1976), 596. Edited and translated by Michael Howard and Peter Paret. Clausewitz emphasizes the vital points against which to apply force of the adversary army, the capital, and the strongest ally, if the ally is stronger than the adversary. He also details his opinion that the adversary ground army is the COG.
Also, Major Jay M. Kreighbaum, *Force Application Planning: A Systems-and-Effects-Based Approach,*(Unpublished Research Paper, School of Advanced Aerospace Studies (SAAS), Maxwell AFB, AL: February 1998), 153. Kreighbaum summarizes in a similar table the theories of Douhet, Mitchell, ACTS, Slessor, and Warden.
Also, David S. Fadok, *John Boyd and John Warden: Air Power's Quest For Strategic Paralysis,* (Unpublished Research Paper, School of Advanced Airpower Studies, Maxwell AFB, AL: Air University Press, 1995), 7, 13-17. Fadok explains the views of Trenchard and Boyd.
Also David A. Deptula, *Effects-Based Operations--A Change in the Nature of Warfare,* (Arlington, VA: Aerospace Education Foundation Press, 1995), 8.

[4] Sun Tzu, The Art of War (New York, NY: Oxford University Press, 1963), 77, 79. Translated by Samuel B. Griffith. Sun Tzu's often-quoted comment on the acme of skill: "For to win one hundred victories in one hundred battles is not the acme of skill. To subdue the enmy without fighting is the acme of skill." Also, on page 79: "Thus, those skilled in war subdue the enemy's army without battle."

[5] Clausewitz, On War, 596. Clausewitz reemphasizes his belief that a nation's COG is the army. "Basing our comments on general experience, the acts we consider most important for the defeat of the enemy are the following: 1. Destruction of his army, if it is at all significant, 2. Seizure of his capital, if it is not only the center of administration but also that of social, professional, and political activity, and 3. Delivery of an effective blow against his principal ally if that ally is more powerful than he."

[6] Charles Webster and Noble Frankland, The Strategic Air Offensive Against Germany 1939–45 , Vol. 4 (London, UK: Her Majesty's Stationery Office, 1961), 71-76. Quoted in Fadok, *John Boyd and John Warden: Air Power's Quest For Strategic Paralysis,* 15. Hugh Trenchard, Marshal of the Royal Air Force, in a 1928 memorandum to the chiefs of staff on the War Object of an Air Force In this memo, he comments on the goal being "to paralyse from the very outset the enemy's production centres of munitions of war of every sort and to stop all communications and transportation." He went on with: "the weight of the air forces will be more effectively delivered against the targets mentioned above rather than against the enemy's armed forces." Warden was later to profess in similar fashion the importance of bypassing the fielded forces to the enemy's strategic power.

[7] Joint Publication (JP) 1-02, *Department of Defense Dictionary of Military and Associated Terms*, 12 April 2001, Joint Electronic Library CD-ROM, Washington, DC: Joint Chiefs of Staff, September 2001.

[8] Ibid., Definition for *operational level of war.*

[9] Ibid.

[10] Milan N. Vego, Operational Warfare, (Newport, RI: Naval War College Press, 2000), 642.

[11] Ibid., 649.

[12] Ibid., 17, 21.

[13] JP 1-02, Definition for *strategic air warfare*

[14] Major Kevin E. Williams, *In Search of the Missing Link: Relating Destruction To Outcome in Airpower Application,* (Unpublished Research Paper, SAAS, Maxwell AFB, AL, June 1994). < http://www.au.af.mil/au/aul/school/acsc/jo00.htm > [14 Mar 2002]
Also Major T.W. Beagle, *Effects-Based Targeting: Another Empty Promise?* (Unpublished Research Paper, SAAS, Maxwell AFB, June 2000). < http://www.au.af.mil/au/aul/school/acsc/jo00.htm > [14 Mar 2002]. Also, Major Scott G. Walker, *Targeting For Effect: Analytical Framework for Counterland Operations,* (Unpublished Research Paper, SAAS, Maxwell AFB, AL, May 1998).
< http://www.au.af.mil/au/aul/school/acsc/jo00.htm > [18 Mar 2002]
Also Major Scott J. Tew, *Linking Target Selection To Political Objectives,* (Unpublished Research Paper, Air Command and Staff College (ACSC), Maxwell AFB, AL, April 2001). < http://www.au.af.mil/au/aul/school/acsc/jo00.htm > [18 Mar 2002]
Beagle, Fadok, Kreighbaum, Walker, Williams, and Tew, in their SAAS and ACSC papers culminate generally in their thesis defining the three categories of effects as: war-making, war-sustaining, and war-will, in conjunction with the three levels of war from tactical to strategic.

