

Strange Gravity: Toward a Unified Theory of Joint Warfighting

**A Monograph
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ABSTRACT

STRANGE GRAVITY: TOWARD A UNIFIED THEORY OF JOINT WARFIGHTING,
by MAJ Michael W. Johnson, 86 pages.

The problem is, valid but incompatible service theories of operational warfighting inhibit rather than promote jointness. One cause of this problem is the joint definition of the center of gravity, which is vague and ineffective. This monograph tests a possible solution by asking, should the United States Armed Forces adopt the unified center of gravity framework proposed by Dr. Joe Strange as an element of operational design? The hypothesis is: the framework reconciles the service theories of operational warfighting while preserving their core principles and is an effective analytical tool to achieve success in full spectrum operations. By modifying the definition of critical vulnerability, the framework was consistent with the service theories of operational art, maneuver-warfare, air warfare, and naval warfare. It was an effective analytical tool to achieve success in Operations Desert Storm, Allied Force, and Joint Guardian. Therefore, the United States Armed Forces should adopt the modified center of gravity framework as an element of operational design. It is the nucleus of a unified theory of joint warfighting that resolves the paradox of valid but incompatible service theories to achieve unified action in operational design.

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I would like to thank Carl von Clausewitz, because reading *On War* fundamentally changed the way I perceive, think about, and understand complex phenomena. The excellent work of Raymond Aron, Bernard Brodie, and Peter Paret greatly increased my understanding of Clausewitz and *On War*.

Two men led the way in this particular subject of the center of gravity. Lieutenant Colonel John B. Saxman first identified the problem with service confusion in his work, “The Concept of Center of Gravity: Does It Have Utility in Joint Doctrine and Campaign Planning?” Then Dr. Joe Strange proposed a solution to this problem in his work, “Centers of Gravity and Critical Vulnerabilities: Building on the Clausewitzian Foundation So That We May All Speak the Same Language.” This monograph simply takes the next step by testing that solution for consistency with service theories of operational warfighting and effectiveness in full spectrum operations.

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ABBREVIATIONS

AFDD	Air Force Doctrine Document
AFSOUTH	Allied Forces Southern Europe
AI	Air Interdiction
AIRSOUTH	Allied Air Forces Southern Europe
C4ISR	Command, Control, Communications, Computers, Intelligence, Surveillance, Reconnaissance
CAS	Close Air Support
CC	Critical Capability
CFACC	Combined Force Air Component Commander
CFLCC	Combined Force Land Component Commander
CFMCC	Combined Force Maritime Component Commander
CG	Center of Gravity
CGSC	Command and General Staff College
CJTF	Combined Joint Task Force
COG	Center of Gravity
CR	Critical Requirement
CV	Critical Vulnerability
FRY	Federal Republic of Yugoslavia
IO	Information Operations
JCS	Joint Chiefs of Staff
JP	Joint Publication
KLA	Kosovo Liberation Army

KFOR	Kosovo Force
KVM	Kosovo Verification Mission
LOC(s)	Line(s) of Communications
MCDP	Marine Corps Doctrine Publication
MEF	Marine Expeditionary Force
MTA	Military Technical Agreement
MTW	Major Theater War
NATO	North Atlantic Treaty Organization
NDP	Naval Doctrinal Publication
PKO	Peacekeeping Operations
SACEUR	Supreme Allied Commander, Europe
SSC	Small Scale Contingency
ST	Student Text
U.N.	United Nations
UNIMIK	United Nations Interim Mission in Kosovo

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INTRODUCTION

Gravity dictates the rhythm of the cosmic dance that is tirelessly and meticulously executed by billions upon billions of cosmic inhabitants...¹

Physicists and strategists share a common quest: the search for a unified theory, one that reconciles valid theories that appear incompatible. For example, experiment has proven general relativity and quantum mechanics to be incredibly accurate, but they cannot both be right as formulated.² The paradox begins with gravity. Newton held the effects of gravity to be instantaneous, but Einstein's theory of special relativity stated that nothing may exceed the speed of light, not even gravitational force. In general relativity, Einstein resolved this conflict by suggesting, "gravity is the warping of space and time," in which the fabric of the cosmos in the absence of mass is flat.³ We know this is true because light bends passing by the sun. Yet Heisenberg's uncertainty principle, which "captures the heart of quantum mechanics," asserts that the cosmos cannot be flat: "quantum undulations are so violent that they destroy the notion of a smoothly curving geometrical space."⁴ We know this is true because we cannot simultaneously determine the location and the velocity of an electron. Space cannot be both smooth and violent, but it apparently is. Preserving their theoretical principles but modifying their present form, Brian Greene resolves this paradox by suggesting that both Einstein's fabric of the cosmos and the elementary particles of quantum mechanics consist of ultramicroscopic, one-dimensional strings, whose pattern of vibration determines its matter and force. If valid, string theory would "offer a truly wonderful unifying framework," one that reconciles general relativity and quantum mechanics to explain the universal design.⁵ The physicist must now test string theory by experiment for consistency and accuracy.

The service theories of operational art, maneuver-warfare, air warfare, and naval warfare are also valid but incompatible in their present form. The paradox begins again with gravity. Unlike Newton, joint doctrine does not define the center of gravity—“those characteristics, capabilities, or localities from which a military force derives its freedom of action, physical strength, or will to fight”—with precision.⁶ This vague definition is the hub of all confusion and contradiction, on which many arguments depend.⁷ Lacking a precise definition, the service theories offer conflicting ideas about what the center of gravity is, its relevance in operational design, and how to attack it.⁸ Consequently, the service theories appear incompatible. The Army aims to defeat the enemy’s strength, but the Marines attack the enemy’s weakness. The Air Force targets multiple strategic centers of gravity, but the Navy insists there can only be one.⁹ Yet, like general relativity and quantum mechanics, each service cites historical evidence to support its theory. They cannot all be right, but they apparently are. Modifying their present form, Dr. Joe Strange proposed changes to joint and service doctrine to resolve this paradox in his work, “Centers of Gravity and Critical Vulnerabilities: Building on the Clausewitzian Foundation So That We Can All Speak the Same Language.”¹⁰ He defined the concepts of center of gravity (CG), critical capability (CC), critical requirement (CR), and critical vulnerability (CV) to develop a unified framework consistent with the Clausewitzian idea. Could this “Strange gravity” be the “string” to tie the joint universe together? If valid, it too would offer a truly wonderful unifying framework, one that effectively reconciles service theories to achieve unified action in operational design.¹¹ Like the physicist, the strategist must now test this center of gravity framework by critical analysis for consistency and effectiveness.

The paradox is the problem. Valid but incompatible service theories inhibit rather than promote jointness, with potentially grave consequences. The center of gravity is the critical element of operational design that determines how campaigns are planned to use engagements for the purpose of war.¹² If the armed services do not resolve their conflicts about the center of gravity and their theories of operational warfighting, then the United States invite failure in future warfare. One need only consider Operation Allied Force, when the dissension about the Serbian center of gravity between the Supreme Allied Commander and his Combined Force Air Component Commander created confusion rather than clarity and promoted unilateral rather than unified action.¹³ The joint definition of the center of gravity achieves service consensus but sacrifices theoretical precision, consistency, and effectiveness.¹⁴ It does not resolve the paradox.

A unified theory is the solution. Clausewitz explained, “The primary purpose of any theory is to clarify concepts and ideas that have become confused and entangled.”¹⁵ Joint doctrine about the center of gravity is certainly confused by different service experience and entangled by budgetary concerns. A unified theory would “cast a steady light on all phenomena so that we can more easily recognize and eliminate the weeds that always spring from ignorance,” enabling the joint force commander to see how things are related and “seize on what is *right* and *true*.”¹⁶ By the clear light of a unified theory, the services can stay out of the weeds and exploit simultaneous, complementary, reinforcing, and asymmetric effects to defeat the enemy’s means and will. A unified theory would promote unified action to accomplish strategic objectives. The proposed center of gravity framework promises to do for joint warfighting what string theory does for modern physics: form the nucleus of a unified theory that resolves the paradox.

Should the United States Armed Forces adopt the unified center of gravity framework proposed by Dr. Joe Strange as an element of operational design? Scientific method provides an appropriate methodology to answer this central research question:

One should state the theory being tested, infer hypotheses from it, subject the hypothesis to observation, and devise a number of distinct and demanding tests. If a test is not passed, ask whether the theory flunks completely, needs repair and restatement, or requires a narrowing...¹⁷

This analysis completes those tasks necessary to bridge the proposed framework into a unified theory of joint warfighting and test that theory for validity. One may infer this hypothesis: the proposed center of gravity framework reconciles the service theories of operational warfighting while preserving their core principles and is an effective analytical tool to achieve success in full spectrum operations. This hypothesis follows from two key assumptions. First, each service theory offers a valid perspective of operational warfighting. Second, a framework that does not enable the joint force commander to understand and achieve success in full spectrum operations is irrelevant. Subjecting the hypothesis to observation, one must test the framework for consistency with service principles and effectiveness in full spectrum operations. The demanding test cases are the service theories defined in key doctrinal publications and operations Desert Storm, Allied Force, and Joint Guardian. These operations represent a full spectrum of conflict and are reasonable indicators of the immediate future of warfare. The outcome of this analysis is a recommendation to accept, modify, or reject the proposed center of gravity framework. If the framework passes these tests, then the Armed Forces should accept it. If it can be repaired to pass these tests, then the Armed Forces should adopt its modified form. If it completely flunks these tests, then the Armed Forces should reject it. The research matrix in figure 1 depicts this methodology.

METHODOLOGY	TEST CASES	INDEPENDENT VARIABLES	DEPENDENT VARIABLE
Subordinate Questions	Observations	Evaluation Criteria	Outcome
1. Does the proposed center of gravity framework support unified action by reconciling the service theories of operational warfighting?	USA’s Operational Art (ST 3-0)	Consistency: Does the framework resolve the conflicts between the service theories by preserving their core principles but modifying their current form as required?	Yes / No / Modify
	USMC’s Maneuver Warfare (MCDP 1)		Yes / No / Modify
	USAF’s Air Warfare (AFDD 2-1)		Yes / No / Modify
	USN’s Naval Warfare (NDP 1)		Yes / No / Modify
2. Is the proposed center of gravity framework an effective analytical tool to achieve success in full spectrum operations?	Operation Desert Storm (MRC)	Effectiveness: Does the framework allow the JFC to understand and defeat the enemy means and will to fight in order to accomplish operational and strategic objectives?	Yes / No / Modify
	Operation Allied Force (SSC)		Yes / No / Modify
	Operation Joint Guardian (PKO)		Yes / No / Modify
Central Research Question	Should the United States Armed Forces adopt the proposed center of gravity framework as an element of operational design?		Yes / No / Modify

Fig. 1. Methodology.

The principal limitations are breadth and depth. While three test cases of full spectrum operations strike an appropriate balance for one monograph, they are by no means exhaustive. Developing the service theories of operational warfighting and the test cases of full spectrum operations in detail would require a dissertation. Therefore, this analysis explains and tests three core principles of each service theory for consistency. It also assumes a general level of knowledge of each operation. Because the limited goal of this analysis is to identify the way ahead for further exploration, the conclusion must be tested by additional research and thorough case studies.

Clausewitz would insist on this caveat: the unified theory is not a checklist to wage war by the numbers. He specifically stated, "Theory cannot equip the mind with formulas for solving problems, nor can it mark the narrow path on which the sole solution is supposed to lie by planting a hedge of principles on either side."¹⁸ To apply the unified theory methodically constitutes "an extreme poverty of imagination" that ruins an army.¹⁹

Against methodicism, Clausewitz wrote, “Any method by which strategic plans are turned out ready-made, as if from some machine, must be totally rejected,” because:

War is not like a field of wheat, which, without regard to the individual stalk, may be mown more or less efficiently depending on the quality of the scythe; it is like a strand of mature trees in which the axe has to be used judiciously according to the characteristics and development of each individual trunk.²⁰

The operational ways (use of the axe) and means (size of the axe) must vary according to the ends (where the tree should fall) and the nature of war (the type of trunk). In some wars, the center of gravity may not be appropriate to understand the conflict or base operational design, given the limited nature of the political objective, the lack of passion, or the exercise of creative military art within the realm of chance. There is no one operational theory that is universally applicable to all wars past, present, and future. The mind—guiding effective force—was, is, and will remain the key to victory. A unified theory can educate the commander’s mind, and provide an important “integrated view of all phenomena,” but it is no substitute for critical reasoning and creative thinking.²¹

Finally, the reader deserves a roadmap to relate the methodology to the structure of this monograph. The second section, “Background,” briefly reviews the literature about the Clausewitzian center of gravity, joint doctrine, and the unified framework proposed by Dr. Strange. The third section, “Analysis,” conducts the two tests. It first checks for consistency by explaining the core principles of the service theories and integrating them into the new framework to develop a unified theory of joint warfighting. It then checks for effectiveness by applying the unified theory to the selected operations. The fourth section, “Conclusion,” presents the results and determines whether the Armed Forces should accept, reject, or modify the proposed center of gravity framework.

BACKGROUND

One of the most widely used, yet most ambiguously defined terms in the current U.S. military lexicon is Clausewitz's "center of gravity." A review of military books, journals, academic texts, and doctrinal publications reveals that the concept of center of gravity seems to mean something to everyone, but not the same thing to anyone.²²

Before testing the proposed center of gravity framework, it is essential to understand the contradictions about the idea. Indeed, a brief review of the literature reveals that, "current joint doctrine fails to meld the different service interpretations of the concept of center of gravity into a clear, unambiguous joint concept."²³ This literature review, in addition to Clausewitz's *On War* and joint doctrine, considers analysis by Dr. James J. Schneider and Lawrence L. Izzo in "Clausewitz's Elusive Center of Gravity" and John B. Saxman in "The Concept of Center of Gravity: Does It Have Utility in Joint Doctrine and Campaign Planning?" It also presents the center of gravity framework proposed by Dr. Strange that purports to solve the problem.

Clausewitzian Gravity

Misreading Clausewitz results from searching for a particular quotation to support one's special interest. Reading Clausewitz accurately requires a holistic approach, often completing the synthesis of opposing ideas independently. In the twenty-four passages Clausewitz used the term center of gravity, he offered different examples at the tactical, operational, and strategic levels of war. (See Appendix.) These examples included a physical force, a geographic city, and an intangible community of interest amongst allies. To answer the common questions raised by these varied examples, one must search for patterns to synthesize the bits of information and understand the whole concept.

Is the center of gravity a strength or a weakness? At the tactical and operational levels, the examples suggest the center of gravity is the primary physical strength (means) that a state uses to defeat the enemy and achieve its objectives (ends). At the strategic level, the examples describe the primary source of political and moral strength that inspires states and people to fight (will). This supports the idea that the enemy's power of resistance "can be expressed as the product of two inseparable factors, viz. *the total means at his disposal* and *the strength of his will*."²⁴ Because Clausewitz understood war is the clash of two independent wills, he considered the interaction between friendly and enemy forces. Thus, a major battle is "a collision of two centers of gravity," as both sides impose their will by force.²⁵ No example of a center of gravity was a weakness. This confuses the nature of a center of gravity (force) with an operational approach (indirect) or the effect of defeating the enemy's center of gravity (victory).

Considering chess, is the center of gravity a "king" or a "queen?" It can be either one, depending on the level of war. At the tactical and operational levels, the examples were queens, the strongest force used to attack or defend. The queen may attack the opponent's force, strike directly at his king, or defeat his attack. Defeating a center of gravity, like losing a queen, is a decisive blow that wins a battle or a campaign. The enemy may well concede the entire match, if he believes further resistance is futile or not worth the effort. However, he may continue the struggle if his interests or passion demand the chance to recover or fight to a draw. At the strategic level, the examples were kings, the ultimate power of resistance. Defeating the strategic center of gravity, like checkmate, wins the war because it eliminates or neutralizes the resistance to achieving the endstate. One common thread of the examples is this decisive effect.

Why design a campaign plan to defeat the enemy's center of gravity? The center of gravity, the primary means and will to fight, must be threatened or defeated to win relevant battles, campaigns, and wars. Although there may occasionally be easier paths to peace, this difficult path is the most certain. Clausewitz was quite clear about this central role of the center of gravity in a war plan: "The first task, then, in planning for a war is to identify the enemy's centers of gravity, and, if possible, trace them back to a single one. The second task is to ensure that the forces to be used against that point are concentrated for a main offensive."²⁶ Here is the common definition of the center of gravity and the logic that justifies its central role in operational design:

... one must keep the dominant characteristics of both belligerents in mind. Out of these characteristics a certain center of gravity develops, the hub of all power and movement, on which everything depends. That is the point against which all our energies should be directed. Small things always depend on great ones, unimportant on important, accidentals on essentials.²⁷

While most readers focus on "the hub of all power and movement," the last sentence is the most valuable because it explains *why* one should direct all of their energies to defeat the enemy's strength.²⁸ Defeating the enemy's tactical and operational center of gravity means his offensive and defensive power culminates; he no longer has the ability to resist. Defeating the enemy's strategic center of gravity means one may dictate or negotiate peace from a position of advantage in order to achieve the political objectives of the war. If one fails to defeat the center of gravity, then one "may not win at the peace table what cannot be won on the battlefield," as the saying goes. Success in war primarily depends on what is great, important, and essential. "Not by taking things the easy way... but by constantly seeking out the center of his power, *by daring all to win all*, will one really defeat the enemy."²⁹ Again, this principle is not without exception, but one may not defy its logic of cause and effect.

Does this logic not justify Liddell-Hart's description of Clausewitz as the bloody Mahdi of Mass? No. Although the battle, campaign, and war should be planned to defeat the enemy's center of gravity, Clausewitz recognized there are multiple operational approaches to achieve that end. Whether the enemy refuses battle or fights to a bloody conclusion depends on his situation and his interests. Consider this analogy:

The decision by arms is for all major and minor operations in war what cash payment is in commerce. Regardless how complex the relationship between the two parties, regardless how rarely settlements actually occur, they can never be entirely absent.³⁰

The settlement, battle, may not occur if the enemy concedes his position is untenable, but he should come to this conclusion only if his center of gravity is credibly threatened with destruction. For example, Napoleon correctly exploited operational maneuver to achieve a relatively bloodless victory at Ulm because he concentrated force at a position of advantage to threaten the Austrian center of gravity, Mack's army, with destruction. In contrast, the United States failed to exploit operational maneuver in the Vietnam War because it never threatened any North Vietnamese center of gravity with destruction.³¹ Clausewitz would support Liddell-Hart's indirect approach using operational maneuver, provided it aims at decisive results by threatening the enemy's center of gravity with destruction and is not misdirected into secondary theaters.

Clausewitz also recognized there are low-intensity wars in which policy will be pervasive throughout military operations. He offers exceptions to the central role of defeating the enemy's center of gravity, including "secondary operations that look exceptionally rewarding" or actions that have "direct political repercussions."³² However, lest he encourage wishful thinking contrary to reality, he added this warning:

... the *violent resolution of the crisis*, the wish to annihilate the enemy's forces, is the first-born son of war. If the political aims are small, the motives slight, and the tensions low, a prudent general may look for any way to avoid major military crises and decisive actions, exploit any weakness in the opponent's military and political strategy, and finally reach a peace settlement. If his assumptions are sound and promise success, we are not entitled to criticize him. But he must never forget that he is moving on devious paths where the god of war may catch him unawares. He must always keep an eye on his opponent so that he does not, if the latter has taken up a sharp sword, approach him armed only with an ornamental rapier.³³

Why attempt to reduce the enemy centers of gravity to one? Reducing to one provides the focus in operational design to concentrate the effects of friendly power in a battle, campaign, or war, and thereby achieve success. Reducing to one depends on the "distribution of the enemy's political power" and "the situation in the theater of war where the various armies are operating."³⁴ The key is the degree of decisive effect achieved by defeating the single center of gravity at each level of war. In Clausewitz's own example, an alliance may have two strategic centers of gravity, but if the defeat of one state causes the other to agree to terms, then one may reduce the centers of gravity to the decisive one.³⁵ The will of the United States was the friendly strategic center of gravity in the Vietnam War because its defeat ensured the defeat of South Vietnam. The enemy may have multiple operational centers of gravity in separate theaters, but only one opposes the mission, as Rommel's army opposed the Allies at Normandy. The enemy may have two tactical centers of gravity, but the defeat of one may render the resistance of another impossible. Defeating the North Korean artillery renders the defense by their battalions untenable because they depend primarily upon fire support. One may only reduce centers of gravity to one when its defeat wins the battle, campaign, or war because the enemy lacks the power to resist. That power is the product of means and will.

Is Clausewitz's concept of the center of gravity still relevant? Yes. Although the physical analogy of the center of gravity may not be appropriate in all cases, its nature (force) and decisive effect (victory) remain relevant. This alone justifies its continued central role in campaign planning. One may rightly object to the physical analogy in modern war, focusing instead on the effects of power rather than its actual deployment.³⁶ This is certainly true of airpower, a primary strength used to impose will, but no longer a dense formation of 1,000 B-17 Flying Fortresses. The physical analogy does not apply to the army that exploits Mao's concepts of guerrilla warfare, where the primary strength is deliberately dispersed, but nonetheless used to impose or resist will. However, the physical analogy accurately described VII Corps during Operation Desert Storm, as General Freddie Franks concentrated the three-division fist to strike the Republican Guard. This supports the idea that, in terms of landpower, "The center of gravity is the greatest concentration of combat force."³⁷ Yet the absence of such concentration does not mean the enemy has no center of gravity in modern war. It would be a mistake to limit the meaning of the center of gravity to the physical analogy when Clausewitz also considered its larger nature and the effect. There is no need to disassociate joint doctrine from Clausewitz, provided one understands this enduring nature and effect. The next section reviews how closely joint doctrine reflects what remains relevant.

Joint Gravity

JP 1-02, the *Dictionary of Military and Associated Terms*, defines the center of gravity to be "those characteristics, capabilities, and locations from which a military force derives its freedom of action, physical strength, or will to fight."³⁸ This may include anything but the military force itself, which best represents the tactical and operational

center of gravity consistent with the Clausewitzian concept.³⁹ The joint definition is misleading, because defeating a characteristic or capability may not yield the same decisive effect as defeating the actual force if it can fight degraded. A location may be a strategic center of gravity, but at the operational and tactical levels, it is often confused with another term—the decisive point. The joint definition allows each service to add to the list of centers of gravity to justify its own weapon systems, turning it into a joint smorgasbord or High Payoff Target List. The joint definition does not capture the true nature and effect of a center of gravity, and because it lacks precision, it is ineffective.

JP 3-0 *Joint Operations* gives additional examples of the center of gravity and explains its role in operational design. It states that, “The essence of operational art lies in being able to mass effects against the enemy’s sources of power in order to destroy or neutralize them.”⁴⁰ Suggesting a center of gravity can be a large military force is consistent with the Clausewitzian idea, but not with the joint definition. JP 3-0 further muddies the conceptual waters by stating long lines of communications can be a center of gravity. This is not a primary strength used to impose will, but a route that supplies the center of gravity. It is a logical, undefended place to attack to degrade a center of gravity.

The final draft of the Army’s newest keystone publication, ST 3-0 *Operations*, faithfully repeats the joint definition. It suggests there are both direct and indirect approaches to defeat the enemy’s center of gravity, and it considers protecting friendly centers of gravity from enemy attack. It declares the center of gravity “becomes the focus of both commander’s intent and operational design. Senior commanders describe the center of gravity in military terms, such as objectives and missions.”⁴¹ This links the desired effect on the enemy center of gravity with a specific unit’s mission and objective.

Air Force doctrine repeats the joint definition and links the center of gravity to air operations planning. AFDD-1 *Air Force Basic Doctrine* states, “the ability to strike directly at an adversary’s strategic or operational center of gravity (COG) is a key theme of air and space power’s maneuver advantage.”⁴² AFDD-2 *Organization and Employment of Aerospace Power* suggests centers of gravity “exist at the strategic, operational, and tactical levels of war,” but it does not explain how they differ.⁴³ It admits a center of gravity “may include fielded forces,” although its apparent preference is for multiple strategic centers of gravity and “vital centers.”⁴⁴ It captures the decisive effect of defeating a center of gravity: “COGs are those centers of power that, if defeated or disrupted, will have the most decisive result.”⁴⁵ Linking doctrine to campaign planning, Stage 3 of the process to prepare the Joint Air and Space Operations Plan (JASOP) is “Center of Gravity Identification.” The next two stages, “Strategy Development” and “JASOP Development,” analyze those centers of gravity and develop vital target sets for aerospace attack consistent with the objectives and commander’s intent.

The Marine’s MCDP-1 *Warfighting* does not repeat the joint definition, but instead offers the following process to identify a center of gravity:

We ask ourselves: *Which factors are critical to the enemy? Which can the enemy not do without? Which, if eliminated, will bend him most quickly to our will?* These are centers of gravity. Depending on the situation, centers of gravity may be intangible characteristics such as resolve or morale. They may be capabilities such as armored forces or aviation strength. They may be localities such as a critical piece of terrain that anchors an entire defensive system. They may be the relationship between two or more components of the system such as the cooperation between two arms, the relations in an alliance, or the junction of two forces. In short, centers of gravity are any important sources of strength.⁴⁶

Some elements in this passage are consistent with the Clausewitzian concept while other elements are not. The questions describe the decisive effect of defeating a center of

gravity, but they do not specify that it must be a primary strength. Resolve and morale are primary sources of moral strength that Clausewitz would consider a strategic center of gravity. Armored forces and aviation strength are good examples of operational and tactical centers of gravity, but naming them capabilities confuses what they are (force) with their characteristics (armored or aviation) or what they can do (attack). A critical piece of terrain at the tactical level is not a primary physical or moral power, but rather a decisive point to defeat a center of gravity. By concluding that a center of gravity is a strength, a change from the previous edition of *Warfighting* that suggested it can be a weakness, the Marines have aligned their doctrine with the joint definition.

MCDP 1-2 *Campaigning* defines the difference between strategic and operational centers of gravity. It adopts the same king-queen approach to strategic-operational centers of gravity that Clausewitz portrayed and provides extremely consistent examples:

We must distinguish between a *strategic center of gravity* and an *operational center of gravity*. The former is an objective whose seizure, destruction, or neutralization will have a profound impact on the enemy leadership's will or ability to continue the struggle...[*moral power, will*] An operational center of gravity, on the other hand, is normally an element of the enemy's armed forces. It is that concentration of the enemy's military power that is most dangerous to us or the one that stands between us and the accomplishment of our strategic mission. [*physical power, means*]⁴⁷

However, the Marines then potentially diverge from joint doctrine and Clausewitz by suggesting the focus of operational design should be to attack enemy weakness, not strength. *Warfighting* defines a critical vulnerability in this manner:

Of all the vulnerabilities we might choose to exploit, some are more critical to the enemy than others. Some may contribute significantly to the enemy's downfall while others may lead only to minimal gains. Therefore, we should focus our efforts against a *critical vulnerability*, a vulnerability that, if exploited, will do the most significant damage to the enemy's ability to resist us.⁴⁸

There are two perspectives about this idea. The first holds it recommends the indirect approach as the efficient way to defeat an enemy center of gravity. The second doubts that a critical vulnerability actually exists, for what is critical is rarely vulnerable and what is vulnerable is rarely critical. Italy, the alleged “soft underbelly” of the Axis during World War II, was neither soft (vulnerable) nor an underbelly (critical). Thus, a critical vulnerability is not the object of the indirect approach to defeat the center of gravity, but rather a waste of combat power in the pursuit of an illusion. The truth, no doubt, depends upon the enemy’s system of political and military power. If a true critical vulnerability actually exists, this would qualify as Clausewitz’s exception for secondary operations that have direct political repercussions or are exceptionally rewarding.

NDP-1 *Naval Warfare*, perhaps reflecting that it was published in 1994, adds to the joint confusion with the following passage:

The center of gravity is something the enemy must have to continue military operations—a source of his strength, but not necessarily strong or a strength in itself. There can only be one center of gravity. Once identified, we focus all aspects of our military, economic, diplomatic, and political strengths against it. As an example, a lengthy resupply line supporting forces engaged at a distance from the home front could be an enemy center of gravity. The resupply line is something the enemy must have—a source of strength, but not necessarily capable of protecting itself.⁴⁹

Again, there are consistent and inconsistent elements. The center of gravity is certainly something the enemy must have, since its loss is a decisive defeat at each level of war. However, by suggesting a center of gravity is not a strength, it contradicts Clausewitz and the probable intent of joint doctrine. To concentrate all elements of national power to defeat the enemy’s center of gravity is consistent, but limiting the number of centers of gravity to one is an ideal goal rather than a fact. Suggesting a long resupply line is a center of gravity confuses what it is (force) with what it needs (logistic supply routes).

To summarize, the joint definition is neither consistent with the Clausewitzian idea nor particularly effective in determining what center of gravity actually is. As John Saxman wrote, “the joint definition of the center of gravity is so ambiguous that a center of gravity can be considered just about anything... In essence, joint doctrine is saying, orient the joint campaign on *something*.”⁵⁰ Nevertheless, the Army, Air Force, and Marine Corps have dutifully adopted the joint definition, with the Navy sure to follow. Yet adopting the vague joint definition will not resolve the inconsistencies that exist, as each service doctrine expands upon the joint definition to suit its parochial interests or singular perspective. The next section presents the proposed framework that attempts to resolve the service confusion and contradiction about the center of gravity.

Strange Gravity

Dr. Strange sought to clarify the concepts of center of gravity, capability, requirements, and critical vulnerability that have become confused and entangled under the joint definition. His expressed intent was to enable military officers to speak the same language. His immediate purpose was to explain why a center of gravity cannot be a critical vulnerability, as expressed in the previous version of *Warfighting*. His standard was to define that common language in precise terms consistent with its Clausewitzian foundation. One may understand his framework by asking four questions. What is a center of gravity? What does a center of gravity do to impose will? (Critical Capability) What does the center of gravity need? (Critical Requirement) Is there a way to defeat a center of gravity efficiently? (Critical Vulnerability) This original diagram in figure 2 depicts the center of gravity framework with the definitions provided by Dr. Strange:

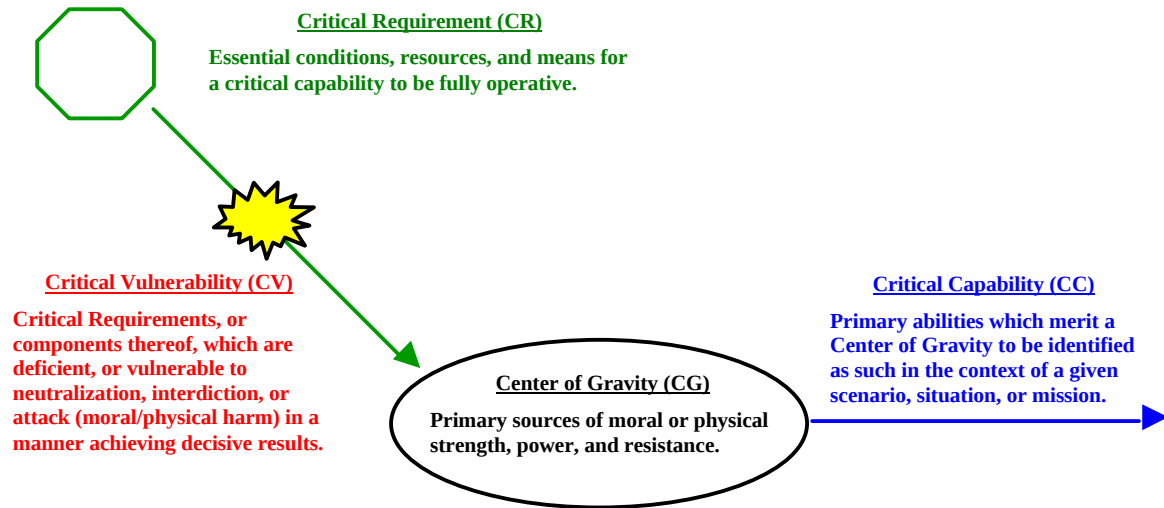


Fig. 2. Proposed Center of Gravity Framework.⁵¹

The framework appears to separate what needs separating. The joint confusion about the center of gravity resulted because the vague definition did not distinguish between the concepts of power, vulnerabilities, capabilities, and requirements. The framework shows how these concepts are related to each other, providing a holistic perspective of operational design. It takes a systems approach by defining and relating key functions to the center of gravity. It clearly defines the center of gravity as the “dynamic agent of influence,” or the primary force to defeat the enemy and accomplish the objectives of the war.⁵² The examples in figure 3 clarify the framework:

Center of Gravity	Critical Capability	Critical Requirement	Critical Vulnerability
Leaders	Command & Control	Information	Command Posts
People	Support the War	A Cause, Leadership	Hope of Success
Army, MEF, Wing, Fleet	Attack, Defend, Move	Logistics	Line of Communications

Fig. 3. CG-CC-CR-CV Matrix.⁵³

This proposed center of gravity framework appears to reconcile the different service opinions about the center of gravity.⁵⁴ It is the force (means) used to achieve tactical, operational, and strategic objectives (ends). It rules unequivocally that the center of gravity is a primary strength, not a weakness. It allows the center of gravity to be a physical force and an intangible moral force at different levels of war. It implies the nature of strategic, operational, and tactical centers of gravity is consistent with Clausewitz's understanding and the Marine Corps' definitions. There is no prohibition against multiple centers of gravity, although the word "primary" clearly reduces the scope and precludes a High Value Target List. The framework supports interaction between friendly and enemy centers of gravity as each attempts to achieve its objectives, much like a duel or wrestling match. Dr. Strange relates the center of gravity to objectives at each level of war by providing numerous examples. Above all, the framework defines the center of gravity in terms consistent with its true nature and effect.