[15] Air Force Doctrine Document (AFDD)-2, *Organization and Employment of Aerospace Power*, 17 February 2000, 2. Lkd. U.S. Air Force Doctrine Publications at <https://www.doctrine.af.mil/Main.asp.> [24 April 2002].

[16] Ibid., 3.

[17] AFDD 1-2, *Air Force Glossary*, 9 July 1999, 16. Lkd. , U.S. Air Force Doctrine Publications at <https://www.doctrine.af.mil/Main.asp.> [24 April 2002].

[18] Richard P. Hallion, Storm Over Iraq (Washington, DC: Smithsonian Institution Press, 1992), 152. See generalized figure attached.

Warden's 5 Rings

[19] JP 1-02, Definition for *operational level of war.*

[20] Robert F.Futrell, Ideas, Concepts, Doctrine: Basic Thinking in the United States Air Force, Vols I and II (Maxwell AFB, AL: Air University Press: 1989), 88. Air doctrine in 1938 stated "the main purpose of the air offensive will be to nullify the former [enemy armed forces] so as to permit breaking down or conclusively threatening the latter [enemy national structure]."
Also Meilinger, Phillip S., Editor. The Paths of Heaven, The Evolution of Airpower Theory. Maxwell Air Force Base, AL: Air University Press, 1997, 216-220. ACTS members create the strategic bombardment

doctrine to emphasize that the Army Air Corps be used against the most strategic targets, not to "serve in harassing operations for the Army (219). Bombers, however lacked the numbers, precision, and destructive capabilities necessary to create strategic effects during the combined bomber offensive. Although it continued as strategic bombardment theory, it really had operational effects.

[21] Beagle, *Effects-Based Targeting: Another Empty Promise?*, Fadok, *John Boyd and John Warden: Air Power's Quest For Strategic Paralysis*, Kreighbaum, *Force Application Planning: A Systems-and-Effects-Based Approach*, Walker, *Targeting For Effect: Analytical Framework for Counterland Operations*, Williams, *In Search of the Missing Link: Relating Destruction To Outcome in Airpower Application*, and Tew, *Linking Target Selection To Political Objectives.*

[22] David A. Deptula, *Effects-Based Operations--A Change in the Nature of Warfare.* (Arlington, VA: Aerospace Education Foundation Press, 1995), 2, 8, and 18.

[23] Ibid., 12.

[24] Ibid.

[25] Ibid., 18.

[26] Ibid., 19.

[27] Doctrine Watch article #13, Lkd. U.S. Air Force Doctrine Site, *Effects-Based Operations.*30 November 2000. <http://www.doctrine.af.mil/DoctrineWatch/DoctrineWatch.asp?Article=13> [29 March 2002].

[28] Personal observation of over twenty brigade-level After Action Reviews at the National Training Center as Senior Air Force Advisor and USAF Tactical Air Control Party training chief from July 1999 through July 2001. Specifics are also detailed in U.S. Army Field Manual 101-5, *Staff Operations*, Chapter 5, Planning.

[29] Joint Publication 2-0, *Doctrine for Intelligence Support To Joint Operations*, 9 March 2000, Chaps II and III. Joint Electronic Library CD-ROM, Washington, DC: Joint Chiefs of Staff, September 2001.

[30] Air Campaign Planning Handbook, (Maxwell AFB, AL: Warfare Studies Institute; College of Aerospace Doctrine, Research, and Education., March 2000), 6-7.

[31] Ibid., 6.

[32] Air Land Sea Application Center, *Targeting: The Joint Targeting Process and Procedures For Targeting Time-Critical Targets*, Langley AFB, VA, July 1997, 1-3.

[33] Ibid., 2.

[34] Ibid., 1-5.