This literature review reveals that the problem exists. Valid service theories remain incompatible because of the contradictions about the center of gravity. It suggests the framework may form the nucleus of a unified theory of joint warfighting to resolve the paradox. However, while Dr. Strange proposed specific changes to joint and service doctrine, he did not show how to apply the service theories of operational warfighting consistent with this framework. While he developed many historical examples of high-intensity warfighting to explain this framework, he did not apply the framework to full spectrum operations or consider contemporary scenarios. Before one may recommend adopting the framework as joint doctrine, one must still test it for consistency with service theories of operational warfighting and effectiveness in full spectrum operations.

ANALYSIS

Ultimately however, one would hope to find a complete, consistent, unified theory that would include all these partial theories as approximations, and that did not need to be adjusted to fit the facts...⁵⁵

Stephen Hawking thus described the goal: a complete, consistent unified theory of joint warfighting that includes the service theories as approximations and does not have to be adjusted to fit historical facts. This standard is consistent with scientific method and Clausewitz's warning that, "Analysis and observation, theory and experience must never disdain or exclude each other; on the contrary, they support each other."⁵⁶ The unified theory in question refers specifically to operational design, a subject far more narrow in scope than the entire nature and conduct of war that Clausewitz explored. This unified theory would simply refine one of the individual nuggets he provided, the center of gravity concept, for application in modern joint warfighting.

To review the methodology, the first test asks, does the proposed center of gravity framework support unified action by reconciling the service theories of operational warfighting? It draws three key principles of operational design from the service theories of operational art, maneuver-warfare, air and naval warfare. It then attempts to integrate them with the proposed framework to check for consistency. If the framework preserves the intent of the key principles, then the outcome is "yes." If the framework with minor modification to its definitions preserves the key principles, then the outcome is "modify." If neither of the above, then the outcome is "no" because the framework is not consistent with the service theories. The second test asks, is the proposed center of gravity framework an effective analytical tool to achieve success in full spectrum operations?

It applies the framework to three test cases: Operations Desert Storm, Allied Force, and Joint Guardian. If the framework allows the commander to understand and defeat the enemy means and will to fight to accomplish operational and strategic objectives, then the outcome is “yes.” If the framework with minor modification to its definitions achieves this standard, then the outcome is “modify.” If the framework cannot be repaired, then the outcome is “no” because it is not effective.

Before examining these service theories and historical test cases, one must be clear about the operational level of war to understand their context. JP 1-02, *Dictionary of Military Terms*, defines the operational level of war to be:

The level of war at which campaigns and major operations are planned, conducted, and sustained to accomplish strategic objectives within theaters or areas of operations. 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. These activities imply a broader dimension of time or space than do tactics; they ensure the logistic and administrative support of tactical forces, and provide the means by which tactical successes are exploited to achieve strategic objectives.⁵⁷

This definition distinguishes the operational from the strategic and the tactical, but it also shows how they are connected. Clausewitz’s definition of strategy, “the use of engagement for the purpose of war,” describes the same operational linkage.⁵⁸ War planning must determine the “operational objective,” the specific military conditions that achieve the political purpose of the war.⁵⁹ The enemy power that resists achieving these objectives is his center of gravity at each level of war. The service theories of operational warfighting describe different ways to defeat enemy centers of gravity to accomplish the political objectives. Thus, the center of gravity concept remains the essential element of operational design because it goes “straight to the heart of the matter, to the duel.”⁶⁰

Operational Art

The Army's theory is operational art. ST 3-0 defines operational art to be, "the use of military forces to achieve strategic goals through the design, organization, integration, and conduct of theater strategies, campaigns, major operations, and battles."⁶¹

Shimon Naveh shows how this art requires the commander to answer three questions:

1. What military conditions must be produced in a theater of war or operations to achieve the strategic goal?
2. What sequence of actions is the most likely to produce that goal?
3. How should the resources of the force be applied to accomplish that sequence of actions?⁶²

Operational art is a compilation of ideas about the answers to these questions that have evolved over time. Nationalism and industrialism precipitated operational art, since the size and strength of modern armed forces expand war in time and space. Jomini's concept of classical strategy and decisive battle, already insufficient by the battle of Leipzig in 1813, was found completely lacking by the American Civil War in 1861.⁶³ Dr. Schneider notes the following characteristics that distinguish operational art from classical strategy:

1. Battles and engagements begin immediately at the national borders.
2. Several armies fight indecisive battles.
3. The only decisive battle is the last battle of the war.
4. Logistics considerations impose pauses upon operations before pursuit can be decisive.
5. Wars consist of several campaigns; campaigns consist of several distinct operations; operations consist of several distance battles and maneuvers.
6. Operational art is strategy with the added dimension of depth.
7. The commander sees little of the many simultaneous battles occurring.⁶⁴

The exact form of operational art evolved from Grant's plan, to Svechin's scientific design of successive deep operations, to the Army's AirLand Battle doctrine.⁶⁵ The tenets of Army doctrine and the elements of operational design capture the modern expression of operational art. The three key principles selected from operational art for this study are the end state, the decisive point, and lines of operations.

The very first element of operational design is the end state and military conditions that the military force must establish to achieve the political purpose and strategic objectives. This equals the emphasis on objective as the first principle of war, since both ideas govern what the force must do. The end state augments the principle of objective by describing the measures of effectiveness to assess whether the force has accomplished its objectives. ST 3-0 states, “At the operational and tactical levels, the end state is the conditions that, when achieved, accomplish the mission.”⁶⁶ When the military end state and political motive of the war are similar in nature, such as the unconditional defeat of Japan, then they appear clearly defined. When they are different, such as a secure environment in Bosnia and the full implementation of the Dayton peace accords, then they may appear poorly defined or entirely absent. This reflects the complex nature of such operations more than the ability to define the end state.

The proposed framework is consistent with the principle of the end state, which is the start point in the process of operational design. Before one can create the friendly center of gravity to impose will, and recognize the enemy center of gravity that resists, one must understand what each side intends to achieve. This is necessary because the political reason and the popular passion to fight for the end state “will determine the military objective to be reached and the amount of effort it requires.”⁶⁷ Given intense reason and passion to fight, the enemy may create a stronger center of gravity to deny the friendly endstate. The degree of enemy resistance determines the nature of the friendly center of gravity and what it must accomplish. Each side striving to achieve its endstate emphasizes the interactive nature of war that is essential to capture in a unified theory. These principles are shown to be consistent with the propose framework in figure 4:

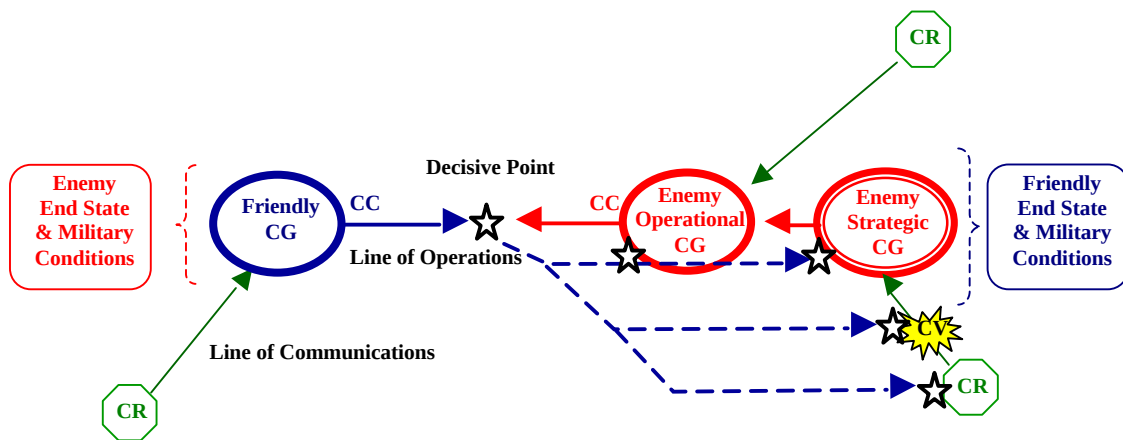


Figure 4. Operational Art.

ST 3-0 defines the next key principle, the decisive point, as “a geographic place, specific key event, or enabling system that allows commanders to gain a marked advantage over an enemy and greatly influence the outcome of an attack.”⁶⁸ Commanders exercise operational art by selecting these key places, events, or systems to defeat the enemy center of gravity to the extent necessary to accomplish the end state. Decisive points bridge operational design into operations orders by incorporating the key places, events, or systems into clearly defined and attainable military objectives. Defeating the enemy center of gravity at the decisive point offers the marked advantage to neutralize his means and will to resist, ultimately enabling one to negotiate or dictate peace to achieve the political purpose of the war.

The framework is consistent with the principle of the decisive point. The key place, event, or system may refer to the enemy’s center of gravity—or a critical capability, requirement, or vulnerability. The commander must consider the capabilities of his own force, the degree of risk of attacking each decisive point, and the extent of the marked advantage gained over the enemy. This cost-benefit analysis will determine the objective, the operational approach, and the line of operations.

The third key principle of operational art is the line of operations. ST 3-0 defines the line of operations to be “the directional orientation of the force in time and space in relation to the enemy.”⁶⁹ The line of operations connects the force with its objectives and end state. They may be geographic, through a series of decisive points that defeat the enemy’s center of gravity in physical battlespace. They may also be logical, through a series of actions at decisive points that establish cause and effect in conceptual terms. The line of operations may be exterior or interior, depending on the relationship between the friendly and enemy centers of gravity. The line of communications connects the force with its logistics base of operations.

The proposed framework is consistent with the line of operations. The line of operations shows a critical capability in action, using geographic or conceptual terms. The line of operations describes how the friendly center of gravity will use its power to defeat the enemy’s center of gravity through the series of decisive points to reach the desired end state. There may be single or multiple lines of operations. They may follow the direct or indirect approach, depending on whether the focus of combat power is against enemy strength (capabilities) or weaknesses (flanks and supplies). The line of communications describes the route that forces, logistics, or other critical requirements follow to render the center of gravity fully operative. One may make more accurate estimates of the effects achieved by attacking the enemy’s line of communications or critical vulnerability once they correspond to a specific center of gravity.

Thus, the proposed center of gravity is entirely consistent with three key principles of the Army’s theory of operational art. The framework easily incorporates the elements of end state, decisive point, and line of operations without modifying any

definitions. It allows the commander to visualize how the elements of operational design portray interaction between friendly and enemy forces. It clarifies these elements by demonstrating how they relate to the center of gravity, capabilities, requirements, or vulnerabilities. So far, the Army has no reason to object to the proposed framework.

Maneuver-Warfare

The Marine theory of operational warfighting, maneuver-warfare, seeks to accomplish the political objective in the most efficient manner. Still, it is the subject of intense debate. Many mistake the debate to be between maneuver and firepower. Instead, the true debate is about the focus of operational design: attacking enemy strength or enemy weakness. MCDP-1 *Warfighting* defines the following two styles of warfare based on the direct and indirect operational approaches:

Styles in warfare can be described by their place on a spectrum of attrition and maneuver. Warfare by attrition pursues victory through the cumulative destruction of the enemy's material assets by superior firepower. It is a direct approach to the conduct of war that sees war as a straightforward test of strength and a matter principally of force ratios. An enemy is seen as a collection of targets to be engaged and destroyed systematically. Enemy concentrations are sought out as the most worth-while targets...

On the opposite end of the spectrum is warfare by maneuver which stems from a desire to circumvent a problem and attack it from a position of advantage rather than meet it straight on. Rather than pursuing the cumulative destruction of every component in the enemy arsenal, the goal is to attack the enemy "system"—to incapacitate the enemy *systemically*. Enemy components may remain untouched but cannot function as part of a cohesive whole. Rather than being viewed as desirable targets, enemy concentrations are generally avoided as enemy strengths.

Warfighting offers trench warfare in World War I as an example of direct attrition, and the German 1940 *blitzkrieg* campaign against France as the epitome of indirect maneuver. The first is portrayed as a bloody slaughter, while the second is military judo. The first defeats the enemy's means, while the second breaks the enemy's will.⁷⁰

Despite the debate, the Army and Marine theories of operational warfighting are not necessarily mutually exclusive. One may consider maneuver-warfare to be a fully developed subset of operational art that emphasizes the indirect approach to defeat the enemy's center of gravity. While maneuver-warfare theory rejects its theoretical antithesis, attrition warfare, operational art allows for that possibility depending on the nature of the war and the enemy system. However, MCDP 1-1 *Strategy* requires maneuver-warfare to support the following strategies of annihilation and exhaustion:

In an *annihilation* strategy, our military objective is unlimited: we seek to eliminate the enemy's ability to resist, thus leaving him helpless to oppose the imposition of our will. The second alternative is a strategy of *erosion* [exhaustion]. Here, our military objective is limited: we seek only to raise the enemy's costs so high that he will find ending the war on our terms more attractive than continuing to fight.⁷¹

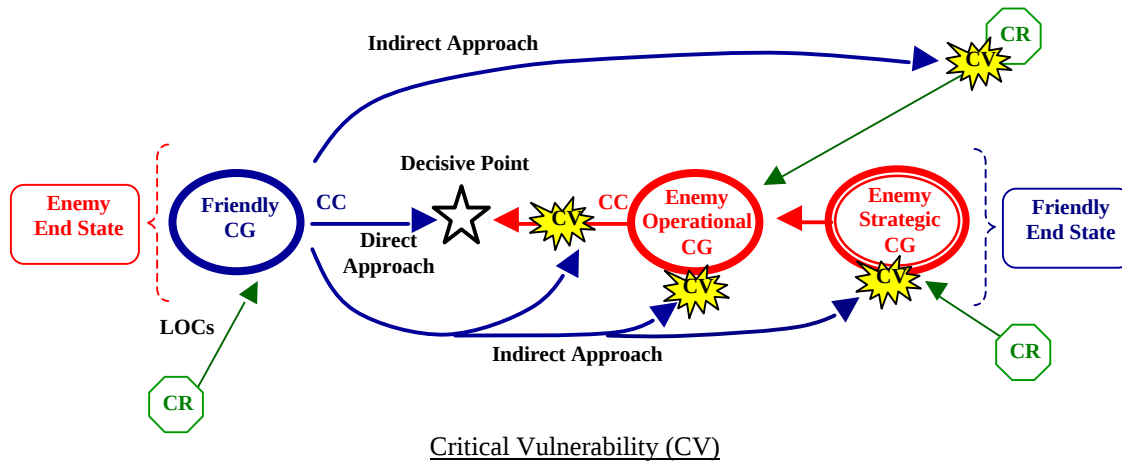
The annihilation strategy sets the standard that maneuver-warfare must achieve, namely the decisive effects against the enemy's strength or center of gravity. The ways may differ, but the ends remain the same. If the indirect approach does not achieve this end, then Marines must practice maneuver-warfare at the tactical level while taking the direct approach at the operational level. Maneuver-warfare, like operational art, stresses exploiting complementary and asymmetric effects to defeat the enemy.⁷² While there may be different emphasis, it is still possible to reconcile the Marine and Army theories of warfighting. Therefore, the key principles tested for consistency with the proposed center of gravity framework are the indirect approach, synergy, and tempo.

Maneuver-warfare theory takes the indirect approach from the work of British and German mechanized theorists during the interwar years. Liddell-Hart coined the phrase and advocated bypassing enemy strength to render it irrelevant, deceiving the enemy, and attacking enemy critical vulnerabilities to cause paralysis of his entire force.⁷³ Marine

doctrine is consistent with the Army's definition of the indirect approach, that which "attacks the enemy center of gravity by applying combat power against a series of decisive points that avoid enemy strength."⁷⁴ JP 3-0 *Operations* suggests those weaknesses to exploit may be "seams, flanks, specific forces or military capabilities, rear areas, and even military morale and public opinion."⁷⁵ These examples describe the tactical and operational levels of war much better than the strategic level. Although Liddell-Hart suggested the aim of the indirect approach is to seek "a strategic situation so advantageous" that the enemy concedes defeat, the realistic cause of this effect is to arrange battle on favorable terms.⁷⁶ Robert Leonard offers precise explanations of how the indirect approach achieves this aim against the enemy's center of gravity:

The highest and purest application of maneuver theory is to *preempt* the enemy, that is, to disarm or neutralize him before the fight. If such is not possible, the maneuver warrior seeks to *dislocate* the enemy forces, i.e., removing the enemy from the decisive point, thus rendering them useless and irrelevant to the fight. If the enemy cannot be preempted or dislocated, then the maneuver-warfare practitioner will attempt to *disrupt* the enemy, i.e., destroy or neutralize the center of gravity, preferably by attacking with friendly strengths through enemy weaknesses.⁷⁷

The proposed framework is consistent with the principle of the indirect approach. One may depict the indirect approach as friendly capabilities that follow lines of operations that avoid enemy capabilities, the actual manifestation of strength. However, one must modify the definition of a critical vulnerability, which Dr. Strange stated must be a critical requirement.⁷⁸ Joint and service doctrine offer examples of critical vulnerabilities to attack the enemy center of gravity itself or its system of capabilities by asymmetric or overwhelming means. This does not suggest that the center of gravity is a weakness; it simply identifies the decisive point to attack it most efficiently. One should retain the high standard of decisive effect, but broaden the term as shown figure 5:



Original Definition: Critical Requirements, or components thereof, which are deficient, or vulnerable to neutralization, interdiction, or attack (moral/physical harm) in a manner achieving decisive results.