[35] The Joint Warfare Analysis Center (JWAC) is a Navy-sponsored joint command under the Director of Operations (J3), Joint Staff, and was officially established in May 1994. Renamed from the Naval Surface Warfare Analysis Center, it analyzes national systems to determine strengths and weaknesses, by focusing on seven major categories: electrical power; petroleum, oils, and lubrication; lines of communication; telecommunications; critical industries; commodities; and military logistics. It's located

in Dahlgren, Virginia with the following mission: *Provides combatant commands, Joint Staff and other customers with responsive, effects-based, precision-targeting options for selected networks and nodes in order to carry out national security and military strategies of the United States during peace, crisis and war.* <http://www.jfcom.mil/About/com_jwac.htm> [2 April 2002]. See also Beagle, *Effects-Based Targeting: Another Empty Promise?,* 85.

[36] Doctrine Watch article #13, Lkd. U.S. Air Force Doctrine Site, *Effects-Based Operations.*30 November 2000. <http://www.doctrine.af.mil/DoctrineWatch/DoctrineWatch.asp?Article=13> [29 March 2002].

[37] Fadok, *John Boyd and John Warden: Air Power's Quest For Strategic Paralysis,* 16-17.

[38] Kreighbaum, *Force Application Planning: A Systems-and-Effects-Based Approach,*149-153, 157.

[39] Jeff Day, Editor, Kitchens and Baths, 1-2-3 (Des Moines, IA: Meredith Books Publishing, 1999), 20-21.

[40] Kreighbaum, *Force Application Planning: A Systems-and-Effects-Based Approach, 65.* In his section on Measurement of Effects, Kreighbaum clarifies the difficulty of measuring effects as they move beyond the first order, since final outcome effects (fourth order) are usually of the psychological type and take human intelligence sources, or HUMINT, to satisfy.

[41] JP 2-01.3, *Joint Tactics, Techniques, and Procedures for Joint Intelligence Preparation of the Battlespace,* 24 Mar 2000, I-7 and I-8. Joint Electronic Library CD-ROM, Washington, DC: Joint Chiefs of Staff, September 2001.

[42] Kreighbaum, *Force Application Planning: A Systems-and-Effects-Based Approach,* 78.

[43] Beagle, *Effects-Based Targeting: Another Empty Promise?,*11-12.

[44] Hallion, Storm Over Iraq, 151.

[45] Alberts, Garstka, and Frederick P. Stein, Network Centric Warfare (Washington, DC, DoD C4ISR Cooperative Research Program Publishing, August 1999), 165.

[46] Cases of overestimating the ability of air power to generate effects: Planners belief in WWII about reaching effects on Germany's industry in a few months. Belief that planners in ODS would reach strategic effects in six days: Gordon and Trainor, The General's War, 88-89. "Warden did not think the United States would ever need to go beyond the [six day] strategic air plan." Chief of Staff of the AF also certified the plan "not overly optimistic."

[47] Beagle, *Effects-Based Targeting: Another Empty Promise?,*107-109.

[48] Michael R. Gordon and General Bernard E. Trainor, The General's War (Little, Brown and Company, 1995), 191-193. Also, Warden, The Air Campaign, 4-6.

[49] Gordon and Trainor, The General's War, 75-266. Hallion, Storm Over Iraq, 132-240. George Bush and Brent Scowcroft, A World Transformed (New York, NY: Vintage Books, 1998), 302-449. General H. Norman Schwarzkopf, It Doesn't Take a Hero (New York, NY: Linda Grey Bantam Books, 1992), 295-427.

[50] Hallion, Storm Over Iraq, 199.

[51] Department of Defense, DoD Final Report to Congress, Kosovo/Operation ALLIED FORCE, 31 January 2000, xvii. strategic objectives (1) and (3).

[52] Ibid., 23. SACEUR talks about a limited 2-day strike.

[53] Ibid.

[54] Lt Col Jeff Western, <western.jeffery@natoschool-shape.de>, "RE: information request via NS(S) website," [E-mail to Dave Silvia <silviaj@nwc.navy.mil>], 7 May 2002. Also, Ms. Laurie Kissel, <Laurie.Kissel@Hurlburt.af.mil>, "FW: Air Campaign Planning," [E-mail to Dave Silvia <silviaj@nwc.navy.mil>], 7 May 2000. NATO and C2W schoolhouse lesson plans prove extensive updates over the past couple years to incorporate Effects-based operational concepts.

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