Modified Definition: A decisive point to attack an enemy center of gravity, critical requirement, or critical capability where friendly strength may exploit an enemy weakness to neutralize or defeat his center of gravity in minimum time or loss of life.

Fig. 5. Maneuver-Warfare.

The next principle of maneuver-warfare theory tested for consistency is synergy. MCDP 1-2 *Campaigning* considers synergy to be the “maximum impact when we harmonize all warfighting functions to accomplish the desired strategic objective in the shortest time possible and with minimal casualties.”⁷⁹ The Marine warfighting functions are command and control, maneuver, fires, intelligence, logistics, and force protection. Consistent with JP 3-0, the commander harmonizes warfighting functions by synchronizing combat power in time, space, and purpose to overwhelm the enemy center of gravity and protect the friendly center of gravity.⁸⁰

The proposed center of gravity framework is consistent with synergy. When multiple critical capabilities exploit complementary, reinforcing, and asymmetric effects to attack the enemy center of gravity, the result is synergy. Additionally, synergy protects the friendly center of gravity from enemy attack by denying its capabilities.

The final principle of maneuver-warfare is tempo. MCDP 1 *Warfighting* states that, “Speed is rapidity of action. It applies to both time and space. Speed over time is tempo—the consistent ability to operate quickly.”⁸¹ MCDP 1-2 *Campaigning* explains that, “Tempo is a rhythm of activity. It is a significant weapon because it is through a faster tempo that we seize the initiative and dictate the terms of war.”⁸² Tempo is often confused with initiative and momentum, but these definitions clarify those terms. Rapid tempo is one factor that enables a force to seize and retain the initiative. Military momentum is not defined in JP 1-02, but borrowing from physics, it may be the product of concentration (mass) and tempo (velocity).

Because tempo is a vital principle of maneuver-warfare, MCDP 1-2 *Campaigning* suggests ways to create and sustain fast tempo. The commander may use simultaneous action to shock the enemy in depth, anticipate branches and sequels, decentralize decision-making using mission orders, and avoid unnecessary combat.⁸³ The desired effect of tempo on the center of gravity is “to shatter the enemy’s cohesion through a variety of rapid, focused, and unexpected actions which create a turbulent and rapidly deteriorating situation with which the enemy cannot cope.”⁸⁴ Using chess as an analogy, the side with faster tempo makes three moves to the enemy’s one by processing the “Observe-Orient-Decide-Act” cycle faster than the enemy.⁸⁵

The proposed center of gravity framework is consistent with tempo. The multiple critical capabilities that attack the enemy’s center of gravity achieve simultaneous action and sustain tempo. The ability of the friendly center of gravity to anticipate branches and act faster than the enemy center of gravity sustains tempo. The shock, paralysis, shattered cohesion, and demoralization occur within the enemy center of gravity itself.

If one modifies the definition of critical vulnerability, then the center of gravity framework is consistent with the Marine Corps theory of maneuver-warfare. The indirect approach aims attacks critical vulnerabilities where friendly strength may exploit enemy weakness to defeat critical requirements, capabilities, and the center of gravity itself. It is a subset of the decisive point. The framework supports synergy and tempo, although they describe effects on the centers of gravity rather than add new elements to the diagram. The Marines should not object to the modified framework based on these principles.

Air Warfare

The Air Force's theory of operational warfighting is air warfare. Its purpose is to design "the sequencing of events and the application of forces and resources to ensure aerospace power makes useful contributions to military and national objectives."⁸⁶ Nevertheless, it too is the subject of intense inter-service debate. One must overlook contentious phrases like the "Decisive Halt" and the "Traditional Ground-Centric View of Conflict" versus the "Modern View of Conflict." These are more appropriate to Pentagon budgetfighting than joint warfighting. Instead, one should examine the actual ideas for consistency with the proposed center of gravity framework, and by extension, with the other service theories. The key principles of air warfare to be tested are strategic attack, counterland, and parallel attack.

AFDD 2-1 *Air Warfare* defines strategic attack to be, "military action carried out against an enemy's COGs [centers of gravity] or other vital target sets, including command elements, war production assets, and key supporting infrastructure."⁸⁷ It then makes the bold claim that strategic attack "affects 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.”⁸⁸ Realistic conventional means often fail to produce this optimum strategic effect, given intense enemy resistance to the friendly political objective. Furthermore, the enemy people may be demoralized, but still take no action to end the war if they lack the means to defeat a dictator and his secret police. It is unfortunate the debate about strategic attack becomes mired in the same argument about the bombing survey conducted after World War II. Again, one should overlook hyperbole to focus on the beneficial idea of simultaneous action striking the enemy throughout the depth of the theater and at all levels of war.

The proposed center of gravity framework is consistent with the principle of strategic attack. It reflects a critical capability of an air center of gravity to bypass enemy capabilities and operational forces to attack the strategic centers of gravity. The vital centers may be critical requirements if the strategic center of gravity needs them to sustain the means or will to fight. Attacking them degrades the enemy’s center of gravity, if not defeating it entirely. The complementary effect of precision engagement and intelligence supports Pape’s theory of coercion, when the interests involved are low and the enemy values his economic infrastructure.⁸⁹ This is depicted in figure 6:

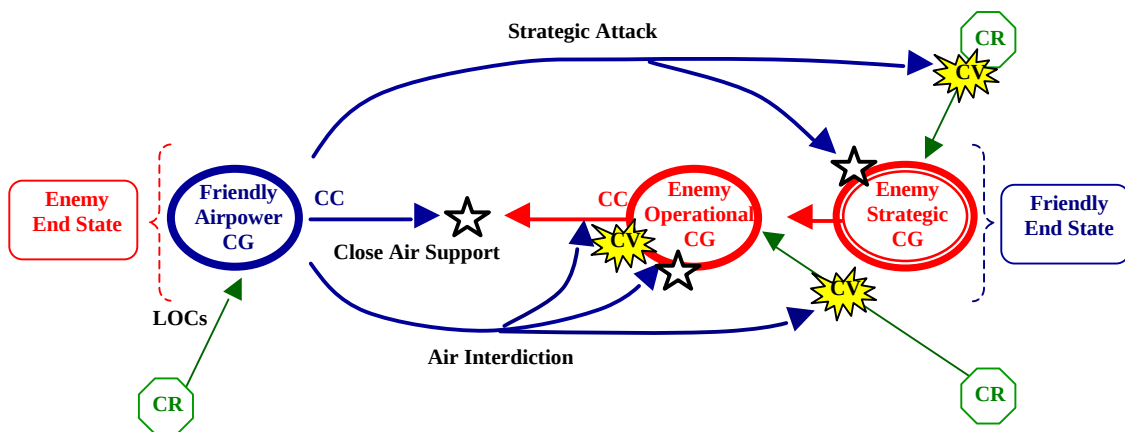


Fig. 6. Air Warfare.

AFDD 2-1 *Air Warfare* defines the next principle, Counterland, as “those operations conducted to attain and maintain a desired degree of superiority over surface operations by the destruction or neutralization of enemy surface forces.”⁹⁰ Counterland includes both air interdiction and close air support missions. Air interdiction (AI) “is a form of aerial maneuver that destroys, disrupts, diverts, or delays the enemy’s surface military potential before it can be used effectively against friendly forces, or otherwise achieve its objectives.”⁹¹ AI may be theater-wide or focused to set the conditions for successful ground combat in a specific area. Typical AI targets include lines of communications, a logistics base of operations, command and control nodes, and fielded forces. Close air support (CAS) “is the use of aerospace assets to directly support the ground force. CAS is flown against targets that are in close proximity to friendly forces; that proximity requires detailed integration between CAS missions and the fire and movement of surface forces.”⁹² Although CAS may be the most important use of airpower to support friendly forces in battle, CAS is also the least efficient use of airpower, primarily due to restrictions that reduce fratricide. CAS is always appropriate “when the surface force cannot handle the enemy with its organic firepower.”⁹³

The proposed center of gravity framework is completely consistent with counterland, as shown in figure 5. CAS attacks the enemy’s tactical centers of gravity, preferably at the decisive point, while they are deployed and using their critical capabilities. AI bypasses the close fight, an indirect approach to strike the operational center of gravity and its critical requirements, preferably at a critical vulnerability if one exists. The target value analysis process reveals the tactical and operational targets that, when attacked, most effectively degrade the enemy’s power to resist.

The final principle of air warfare to be tested for consistency is parallel attack. AFDD 2-1 *Air Warfare* defines parallel attack to be, “simultaneous attack of varied target sets to shock, disrupt, or overwhelm an enemy, resulting in decisive effects. Parallel attack is possible at one or multiple levels of war and achieves rapid effects that leave the enemy little time to respond.”⁹⁴ Parallel attack is a subset of simultaneous action, the employment of airpower against the entire enemy system at as many decisive points as possible. It supports synergy, since airpower may achieve asymmetric, complementary, and reinforcing effects. Resources may limit parallel attack, such as the number of available aircraft and the operational reach to conduct air operations.

The proposed center of gravity framework is also consistent with parallel attack. It reflects critical capabilities striking the enemy’s centers of gravity, requirements, capabilities, and critical vulnerabilities simultaneously throughout the theater of operations. The intent is to defeat the enemy by presenting multiple threats in depth that overwhelm his capabilities and increase the rate of physical and moral destruction.

The proposed center of gravity framework is consistent with the operational theory of air warfare. The unified framework clarifies to non-airmen how the capabilities of airpower support the defeat of the enemy’s centers of gravity at each level of war. Strategic attack portrays the critical capability of airpower to attack the enemy’s strategic center of gravity. If the enemy’s interests and passions evoked by the political demands are low, then strategic attack could be the decisive operation to accomplish the mission. In addition to CAS, the framework depicts how AI attacks the operational center of gravity, its capabilities and requirements. The Air Force should have no objection to adopting the framework based on these principles.

Naval Warfare

NDP 1 *Naval Warfare* introduces the maritime theory of operational warfighting. Since 90 percent of the world's trade moves by sea, including 99% of American exports, the oceans and coastal waterways are indeed the lifelines of supply and commerce.⁹⁵ Therefore, the key principles from the theory of naval warfare that must be tested for consistency with the proposed center of gravity framework include control of the sea, line of communications, and power projection.

The first principle of naval warfare is to gain and maintain control of the sea. The purpose is “to protect sea lines of communication, to deny the enemy commercial and military use of the seas, to establish an area of operations for power projection ashore and support of amphibious operations, and to protect naval logistic support to forward deployed battle forces.”⁹⁶ To achieve control of the sea, naval forces:

1. Destroy or neutralize enemy ships, submarines, aircraft, or mines.
2. Disable or disrupt enemy command and control.
3. Destroy or neutralize the land-based infrastructure that supports enemy sea control forces.
4. Seize islands, choke points, peninsulas, and coastal bases in the littorals.
5. Conduct barrier operations in choke points that prevent enemy mobility under, on, and above the sea.⁹⁷

The proposed center of gravity framework is consistent with the principle of control of the sea. The methods to control the sea are the critical capabilities of a friendly maritime center of gravity. They preserve capabilities, ensure requirements flow, guard vulnerabilities, and protect friendly centers of gravity. They also neutralize enemy capabilities, interdict his requirements, attack his vulnerabilities, and reinforce efforts to defeat the his centers of gravity. This reflects a consistent trend in the service theories, worth adding to the framework's definition, that a critical capability is the ability of a center of gravity to defeat the enemy means and will. The principle is shown in figure 7:

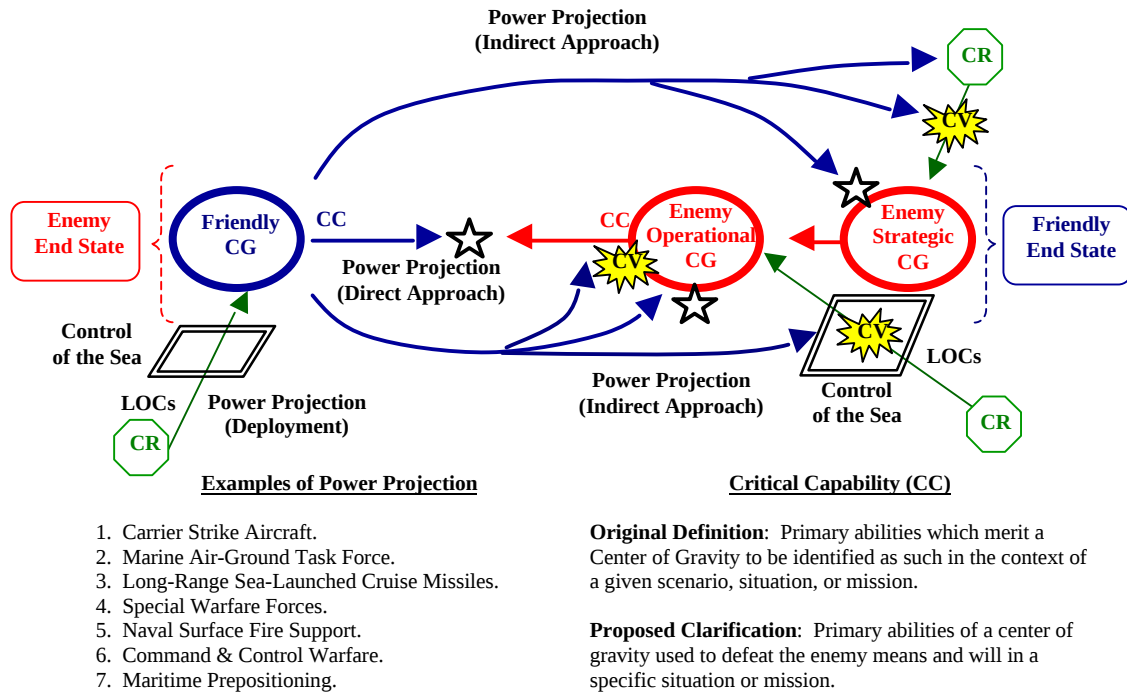


Fig. 7. Naval Warfare.

The next principle is the lines of communication (LOCs). The theory of naval warfare accepts the joint definition as: “All the routes, land, water, and air, which connect an operating military force with a base of operations and along which supplies and military forces move.”⁹⁸ However, naval warfare suggests that the LOCs may be the enemy’s center of gravity. This contradicts the framework, which defines a center of gravity as the primary source of physical or moral strength.

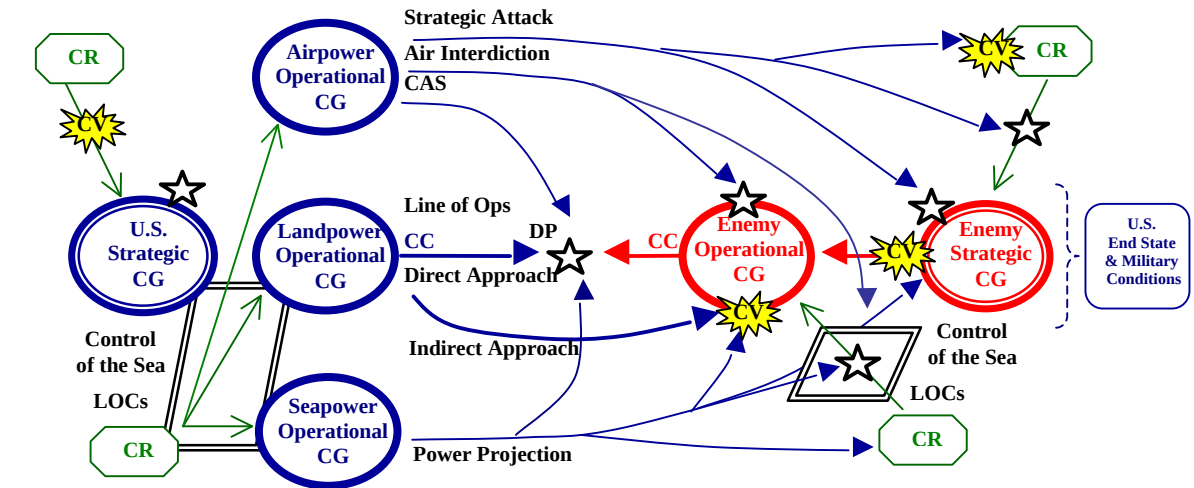
Nevertheless, the framework is consistent with naval warfare, because one may preserve the core principle of the LOCs but modify its form. LOCs are the route that the critical requirements follow to supply the center of gravity. NDP 1 *Naval Warfare* is correct to note that supply is something a force must have to be fully operative. The force should defend friendly LOCs and attack the enemy’s LOCs to interdict these supplies, suggesting LOCs may be a critical vulnerability. Naming the LOCs a center of gravity confuses what it is (force) with what it needs (supply routes).

The final principle of naval warfare is power projection. The maritime concept of power projection includes much more than deployment to a theater of operations; it also includes generating combat power and striking the enemy throughout the depth of the theater.⁹⁹ As NDP 1 states, power projection “takes the battle to the enemy.”¹⁰⁰ Figure 6 provides examples of this expanded concept of power projection at each level of war.

The proposed center of gravity framework is consistent with the principle of power projection. It describes the critical capabilities of a maritime center of gravity to strike the enemy by direct and indirect approaches at all levels of war. Power projection may neutralize enemy capabilities, interdict critical requirements, or attack the center of gravity. Power projection also describes the deployment and generation of combat power to create and sustain the friendly center of gravity.

The proposed center of gravity framework is consistent with the operational theory of naval warfare. Power projection and the actions taken to gain and maintain control of the sea may attack each component of the framework. Considering lines of communications to be a critical requirement or vulnerability, rather than a center of gravity, does not diminish its importance. Instead, it preserves the true nature of this core principle while rendering it consistent with the framework. The Navy should have no cause to object to the framework based on these three principles.

Because the center of gravity framework is consistent with the service theories, it is possible to develop a partial unified theory of joint warfighting as shown in figure 8. This figure serves to summarize the results of the first test, consistency. One may always integrate additional joint and service principles with the framework, but this partial unified theory is sufficient to serve as the basis for the second test, effectiveness.



- Center of Gravity (CG):** Primary sources of moral or physical strength, power, and resistance.
 - Critical Capability (CC):** Primary abilities of a center of gravity used to defeat the enemy means and will in a specific situation or mission.
 - Critical Requirement (CR):** Essential conditions, resources, and means for a critical capability to be fully operative.
 - Critical Vulnerability (CV):** A decisive point to attack an enemy center of gravity, critical requirement, or critical capability where friendly strength may exploit an enemy weakness to neutralize or defeat his center of gravity in minimum time or loss of life.
 - End State:** At the strategic level, the end state is what the NCA want the situation to be when operations conclude and military force is no longer the principal means. At the operational level, these conditions attain the aims set for the campaign or operation. At the operational and tactical levels, the end state is the conditions that, when achieved, accomplish the mission.
 - Decisive Point (DP):** A geographic place, specific key event, or enabling system that allows commanders to gain a marked advantage over an enemy and greatly influence the outcome of an attack
 - Line of Operations:** The directional orientation of the force in time and space in relation to the enemy.
 - Lines of Communications (LOCs):** All the routes, land, water, and air, which connect an operating military force with a base of operations and along which supplies and military forces move.
 - Direct Approach:** Applies combat power directly against the enemy center of gravity or the enemy's principal strength.
 - Indirect Approach:** Attacks the enemy center of gravity by applying combat power against a series of decisive points that avoid enemy strengths.
 - Control of the Sea:** Enhances friendly freedom of action and denies the enemy freedom of action over, on, or under the sea. It permits power projection and force sustainment to accomplish the full range of potential missions.
 - Strategic Attack:** Military action carried out against an enemy's COGs [centers of gravity] or other vital target sets, including command elements, war production assets, and key supporting infrastructure
 - Air Interdiction:** A form of aerial maneuver that destroys, disrupts, diverts, or delays the enemy's surface military potential before it can be used effectively against friendly forces, or otherwise achieve its objectives
 - Close Air Support:** is the use of aerospace assets to directly support the ground force. CAS is flown against targets that are in close proximity to friendly forces; that proximity requires detailed integration between CAS missions and the fire and movement of surface forces.
- Simultaneous Operations:** Seek to employ combat power against the entire enemy system by engaging concurrently as many decisive points as possible. Simultaneity exploits depth and agility to overwhelm enemy forces.
- Parallel Attack:** Simultaneous attack of varied target sets to shock, disrupt, or overwhelm an enemy, resulting in decisive effects. Parallel attack is possible at one or multiple levels of war and achieves rapid effects that leave the enemy little time to respond.
- Synergy:** Maximum impact when we harmonize all warfighting functions to accomplish the desired strategic objective in the shortest time possible and with minimal casualties.
- Asymmetric Effects:** Take advantage of friendly strengths and enemy vulnerabilities and preserve freedom of action.

Fig. 8. Unified Theory of Joint Warfighting.

Operation Desert Storm

The next test applies the unified theory of joint warfighting to Operation Desert Storm. The purpose is to determine if the proposed center of gravity framework is an effective analytical tool to achieve success in full spectrum operations. If it allows the commander to understand and defeat the enemy means and will to fight to accomplish operational and strategic objectives, then it is effective. Since this test assumes a general level of knowledge of these operations, it simply presents the framework, explains its design, and renders an evaluation of effectiveness based on historical experience. Figure 9 depicts the operational design of Operation Desert Storm:

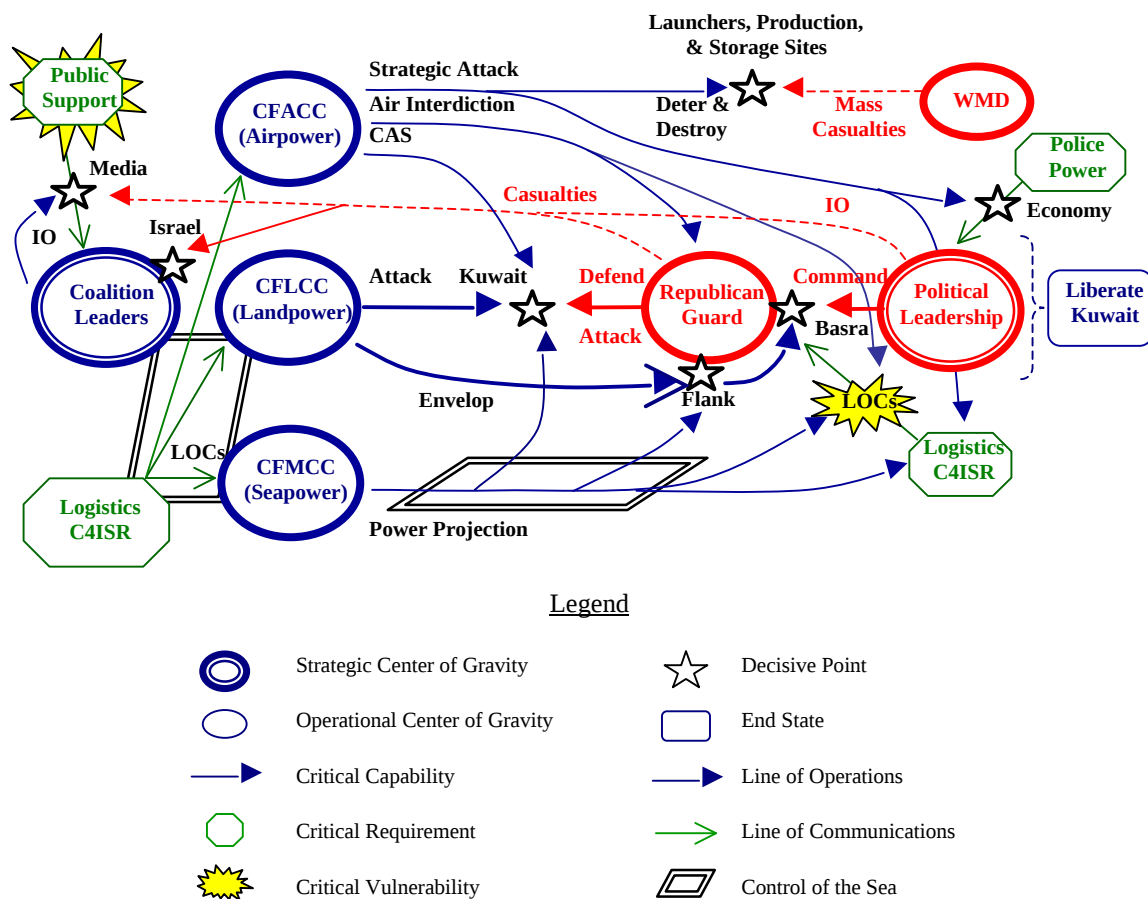


Fig. 9. Operation Desert Storm.

President George Bush declared the strategic objectives of the United States with respect to the Iraqi invasion of Kuwait were:

1. To effect the immediate, complete, and unconditional withdrawal of all Iraqi forces from Kuwait.
2. To restore Kuwait's legitimate government.
3. To protect the lives of American citizens abroad.
4. To promote the security and the stability of the Persian Gulf.¹⁰¹

The strategic endstate was to liberate Kuwait. It is clear by these objectives that the Coalition sought significant concessions from Saddam Hussein. Dictators typically do not surrender their conquests without a fight, since revealing weakness threatens their personal survival. Political reason increased the intensity of the war. Therefore, the Coalition declared the operational objectives and military conditions were to:

1. Destroy Iraq's military capability to wage war.
2. Gain and maintain air supremacy.
3. Cut Iraqi supply lines.
4. Destroy Iraq's chemical, biological, and nuclear capability.
5. Destroy Republican Guard forces.
6. Liberate Kuwait City with Arab forces.¹⁰²

The enemy strategic center of gravity that resisted this endstate was the Iraqi political leadership, Saddam Hussein in particular. His political objective was to prevent the Coalition from achieving its objectives. Hussein had the critical capability to command, that is, to choose war or peace. Thus, Hussein was the "king," for the Coalition would end the war when Hussein agreed to a cease-fire. Hussein needed police power, a critical requirement to maintain his rule. The Iraqi operational center of gravity was the Republican Guard, the primary source of physical strength used to resist the Coalition's will. Its critical capabilities were the ability to attack and defend. These cause casualties, which Hussein could have used to conduct information operations in the media, a decisive point to erode public support for the war. This was one method by

which Iraq could strike the Coalition's critical vulnerability by the indirect approach. The critical requirements the Republican Guard needed were logistics and the command, control, communications, computers, intelligence, surveillance and reconnaissance (C4ISR) functions. Another Iraqi center of gravity was its weapons of mass destruction (WMD), which had the ability to inflict or threaten mass casualties by missile attack. A second decisive point to attack the Coalition was Israel, since provoking retaliation would change the character of the war from reversing aggression to an Arab-Israeli conflict.

The Coalition's strategic center of gravity was its political leadership, which was united by a community of interest to contain Iraq and reverse aggression. Its critical capability, besides the power to command, was to conduct information operations to sustain this community of interest. Its critical requirement and vulnerability was public support to sustain combat operations and work cooperatively. The Coalition created three operational centers of gravity to defeat the Iraqi means and will as necessary to achieve its strategic endstate. The first was landpower commanded by the Combined Force Land Component Commander (CFLCC). Its critical capability was to attack by the direct approach through Kuwait and by the indirect approach to envelop the right flank of the Republican Guard. This line of operations would have reached its final decisive point in Basra. For clarification, the VII (US) Corps was the tactical center of gravity that defeated the Republican Guard divisions in a battle. The second operational center of gravity was airpower commanded by the Combined Force Air Component Commander (CFACC), which had several critical capabilities. It conducted strategic attack to deter and destroy Iraqi WMD at its launch, production, and storage sites; destroy Iraqi economic infrastructure to turn the secret police against Hussein; and attack Iraqi logistics and

C4ISR infrastructure to destroy these critical requirements. It also conducted AI and CAS to defeat the centers of gravity and interdict critical requirements. The third operational center of gravity was seapower under the command of the Combined Force Maritime Component Commander (CFMCC). One of its critical capabilities was to gain and maintain control of the sea to protect friendly lines of communications and areas to conduct offensive operations. A second capability was to conduct power projection at the tactical (naval surface fire support), operational (offensive air support), and strategic (missile attack) levels of war. Together, airpower and seapower cut the Iraqi lines of communications, a critical vulnerability of the Republican Guard. Without logistics, C4ISR, and freedom of movement, the Republican Guard could not escape defeat.

Thus, the proposed center of gravity framework is an effective analytical tool for the combined force commander to achieve success in a major theater war like Operation Desert Storm. It enables the commander in chief to understand and defeat the Iraqi means and will to fight in order to achieve strategic and operational objectives. It enables the services to exploit simultaneous action, parallel attack, and synergy by attacking multiple decisive points throughout the depth of the theater. Most important, it resolves the service confusion about the meaning of the center of gravity and its relevance in operational design. The services need no longer argue about the center of gravity based on their parochial interests. Instead, they can achieve unified action in operational design by understanding how each service theory fits together to form a unified theory of joint warfighting. Armed with this framework, General Norman Schwarzkopf need not have taken the extreme measure of banning the term center of gravity from his headquarters.

Operation Allied Force

Figure 10 depicts the proposed center of gravity framework applied to Operation Allied Force, the war to coerce Yugoslavia to accept the Rambouillet peace accords:

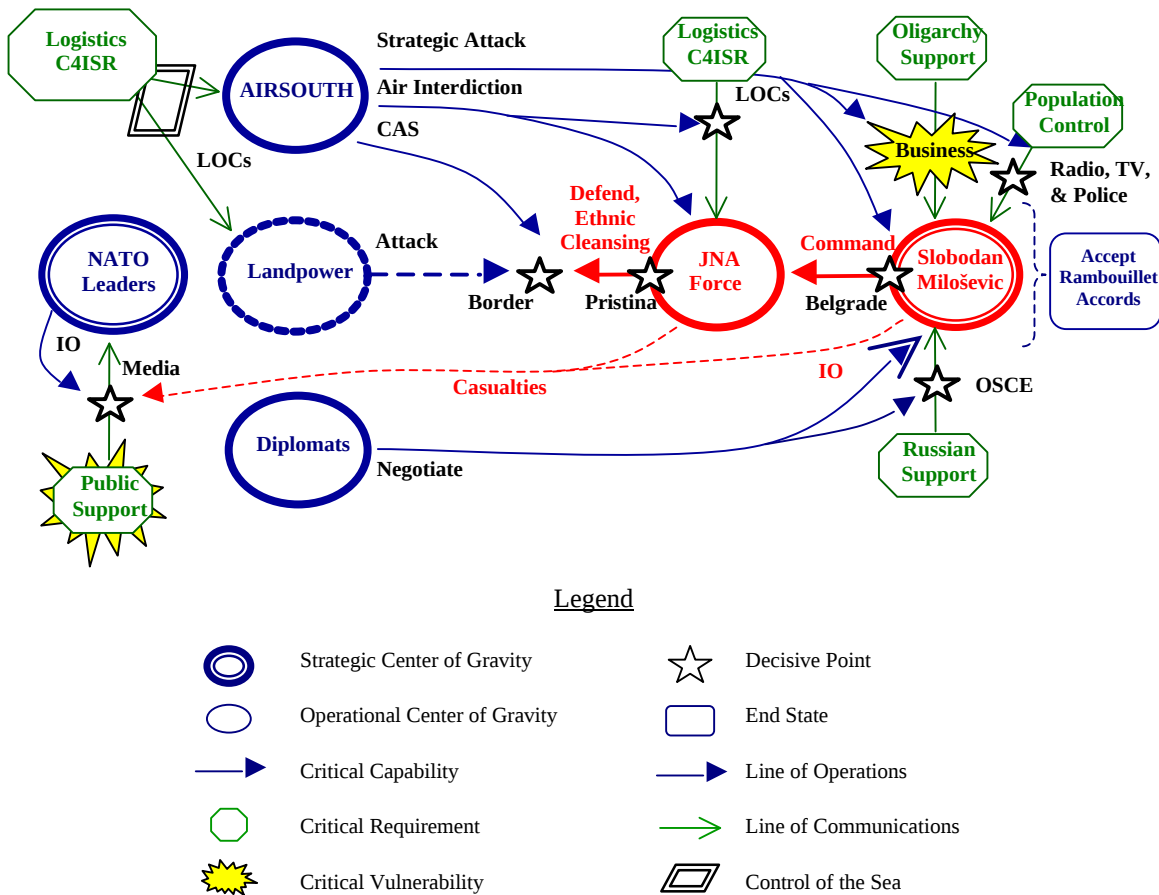


Fig. 10. Operation Allied Force.

President Clinton declared NATO's political motive in Kosovo was "to stop the killing and achieve a durable peace that restores Kosovars to self-governance."¹⁰³ The humanitarian motive of the war was "to force Milošević back to the negotiating table so that NATO could find a way short of independence to protect Kosovo's ethnic Albanian population from Serb violence and political domination."¹⁰⁴ The strategic endstate was that Milošević must accept the Rambouillet accords captured in these strategic objectives:

1. Ensure a verifiable stop to all military action and the immediate ending of violence and repression in Kosovo.
2. Withdraw from Kosovo his military, police, and para-military forces.
3. Agree to the stationing in Kosovo of an international military presence.
4. Agree to the unconditional and safe return of all refugees and displaced persons, and unhindered access to them by humanitarian aid organizations.
5. Provide credible assurance of his willingness to work for the establishment of a political framework agreement based on the Rambouillet accords.¹⁰⁵

To achieve these strategic objectives, General Hugh Shelton, Chairman of the Joint Chiefs of Staff, reported that the military operational objectives of NATO were:

1. To demonstrate the seriousness of NATO's opposition to Belgrade's aggression in the Balkans.
2. To deter Milošević from continuing and escalating his attacks on helpless civilians and create the conditions to reverse his ethnic cleansing.
3. To damage Serbia's capacity to wage war against Kosovo in the future or spread war to neighbors by diminishing or degrading its ability to wage war.¹⁰⁶

One notes immediately that some political objectives were distinctly different in nature from the military objectives. NATO admitted the difficulty of coercion by air attack when it changed the wording of its objectives from the duly impressive, "*ensure the immediate ending of violence*," to the modestly hopeful, "*deter continuing attacks*." The words, "damage Serbia's capacity to wage war," suggest the operational approach was to persuade Milošević that he would lose more by fighting than by negotiating.¹⁰⁷ The cause and effect logic was to establish military conditions that made his personal costs of resistance (the political effects of air operations) higher than his costs of accepting the terms (NATO peacekeepers in Kosovo). While diplomacy was the "decisive operation" and military operations were the "shaping operation," both operations were united in purpose and directed against the Serbian centers of gravity.¹⁰⁸

The Yugoslav strategic center of gravity that resisted this endstate was Slobodan Milošević. Like Hussein, his political objective was a negative aim, to prevent NATO from achieving its objectives. Milošević also had the critical capability to command, making him the “king,” since the war would end when he agreed to terms. Milošević had three critical requirements, rendering him more susceptible to coercion by airpower than Hussein. His most important requirement was the support of the Yugoslav political oligarchy, his personal allies who ran several state-sponsored businesses, reaping significant profits. Cutting their support, a critical vulnerability, was the desired effect of strategic attack. He also needed the means of population control to maintain his authoritarian rule and a measure of Russian diplomatic support to sustain the people’s will to fight. The Yugoslav operational center of gravity was the army forces, supported by paramilitary organizations, that defended Kosovo and conducted ethnic cleansing. Defending Kosovo would cause casualties, which Milošević could reinforce with information operations to strike NATO’s critical vulnerability, public support for the war, at its decisive point in the media. The army forces needed logistics and C4ISR as its critical requirements. The Yugoslav strategy was one of exhaustion, defending Kosovo until NATO’s public and political will to fight eroded.

NATO’s strategic center of gravity was its political leadership, again united by a community of interest to stop the killing and maintain regional stability in Europe. Its critical capability was to conduct information operations to sustain public support for the war. NATO’s operational center of gravity was Allied Air Forces Southern Europe (AIRSOUTH), the air component of Allied Forces Southern Europe (AFSOUTH). Its primary critical capability was to conduct strategic attack to neutralize, interdict, or

destroy the Yugoslav critical requirements. The decisive points were the economic businesses of the oligarchy and the radio, television, and police stations that maintained population control. The purpose was to raise Milošević's personal cost of resistance higher than the cost of accepting KFOR. AIRSOUTH also conducted AI and CAS against the enemy operational center of gravity in Kosovo. The purpose was to deflect media criticism that NATO could not protect the Kosovars, and thereby decrease the pressure for ground operations. Another NATO center of gravity was the diplomats, who conducted the decisive operations to gain Russian support and persuade Milošević to yield to terms. Although NATO initially ruled out a ground option, it established Task Force Hawk in Albania and subsequently suggested that landpower would attack.¹⁰⁹ NATO had the potential to create a land center of gravity by standing up a combined joint task force (CJTF).¹¹⁰ Its critical capability was to attack on a line of operations from the first decisive point at the border mountain passes to the second decisive point at Pristina. This would change the nature of the war from one to negotiate peace to one to dictate peace. Both AIRSOUTH's and the landpower's critical requirements were logistics and C4ISR. NATO followed the same strategy of exhaustion, avoiding decisive battle while conducting strategic attack to erode Milošević's will to fight.

Thus, the proposed center of gravity framework is an effective analytical tool for the combined force commander to achieve success in a small-scale contingency like Allied Force. It enables General Wesley K. Clark to understand and defeat the Serbian means and will to fight in order to achieve NATO objectives. It accentuates the principles of simultaneous action, parallel attack, and synergy. Above all, it would have enabled the SACEUR and his CFACC to agree on the Serbian centers of gravity.

Operation Joint Guardian

Figure 11 depicts the proposed center of gravity framework applied to Operation Joint Guardian, the peacekeeping operation to implement the Rambouillet accords:

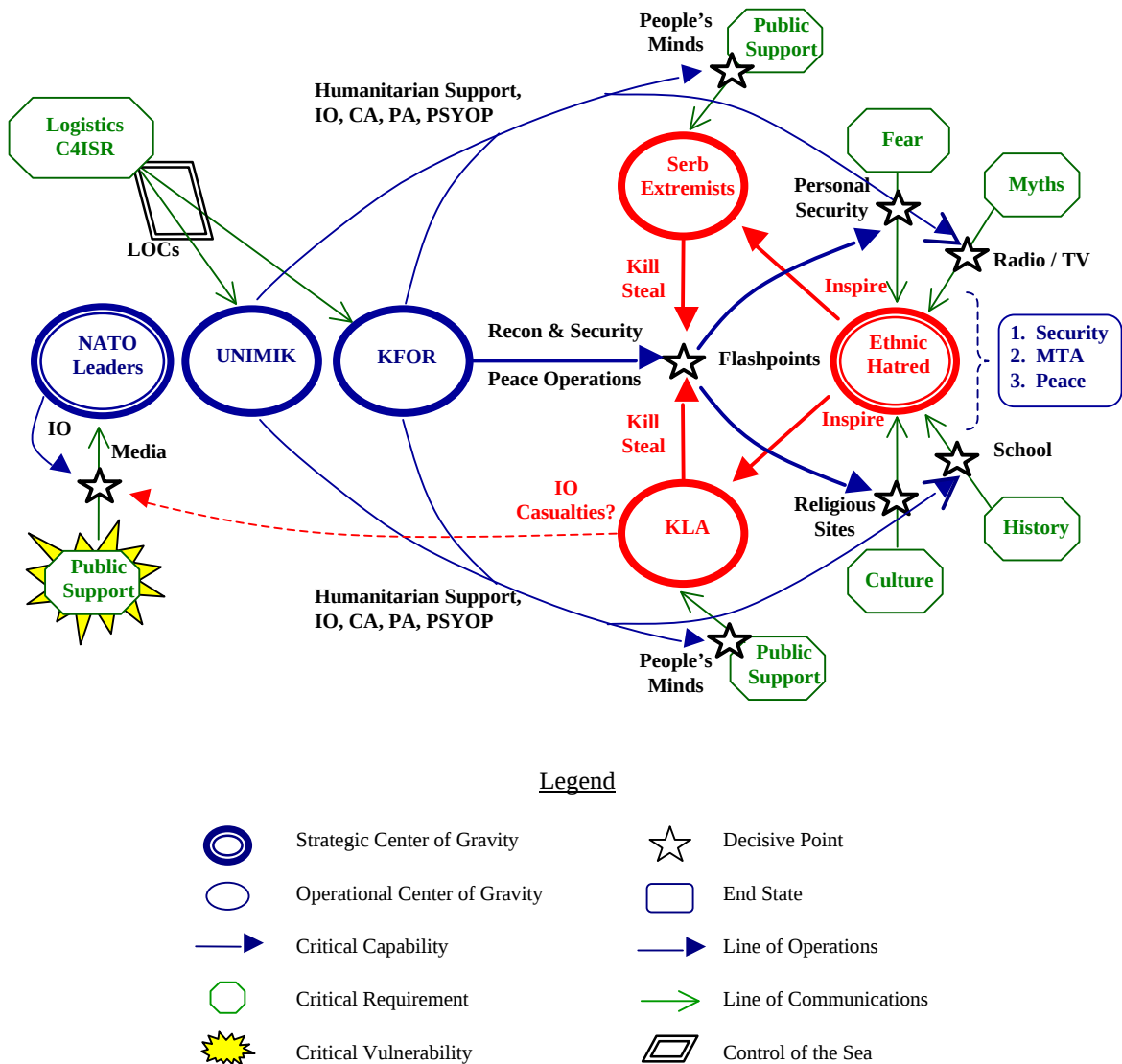


Fig. 11. Operation Joint Guardian.

Operation Joint Guardian was the sequel to Operation Allied Force. Pursuing the same political objectives, the operational mission changed from coercion to the following:

1. To establish and maintain a secure environment in Kosovo, including public safety and order.
2. To monitor, verify and when necessary, enforce compliance with the conditions of the Military Technical Agreement (MTA) and the UCK Undertaking.
3. To provide assistance to the United Nations Interim Mission in Kosovo (UNMIK), including core civil functions until they are transferred to UNMIK.¹¹¹

This mission suggests that the strategic endstate is transfer of peacekeeping responsibility to UNMIK. The operational endstate and military conditions are a secure environment and the full implementation of the MTA and the UCK Undertaking.

The enemy strategic center of gravity that continues to resist this endstate is the ethnic hatred that sustains and inspires the will to fight on all sides. It has no critical vulnerabilities and it cannot be attacked directly. Its critical requirements are fear, myths, history, and culture. The two enemy operational centers of gravity, the KLA and the Serb extremists, oppose each other. Their critical capabilities are to kill and steal property, such as homes. The locations where such violence is likely to occur are the flashpoints. The critical requirement of the KLA and Serb extremists is popular support. They need sanctuary and cooperation from the people to remain effective terrorist organizations. The Serb extremists pursue vengeance to raise the cost of the KLA's ethnic cleansing. The KLA follows a terrorist strategy of intimidation, making the Serbs' cost of remaining in Kosovo higher than their costs of relocating to Serbia. If the KLA believes it can deter or defeat Serbian military repression in Kosovo after NATO departs, then it may provoke attacks on peacekeepers to cause NATO to withdraw from the lack of public support.

The friendly strategic center of gravity is the Allied political leadership, still united by a community of interest to stop the killing and maintain regional stability in Europe. Its critical capability is to conduct information operations to sustain the public

will and international consensus. Its critical vulnerability is the need for public support for humanitarian intervention. Should KFOR peacekeepers suffer casualties, then NATO's political leaders must justify the operation in terms of national interests and probability of success. The operational center of gravity is KFOR, the primary strength used to establish security, enforce the MTA, and build peace. Its primary critical capabilities are to conduct peace, reconnaissance, and security operations. The decisive points of these operations are the flashpoints of ethnic violence, the personal security of civilians, and the religious sites important to each culture. Once the environment is relatively secure, KFOR and another center of gravity, UNIMIK, may conduct additional operations. These critical capabilities include humanitarian support, civil affairs, public affairs, information operations, and psychological operations.¹¹² Their purpose is to neutralize the enemy critical requirements of fear, myths, history, and culture. The decisive points of these lines of operations are personal security, radio and television stations, schools, religious sites, and the minds of the people. KFOR and UNIMIK need the critical requirements of logistics and C4ISR over secure lines of communications.

Thus, the proposed center of gravity framework is an effective analytical tool for the combined force commander to achieve success in peace operations like Joint Guardian. It enables the KFOR commander to understand and neutralize ethnic hatred to achieve strategic objectives. The framework easily adapts from mutual interaction between belligerents, to third-party peacekeeping to pacify two belligerents. It reveals the difficulty of complex peacekeeping operations, as the strategic center of gravity is a powerful moral force that has no critical vulnerabilities and cannot be directly attacked. Finally, it accentuates the principles of simultaneous action, parallel attack, and synergy.

CONCLUSION

Theory will have fulfilled its main task when it is used to analyze the constituent elements of war, to distinguish precisely what at first sight seems fused, to explain in full the properties of the means employed and to show their probable effects, to define clearly the nature of the ends in view, and to illuminate all phases of warfare in a thorough critical inquiry. Theory then becomes a guide... it will light his way, ease his progress, train his judgment, and help him to avoid the pitfalls.¹¹³

Based on these service principles and operations, the United States Armed Forces should adopt the modified center of gravity framework as an element of operational design. (This modified framework is defined and depicted in figure 8.) The evidence suggests the hypothesis is true: the modified center of gravity framework reconciles the service theories of operational warfighting while preserving their core principles and is an effective concept to achieve success in full spectrum operations. Figure 12 presents the results of this analysis:

METHODOLOGY	TEST CASES	INDEPENDENT VARIABLES	DEPENDENT VARIABLE
Subordinate Questions	Observations	Evaluation Criteria	Outcome
1. Does the proposed center of gravity framework support unified action by reconciling the service theories of operational warfighting?	USA’s Operational Art (ST 3-0)	Consistency: Does the framework resolve the conflicts between the service theories by preserving their core principles but modifying their current form as required?	Yes
	USMC’s Maneuver Warfare (MCDP 1)		Modify
	USAF’s Air Warfare (AFDD 2-1)		Yes
	USN’s Naval Warfare (NDP 1)		Yes
2. Is the proposed center of gravity framework an effective analytical tool to achieve success in full spectrum operations?	Operation Desert Storm (MRC)	Effectiveness: Does the framework allow the JFC to understand and defeat the enemy means and will to fight in order to accomplish operational and strategic objectives?	Yes
	Operation Allied Force (SSC)		Yes
	Operation Joint Guardian (PKO)		Yes
Central Research Question	Should the United States Armed Forces adopt the proposed center of gravity framework as an element of operational design?		Adopt Modified Framework

Figure 12. Results.

The literature review clarified the nature and effect of a center of gravity. From the twenty-four passages that Clausewitz used the term, its nature is consistently force. The center of gravity is the primary power to sustain the will to fight and defeat the enemy's means and will. The effect of defeating a center of gravity is decisive. It neutralizes or eliminates the effective enemy resistance to achieving the strategic, operational, or tactical objectives. While service definitions of the center of gravity have moved closer together, the progress made comes from adopting the vague joint definition. This does not resolve the confusion and contradiction about the center of gravity because it does not define its nature and effect in precise terms.

The first test asked, does the proposed center of gravity framework support unified action by reconciling the service theories of operational warfighting? The framework was consistent with the key principles from operational art, maneuver-warfare, air warfare, and naval warfare—except for the principle of the indirect approach. Dr. Strange limited the set of critical vulnerabilities to be critical requirements, which is too restrictive. Marine and Joint doctrine provide examples of the indirect approach attacking critical vulnerabilities that included systemic capabilities and weak points of the center of gravity itself. Dr. Strange suggested a broader set when he wrote, “Critical vulnerabilities are weaknesses which can be exploited to undermine, neutralize, and/or defeat an enemy center of gravity.”¹¹⁴ This does not mean the center of gravity is a weakness; it means the primary enemy strength may have a weakness that friendly strength can exploit with asymmetric, complementary, or reinforcing effects. The critical vulnerability is a narrow subset of a decisive point. It must be an exploitable weakness and it must neutralize or defeat the enemy center of gravity.

Analysis of the service theories also reveals that a center of gravity uses its critical capabilities to defeat the enemy's means and will. Adding this clarification to the framework does not modify the original definition; it simply defines the purpose for using the capabilities. Figure 13 shows the original and modified definitions:

	Original Framework	Modified Definitions
Center of Gravity (CG)	Primary sources of moral or physical strength, power, and resistance.	Same.
Critical Capability (CC)	Primary abilities which merit a Center of Gravity to be identified as such in context of a given scenario, situation, or mission.	Primary abilities of a center of gravity to defeat the enemy means and will in a specific situation or mission.
Critical Requirement (CR)	Essential conditions, resources, and means for a critical capability to be fully operative.	Same.
Critical Vulnerability (CV)	Critical Requirements, or components thereof, which are deficient, or vulnerable to neutralization, interdiction, or attack (moral/physical harm) in a manner achieving decisive results.	A decisive point to attack an enemy center of gravity, critical requirement, or critical capability where friendly strength may exploit an enemy weakness to neutralize or defeat his center of gravity in minimum time or loss of life.

Fig. 13. Original & Modified Framework Definitions.

The second test asked, is the proposed center of gravity framework an effective analytical tool to achieve success in full spectrum operations? The framework was an effective tool because it enabled the joint force commander to understand the conflict and accomplish the strategic end state. Aiding visualization, it portrays the operational design and use of joint combat power to defeat the enemy's means and will to resist, and thereby win battles, campaigns, and wars. It proved effective in full spectrum operations, providing clear operational design in a major theater war (Desert Storm), a small-scale contingency (Allied Force), and peace operations (Joint Guardian).

“Strange gravity” is indeed the “string” to tie the joint universe together. The framework serves as the nucleus of a unified theory of joint warfighting that resolves the paradox of service theories that are valid but incompatible. Testing the framework by critical analysis revealed that it is consistent with service theories and effective in full spectrum operations. By showing how the theories are related to the enemy’s center of gravity, it preserves their core principles while making minor modifications to their form.

Furthermore, the benefit of this unified theory is significant. It promotes unified action in operational design by promoting jointness instead of service arguments to support parochial weapon systems or singular perspectives. It achieves this service consensus without sacrificing precise definitions. It integrates the service principles of simultaneous action, parallel attack, synergy, control of the sea, and power projection in operational design to overwhelm the enemy in depth. Doing so increases the rate of his physical and moral destruction. The ultimate benefit of the unified theory is decisive victory from effective operational design and campaign planning.

Therefore, the Armed Forces should adopt this modified center of gravity framework as an element of operational design. As Clausewitz advised, “Nothing is more important in life than finding the right standpoint for seeing and judging events, and then adhering to it. One point and one only yields an integrated view of all phenomena; and only by holding to that point of view can one avoid inconsistency.”¹¹⁵ The modified framework provides an integrated view of all phenomena, enabling the joint force commander to avoid service inconsistency and visualize unified action in operational design. Yet as Stephen Hawking warns, “A complete, consistent, unified theory is only the first step: our goal is a complete *understanding* of the events around us...”¹¹⁶

¹ Brian Greene, *The Elegant Universe: Superstrings, Hidden Dimensions, and the Quest for the Ultimate Theory* (New York: Random House, 1999), 54.

² Brian Greene, *The Elegant Universe*, 3.

³ Brian Greene, *The Elegant Universe*, 67.

⁴ Brian Greene, *The Elegant Universe*, 152.

⁵ Brian Greene, *The Elegant Universe*, 146.

⁶ Joint Publication 3-0, *Doctrine for Joint Operations* (Washington: Joint Chiefs of Staff, 1995), III-20.

⁷ John B. Saxman, “The Concept of Center of Gravity: Does It Have Utility in Joint Doctrine and Campaign Planning?” (M.M.A.S. monograph, School of Advanced Military Studies, 1992), 30.

⁸ John B. Saxman, “The Concept of Center of Gravity,” 30. Consider: “The fact that this definition is so all encompassing may account for why it has been accepted by the services as the official joint definition. The services have no reason to object to a definition they can interpret to mean anything they want. It allows the Air Force to focus on strategic targets such as command and control (vital components), the Army to focus on the enemy’s operational concentration of forces (strength), and the Marine Corps to attack the enemy vulnerabilities (weakness).”

⁹ This analysis uses the following service manuals as the primary expression of their theories of operational warfighting. Operational Art: Student Text 3-0, *Operations* (Washington: United States Army, 2000). Maneuver-Warfare: Marine Corps Doctrinal Publication 1, *Warfighting* (Washington: United States Marine Corps, 1997). Air Warfare: Air Force Doctrinal Publication 2-1, *Air Warfare* (Washington: United States Air Force, 2000). Naval warfare: Naval Doctrinal Publication 1, *Naval Warfare* (Washington: United States Navy, 1997). These may be augmented by additional references as appropriate.

¹⁰ Joe Strange, “Centers of Gravity and Critical Vulnerabilities: Building on the Clausewitzian Foundation So That We May All Speak the Same Language,” *Perspectives on Warfighting Number Four* (Quantico: Marine Corps War College, 1996).

¹¹ Joint Publication 0-2, *Unified Action Armed Forces* (Washington: Joint Chiefs of Staff, February 1995), I-4. Unified Action: “integrates joint, single-Service, special, and supporting operations; in conjunction with interagency, nongovernmental, private voluntary organizations, multinational, or United Nations operations, into a unity of effort in the theater or joint operations area... Combatant commanders should ensure that their

unified action synchronizes joint operations and single-Service operations in time, space, and purpose with the actions of supporting combatant commands and other military forces (multinational operations) and non-military organizations (DOD and other federal government agencies such as the Defense Logistics Agency, the Agency for International Development, nongovernmental organizations such as religious relief agencies, corporations, private and nongovernment volunteer organizations, international agencies such as the International Red Cross, and the United Nations).”

¹² Carl von Clausewitz, *On War*, 177.

¹³ Congress, Senate, Armed Services Committee, *Lessons Learned from the Air Campaign in Kosovo*, 106th Cong., 2d sess., 21 October 1999 in [database on-line]; available from *FDCH Political Transcripts*, Military Library FullTEXT database.

¹⁴ John B. Saxman, “The Concept of Center of Gravity,” 30. Consider: “While this ambiguous definition may have been necessary to achieve service consensus, it certainly does not provide much guidance for the joint planner who must resolve the service differences and ‘operationalize’ the concept in the joint plan.”

¹⁵ Carl von Clausewitz, *On War*, 132. Clausewitz went on to explain how theory should assist the commander: “Theory then becomes a guide to anyone who wants to learn about war from books; it will light his way, ease his progress, train his judgment, and help him to avoid pitfalls... It is meant to educate the mind of the future commander, or, more accurately, to guide him in his self-education, not to accompany him to the battlefield.” (141)

¹⁶ Carl von Clausewitz, *On War*, 578.

¹⁷ Kenneth Neal Waltz, *Theory of International Politics* (San Francisco: McGraw-Hill, 1979), 2-5.

¹⁸ Carl von Clausewitz, *On War*, 578.

¹⁹ Carl von Clausewitz, *On War*, 155.

²⁰ Carl von Clausewitz, *On War*, 155. Clausewitz described the consequences of operational methodism: “When in 1806 the Prussian generals plunged into the open jaws of disaster by using Frederick the Great’s oblique order of battle, it was not just a case of a style that had outlived its usefulness but the most extreme poverty of the imagination to which routine has ever led. The result was that the Prussian army under Hohenlohe was ruined more completely than any army has ever been ruined on the battlefield.”

²¹ Carl von Clausewitz, *On War*, 606.

²² John B. Saxman, “The Concept of Center of Gravity,” 4.

- ²³ John B. Saxman, “The Concept of Center of Gravity,” iii.
- ²⁴ Carl von Clausewitz, *On War*, 77.
- ²⁵ Carl von Clausewitz, *On War*, 489.
- ²⁶ Carl von Clausewitz, *On War*, 619.
- ²⁷ Carl von Clausewitz, *On War*, 595.
- ²⁸ John B. Saxman, “The Concept of Center of Gravity,” 11.
- ²⁹ Carl von Clausewitz, *On War*, 596.
- ³⁰ Carl von Clausewitz, *On War*, 97.
- ³¹ Harry G. Summers, *On Strategy: A Critical Analysis of the Vietnam War* (New York: Dell Publishing, 1982), 177. Consider: “... we had adopted a strategy that focused on none of the possible North Vietnamese centers of gravity—their army, their capital, the army of their protector, the community of interest with their allies, or public opinion. The center of gravity could not be the North Vietnamese Army because we had made the conscious decision not to invade North Vietnam to seek out and destroy its armed forces. For the same reason, it could not be Hanoi, the North Vietnamese capital.” [Note, we do not determine what the enemy center of gravity is; the enemy maintains the exclusive right to decide with what means and will he will resist. Thus, the North Vietnamese Army, Hanoi, and the will of the people to be free from foreign domination were the enemy centers of gravity. The United States simply chose not to use operational maneuver to defeat them.]
- ³² Carl von Clausewitz, *On War*, 618.
- ³³ Carl von Clausewitz, *On War*, 99.
- ³⁴ Carl von Clausewitz, *On War*, 617.
- ³⁵ Carl von Clausewitz, *On War*, 597.
- ³⁶ John B. Saxman, “The Concept of Center of Gravity,” 38.
- ³⁷ James J. Schneider and Lawrence L. Izzo, “Clausewitz’s Elusive Center of Gravity,” *Parameters* 17, no 3 (September 1987): 56.
- ³⁸ Joint Publication 1-02, *Department of Defense Dictionary of Military and Associated Terms* (Washington: Joint Chiefs of Staff, March 1994, as amended through January 2000), 72.

- ³⁹ Joe Strange, “Centers of Gravity and Critical Vulnerabilities,” 95.
- ⁴⁰ Joint Publication 3-0, *Doctrine for Joint Operations* (Washington: Joint Chiefs of Staff, February 1995), III-20.
- ⁴¹ Student Text 3-0, *Operations* (Washington: Department of the Army, October 2000), 5-7. Note, this is a student text, not a doctrinal publication. It is approved for public release, but the material in this manual is not approved doctrine.
- ⁴² Air Force Doctrine Document 1, *Air Force Basic Doctrine* (Washington: Department of the Air Force, September 1997), 17.
- ⁴³ Air Force Doctrine Document 2, *Organization and Employment of Aerospace Power* (Washington: Department of the Air Force, September 1998), 126.
- ⁴⁴ Air Force Doctrine Document 2, *Organization and Employment of Aerospace Power*, 8.
- ⁴⁵ Air Force Doctrine Document 2, *Organization and Employment of Aerospace Power*, 79.
- ⁴⁶ Marine Corps Doctrinal Publication 1, *Warfighting*, 45.
- ⁴⁷ Marine Corps Doctrinal Publication 1-2, *Campaigning* (Washington: United States Marine Corps, 1997), 41-42.
- ⁴⁸ Marine Corps Doctrinal Publication 1, *Warfighting*, 46.
- ⁴⁹ Naval Doctrinal Publication 1, *Naval Warfare* (Washington: Department of the Navy, March 1994), 35.
- ⁵⁰ John B. Saxman, “The Concept of Center of Gravity,” 30.
- ⁵¹ Joe Strange, “Centers of Gravity and Critical Vulnerabilities,” 3. Note, Dr. Strange did not develop this diagram and takes no responsibility for its use. I developed and used it throughout the analysis section to integrate the key principles of the service theories of operational warfighting with the framework. It is also used to apply the framework to the four cases of full spectrum operations.
- ⁵² Joe Strange, “Centers of Gravity and Critical Vulnerabilities,” 47
- ⁵³ Joe Strange, “Centers of Gravity and Critical Vulnerabilities,” 41-73
- ⁵⁴ John B. Saxman, “The Concept of Center of Gravity,” 4. “There are different opinions about: [1] Whether or not the center of gravity is an end or a means to an end;

[2] Whether it is a strength, weakness, or vulnerability, [3] Whether a center of gravity must be a concentration of military forces or if it can be something more intangible; [4] If there can be multiple centers of gravity; and [5] The relationship between strategic, operational, and tactical centers of gravity and strategic, operational, and tactical objectives.”

⁵⁵ Stephen Hawking, *A Brief History of Time: From the Big Bang to Black Holes*, (New York: Bantam Books, 1988), 155.

⁵⁶ Carl von Clausewitz, *On War*, 61.

⁵⁷ Joint Publication 1-02, *Department of Defense Dictionary of Military and Associated Terms*, 329.

⁵⁸ Carl von Clausewitz, *On War*, 177.

⁵⁹ Carl von Clausewitz, *On War*, 579. Emphasizing the operational objective: “No one starts a war—or rather, no one in his senses ought to do so—without first being clear in his mind what he intends to achieve by that war and how he intends to conduct it. The former is its political purpose; the latter is its operational objective.”

⁶⁰ Carl von Clausewitz, *On War*, 75.

⁶¹ Student Text 3-0, *Operations*, 2-3.

⁶² Shimon Naveh, *In Pursuit of Military Excellence: The Evolution of Operational Theory* (London: Frank Cass, 1997), 308.

⁶³ James J. Schneider, “Theoretical Paper No. 3: The Theory of Operational Art,” (Fort Leavenworth: Command and General Staff College, 1988), 15. Dr. Schneider wrote, “During the American Civil War a further development occurred: the establishment of the field army. As Napoleon invented strategy, Grant “invented” operational art as it is currently understood.” (15)

⁶⁴ James J. Schneider, “The Theory of Operational Art,” 14.

⁶⁵ Alexandr A. Svechin, *Strategy* (Minneapolis: East View Publications, 1992), 165-308.

⁶⁶ Student Text 3-0, *Operations*, 5-6.

⁶⁷ Carl von Clausewitz, *On War*, 81.

⁶⁸ Student Text 3-0, *Operations*, 5-6.

⁶⁹ Student Text 3-0, *Operations*, 5-6.

⁷⁰ Marine Corps Doctrinal Publication 1-1, *Strategy* (Washington: United States Marine Corps, 1997), 73.

⁷¹ Marine Corps Doctrinal Publication 1-1, *Strategy*, 54.

⁷² Robert Leonard, *The Art of Maneuver* (Novato, CA: Presidio Press, 1991), 111. “... in accordance with combined arms theory, maneuver-warfare seeks to defeat enemy systems by attacking them in advantageous mediums with unlike systems.” Student Text 3-0, *Operations*, 4-29 to 4-32. “Complementary capabilities protect the weaknesses of one system or organization with the capabilities of another.” (Combined Arms Theory) “Asymmetry concerns dissimilarities in organization, equipment, doctrine, capabilities, and values between other armed forces and US forces. JFCs arrange symmetrical and asymmetrical actions to take advantage of friendly strengths and enemy vulnerabilities, and to preserve freedom of action.” (Unlike Systems)

⁷³ Robert Leonard, *The Art of Maneuver*, 47.

⁷⁴ Student Text 3-0, *Operations*, 5-6.

⁷⁵ Joint Publication 3-0, *Operations*, III-21.

⁷⁶ Marine Corps Doctrinal Publication 1-2, *Campaigning* (Washington: United States Marine Corps, 1997), 76.

⁷⁷ Robert Leonard, *The Art of Maneuver*, 20.

⁷⁸ Joe Strange, “Centers of Gravity and Critical Vulnerabilities,” 74. In the explanation of critical vulnerabilities, Dr. Strange is not so restrictive. He implies that a critical vulnerability may be a capability, requirement, or component of the center of gravity itself in the following passage: “Critical vulnerabilities are weaknesses which can be exploited to undermine, neutralize, and/or defeat an enemy center of gravity.”

⁷⁹ Marine Corps Doctrinal Publication 1-2, *Campaigning*, 76.

⁸⁰ Joint Publication 3-0, *Operations*, III-11.

⁸¹ Marine Corps Doctrinal Publication 1, *Warfighting*, 40.

⁸² Marine Corps Doctrinal Publication 1-2, *Campaigning*, 73.

⁸³ Marine Corps Doctrinal Publication 1-2, *Campaigning*, 73-74.

⁸⁴ Marine Corps Doctrinal Publication 1-1, *Strategy*, 73.

⁸⁵ William S. Lind, *Maneuver Warfare Handbook* (Boulder: Westview Press, 1985), 4.

⁸⁶ Air Force Doctrine Document 2-1, *Air Warfare*, v.

⁸⁷ Air Force Doctrine Document 2-1, *Air Warfare*, 14.

⁸⁸ Air Force Doctrine Document 2-1, *Air Warfare*, 14.

⁸⁹ Robert A. Pape, *Bombing to Win: Air Power and Coercion in War* (Ithica: Cornell University Press, 1996), 16.

⁹⁰ Air Force Doctrine Document 2-1, *Air Warfare*, 10.

⁹¹ Air Force Doctrine Document 2-1, *Air Warfare*, 11.

⁹² Air Force Doctrine Document 2-1, *Air Warfare*, 11.

⁹³ Air Force Doctrine Document 2-1, *Air Warfare*, 11.

⁹⁴ Air Force Doctrine Document 2-1, *Air Warfare*, 5.

⁹⁵ Naval Doctrinal Publication 1, *Naval Warfare*, 3-4.

⁹⁶ Naval Doctrinal Publication 1, *Naval Warfare*, 26.

⁹⁷ Naval Doctrinal Publication 1, *Naval Warfare*, 26.

⁹⁸ Joint Publication 1-02, *Department of Defense Dictionary of Military and Associated Terms*, xii.

⁹⁹ Joint Publication 1-02, *Department of Defense Dictionary of Military and Associated Terms*, 276. “Power projection in and from the maritime environment, including a broad spectrum of offensive military operations to destroy enemy forces or logistic support or to prevent enemy forces from approaching within enemy weapons’ range of friendly forces. Maritime power projection may be accomplished by amphibious assault operations, attack of targets ashore, or support of sea control operations.”

¹⁰⁰ Naval Doctrinal Publication 1, *Naval Warfare*, 67.

¹⁰¹ Eliot A. Cohen, director, *Gulf War Air Power Survey, Volume II Operations, Part II Effects and Effectiveness* (Washington: U.S. Government Printing Office, 1993): 74. Quoting George Bush, “Address to the Nation Announcing the Deployment of United States Armed Forces to Saudi Arabia” (8 August 1990). In *Public Papers of the Presidents of the United States: George Bush, 1990* (Washington: U.S. Government

Printing Office, 1991), 1108. Note, all further citations refer to this volume and part of the *Gulf War Air Power Survey*.

¹⁰² Eliot A. Cohen, *Gulf War Air Power Survey*, 79. Quoting the *Combined Operations Plan for Offensive Operations to Eject Iraqi Forces from Kuwait (Operation Desert Storm)*, 2-4.

¹⁰³ The White House, "White House Statement on Kosovo," a press release (March 22, 1999) [database on-line]; available from http://www.fas.org/man/dod-101/ops/docs99_99032212_tlt.htm; accessed 2 April 2000.

¹⁰⁴ Ivo H. Daalder and Michael E. O'Hanlon, *Winning Ugly: NATO's War to Save Kosovo* (Washington: Brookings Institution, 2000): 2.

¹⁰⁵ North Atlantic Council, "Statement on Kosovo," a press release (April 23, 1999) [database on-line]; available from <http://www.fas.org/man/dod-101/ops/docs99/p99-062e.htm>; accessed 2 April 2000.

¹⁰⁶ William S. Cohen and Henry H. Shelton, "Joint Statement on the Kosovo After-Action Review," a press release (14 October 1999) [database on-line]; available from http://www.fas.org/man/dod-101/docs99/b10141999_bt478-99.htm; accessed on 2 April 2000.

¹⁰⁷ Geoffrey Blainey, *The Causes of War*, 3d ed., (New York: The Free Press, 1988): 292. The transition from peace to war and back to peace: "While the breakdown of diplomacy reflects the belief of each nation that it will gain more by fighting than by negotiating, the breakdown of war reflects the belief of each nation that it will gain more by negotiating than by fighting."

¹⁰⁸ Department of the Army, *Field Manual 3-0 Operations* (Washington: Department of the Army, 2000): 4-22. "Decisive operations at any echelon directly achieve the mission of the higher headquarters." The NATO and Russian diplomatic effort directly achieved the mission: to gain Milošević's consent to Rambouillet terms. "Sustaining operations at any echelon create and preserve conditions for the success of the decisive operation."

¹⁰⁹ Ivo H. Daalder and Michael E. O'Hanlon, *Winning Ugly*, 159.

¹¹⁰ "Allied Forces Southern Europe Organization" [database on-line]; available from <http://www.afsouth.nato.int/factsheets/RHQAFSOUTH.HTM>; accessed on 12 April 2001.

¹¹¹ "Operation Joint Guardian Mission" [database on-line]; available from <http://www.afsouth.nato.int/operations/kfor/kfor2.htm>; accessed on 12 April 2001.

¹¹² “United Nations Interim Mission in Kosovo Organization,” [database on-line]; available from <http://www.un.org/peace/kosovo/pages/kosovo9.htm>; accessed on 12 April 2001. UNMIK consists of three functional organizations: Interim Civil Administration, Institution Building, and Reconstruction.

¹¹³ Carl von Clausewitz, *On War*, 141.

¹¹⁴ Joe Strange, “Centers of Gravity and Critical Vulnerabilities,” 74.

¹¹⁵ Carl von Clausewitz, *On War*, 606.

¹¹⁶ Stephen Hawking, *A Brief History of Time*, 169.

APPENDIX

Clausewitz on the Center of Gravity

This appendix contains all of the passages from *On War* in which Clausewitz used the term center of gravity. Below each passage is the level of war to which it applies, the nature of the center of gravity example, and its effect on the battle, campaign, or war. The purpose of this appendix is to gain a hollistic understanding of the concept by identifying patterns in its use.

1. “Even though Blücher was weaker than Schwarzenberg, his enterprising spirit made him more important. The center of gravity lay with him, and he pulled the other forces in his direction.” (Book Two, *On the Theory of War*, Chapter Five, “Critical Analysis,” 163)

- Level of War: Tactical.
- Nature: Exceptional Commander. (Moral Power)
- Effect: Determines the outcome of a battle. (Decisive)

2. “But since the essence of war is fighting, and since the battle is the fight of the main force, the battle must always be considered as the true center of gravity of the war.” (Book Four, *The Engagement*, Chapter Nine, “The Battle: Its Decision,” 248)

- Level of War: Operational.
- Nature: Not applicable. Used as an analogy.
- Effect: Determines the outcome of a war. (Decisive)

3. “The major battle is therefore to be regarded as concentrated war, as the center of gravity of the entire conflict or campaign.” (Book Four, *The Engagement*, Chapter Eleven, “The Battle—Continued: The Use of Battle,” 258)

- Level of War: Operational.
- Nature: Not applicable. Used as an analogy.
- Effect: Determines the outcome of a war or campaign. (Decisive)

4. “We regard a great battle as a decisive factor in the outcome of a war or campaign, but not necessarily the only one. Campaigns whose outcomes have been determined by a single battle have become fairly common only in recent times, and those cases in which they have settled an entire war are very rare exceptions... But by committing the major part of their available strength to this gigantic duel, both sides initiate a major decision. It may not be the only decision, but it is the *first*, and as such will affect those that follow. Therefore, the purpose of a great battle is to act—more or less according to circumstances, but always to some extent—as the provisional center of gravity of the entire campaign.” (Book Four, *The Engagement*, Chapter Eleven, “The Battle—Continued: The Use of Battle,” 260)

- Level of War: Operational.
- Nature: Not applicable. Used as an analogy.
- Effect: Influences the remainder of the campaign. (Decisive)

5. “All these pressures will be brought to bear on the battle’s center of gravity while the outcome still hangs in the balance, in order to produce a total reversal.” (Book Six, *Defense*, Chapter Nine, “The Defensive Battle,” 291)

- Level of War: Tactical.
- Nature: Where and when the strongest forces clash. (Strongest Physical Force = Queen)
- Effect: Determines the outcome of a battle. (Decisive)

6. “The scale of a victory’s sphere of influence depends, of course, on the *scale* of the victory, and that in turn depends on *the size of the defeated force*. For this reason, the *blow* from which the broadest and most favorable repercussions can be expected will be aimed against *that area* where the greatest concentration of enemy troops can be found; the larger the force with which the blow is struck, the surer its effect will be. This rather obvious sequence leads us to an analogy that will illustrate it more clearly—that is, the nature and effect of a center of gravity.” (Book Six, *Defense*, Chapter Twenty-Seven, “Defense of a Theater of Operations,” 485)

- Level of War: Operational.
- Nature: The greatest concentration of troops, both friendly and enemy. (Physical Power = Queen)
- Effect: ? Defeated Force → ? Scale of Victory → ? Operational Influence of the Victory. (Decisive)

7. “A center of gravity is always found where the mass is concentrated most densely. It presents the most effective target for a blow; furthermore, the heaviest blow is that struck by the center of gravity. The same holds true in war. The fighting forces of each belligerent—whether a single state or an alliance of states—have a certain unity and therefore some cohesion. Where there is cohesion, the analogy of the center of gravity can be applied. Thus, these forces will possess certain centers of gravity, which by their movement and direction, govern the rest; and those centers of gravity will be found wherever the forces are most concentrated. But in war as in the world of inanimate matter, the effect produced on a center of gravity is determined by the cohesion of the parts. In either case, a blow may be stronger than resistance requires, and in that case it may strike nothing but air, and so be a waste of energy.” (Book Six, *Defense*, Chapter Twenty-Seven, “Defense of a Theater of Operations,” 485)

- Level of War: Tactical.
- Nature: Concentrated mass. (Strongest Physical Force = Queen)
- Effect: Most effective target for a blow and the heaviest blow struck. (Decisive)

- Level of War: Operational.
- Nature: The concentrated fighting forces of each state in an alliance. (Strongest Physical Force = Queen)
- Effect: Shatter the unity and cohesion of an alliance. (Decisive)

8. “The last book will describe how the idea of this center of gravity in the enemy’s force operates throughout the plan of war. In fact, that is where the matter properly belongs; we have merely drawn on it here in order not to leave a gap in the argument. Our reflections are intended to demonstrate that the general reasons for dividing one’s forces. Basically, there are two conflicting interests: one, *possession of the country*, tends to disperse the fighting forces; the other, *a stroke at the center of gravity of the enemy’s forces*, tends, in some degree, to keep them concentrated.” (Book Six, *Defense*, Chapter Twenty-Seven, “Defense of a Theater of Operations,” 486)

- Level of War: Operational.
- Nature: The concentrated fighting forces. (Strongest Physical Force = Queen)
- Effect: Occupation requires dispersion, but defeating the enemy center of gravity requires concentration. (Decisive)

9. “Our position, then, is that a theater of war, be it large or small, and the forces stationed there, no matter what their size, represent the sort of unity in which a *single* center of gravity can be identified. That is the place where the decision should be reached; a victory at that point is in its fullest sense identical with the defense of a theater of operations.” (Book Six, *Defense*, Chapter Twenty-Seven, “Defense of a Theater of Operations,” 487)

- Level of War: Operational.
- Nature: Where the forces have unity resulting from concentration. (Strongest Physical Force = Queen)
- Effect: The place to reach a decision that achieves victory in a theater of operations. (Decisive)

10. “It is the decision [from waiting to accepting battle] that changes the centers of gravity on each side, and the operational theaters they create, into *active agents*. If one drops the idea of a decision, the centers of gravity are neutralized, and so, indeed, in a certain sense, are all the forces.” (Book Six, *Defense*, Chapter Twenty-Eight, “Defense of a Theater of Operations—Continued,” 488)

- Level of War: Operational.
- Nature: The concentrated forces that are active agents to defeat the enemy. (Strongest Force = Queen)
- Effect: Friendly force reaches a decision by defeating the enemy force in battle. (Decisive)

11. “A major battle in a theater of operations is a collision between two centers of gravity; the more forces we can concentrate in our center of gravity, the more certain and massive the effect will be. Consequently, any partial use of force not directed toward an objective that cannot be attained by the victory itself or that does not bring about the victory should be *condemned*.” (Book Six, *Defense*, Chapter Twenty-Eight, “Defense of a Theater of Operations—Continued,” 489)

- Level of War: Operational.
- Nature: Concentrate to weight the main effort. (Strongest Force = Queen)
- Effect: Achieve a more certain and massive effect. (Decisive)

12. “There is only one point that, at first sight, seems self-contradictory, and that, because it is one of the most important points in defense, is all the more in need of further development: it is how to hit the enemy’s exact center of gravity.” (Book Six, *Defense*, Chapter Twenty-Eight, “Defense of a Theater of Operations—Continued,” 489)

- Level of War: Tactical.
- Nature: Concentrated Forces. (Strongest Physical Force = Queen)
- Effect: Not specified, but implied decisive results.

13. [If a defender is bypassed, he can (1) split his forces, (2) concentrate on one flank, (3) throw full force at the enemy’s flank, (4) operate against the enemy’s lines of communication, or (5) counterattack into the enemy’s area of operations.] “The [last] three other means left to the defender are more suited to the objective, because they aim at an immediate decision, a confrontation of the two centers of gravity. We shall say at once, however, that we decidedly prefer the third to the other two.” (Book Six, *Defense*, Chapter Twenty-Eight, “Defense of a Theater of Operations—Continued,” 491)

- Level of War: Operational.
- Nature: A sizeable force that advances into friendly territory. (Strongest Physical Force = Queen)
- Effect: Aim at an immediate decision. (Decisive)

14. “What the theorist has to say here is this: one must keep the dominant characteristics of both belligerents in mind. Out of these characteristics a certain center of gravity develops, the hub of all power and movement, on which everything depends. That is the point against which all our energies should be directed. Small things always depend on great ones, unimportant on important, accidentals on essentials. This must guide our approach.” (Book Eight, *War Plans*, Chapter Four, “Closer Definition of the Military Objective: The Defeat of the Enemy,” 595.)

- Level of War: Operational - Strategic.
- Nature: Hub of all power and movement. (Physical or Moral, Queen or King)
- Effect: Determines the outcome of a battle, campaign, or war because, without the strongest force, the enemy lacks the means or will to resist. (Decisive)

15. “For Alexander, Gustavus Adolphus, Charles XII, and Frederick the Great, the center of gravity was their army. If the army had been destroyed, they would all have gone down in history as failures. In countries subject to domestic strife, the center of gravity is generally their capital. In small countries that rely on large ones, it is usually the army of their protector. Among alliances, it lies in the community of interest, and in popular uprisings, it is the personalities of the leaders and public opinion. It is against these that our energies must be directed. If the enemy is thrown off balance, he must not be given time to recover. Blow after blow must be aimed in the same direction: the victor, in other words, must strike with all his strength and not just against a fraction of the enemy’s. Not by taking things the easy way—using superior strength to filch some province, preferring the security of this minor conquest to great success—but by constantly seeking out the center of his power, by daring all to win all, will one really defeat the enemy.” (Book Eight, *War Plans*, Chapter Four, “Closer Definition of the Military Objective: The Defeat of the Enemy,” 596.)

- Level of War: Operational.
- Nature: The army of Alexander, Gustavus, Charles XII, and Frederick the Great. (Strongest Physical Force = Queen)
- Effect: Losing the army results in failure. (Decisive)

- Level of War: Strategic.
- Nature: The capital of a country subject to domestic strife. (Moral Power = King)
- Effect: Resolves the domestic strife. (Decisive)

- Level of War: Strategic – Multi-national.
- Nature: Community of interest within an alliance. (Moral Power = King)
- Effect: Dividing the community of interest splits the alliance. (Decisive)

- Level of War: Strategic.
- Nature: Leaders or Public Opinion in a popular uprising. (Moral Power = King)
- Effect: Sustains or defeats the popular uprising. (Decisive)

Common Thread: Direct energies to defeat these centers of gravity to achieve decisive results by defeating the enemy’s means and will to resist. “By daring all to win all.”

16. “Up till now we have assumed—as is generally permissible—that the enemy is a single power. But having made the point that the defeat of the enemy consists in overcoming the resistance concentrated in his center of gravity, we must abandon this assumption and examine the case when there is more than one enemy to defeat... I would, therefore, state it as a principle that if you can vanquish all your enemies by defeating one of them, that defeat must be the main objective of the war. In this one enemy we strike at the center of gravity of the entire conflict. There are very few cases where this conception is not applicable—where it would not be realistic to reduce several centers of gravity to one.” (Book Eight, *War Plans*, Chapter Four, “Closer Definition of the Military Objective: The Defeat of the Enemy,” 597.)

- Level of War: Strategic – Multi-national.
- Nature: The key state that holds an alliance together. (Moral Power = King)
- Effect: Vanquish all enemies by defeating one of them. (Decisive)

17. “The task of reducing the sources of enemy strength to a single center of gravity will depend on: 1. The distribution of the enemy’s political power... 2. The situation in the theater of war where the various armies are operating...” (Book Eight, *War Plans*, Chapter Nine, “The Plan of War Designed to Lead to the Total Defeat of the Enemy,” 617.)

- Level of War: Operational – Strategic.
- Nature: Primary sources of enemy power. (Moral or Physical, King or Queen)
- Effect: Total defeat of the enemy. (Decisive)

18. “From this it follows that the concept of separate and connected enemy power runs through every level of operations, and thus the effects that events in a given theater will have elsewhere can only be judged in each particular case. Only then can it be seen how far the enemy’s various centers of gravity can be reduced to one.” (Book Eight, *War Plans*, Chapter Nine, “The Plan of War Designed to Lead to the Total Defeat of the Enemy,” 618.)

- Level of War: Operational – Strategic.
- Nature: Primary sources of enemy power. (Moral or Physical, King or Queen)
- Effect: Reduce the enemy centers of gravity to one if its defeat yields decisive effects. (Decisive)

19. “The principle of aiming everything at the enemy’s center of gravity admits of only one exception—that is, when secondary operations look exceptionally rewarding. But we must repeat that only decisive superiority can justify diverting strength without risking too much in the principal theater.” (Book Eight, *War Plans*, Chapter Nine, “The Plan of War Designed to Lead to the Total Defeat of the Enemy,” 618.)

- Level of War: Operational.
- Nature: Economy of force in secondary theaters if there is “decisive superiority” in the principal theater. (Strongest Physical Force = Queen)
- Effect: “Exceptionally rewarding” implies nearly decisive results. (Decisive)

20. “The first task, then, in planning for a war is to identify the enemy’s centers of gravity, and if possible, trace them back to a single one. The second task is to ensure that the forces to be used against that point are concentrated for a main offensive.” (Book Eight, *War Plans*, Chapter Nine, “The Plan of War Designed to Lead to the Total Defeat of the Enemy,” 619.)

- Level of War: Operational.
- Nature: Concentrated forces. (Strongest Force = Queen)
- Effect: Concentrate to achieve a decision. (Decisive Results)

21. “Hence, if there is reason to fear that a divided and convergent thrust will give the enemy a chance to equalize his strength by using his interior lines, it is better not employed. If the deployment of forces makes it essential, it must be regarded as a necessary evil. Seen from that point of view, one cannot possibly approve of the way in which France was invaded in 1814. The Russian, Austrian, and Prussian armies were all assembled at Frankfurt, on the obvious and most direct route to France’s center of gravity. [French Army and Paris?] They were then split up so that one army should invade through Mainz and the other should pass through Switzerland...” (Book Eight, *War Plans*, Chapter Nine, “The Plan of War Designed to Lead to the Total Defeat of the Enemy,” 620.)

- Level of War: Operational – Strategic.
- Nature: The French Army and Paris, implied in another passage. (Strongest Physical Force = Queen, Source of Moral Power to Resist = King)
- Effect: Not specified, but implied decisive results.

22. “We hold, moreover, that the plan of operations should have this tendency even when the enemy’s whole resistance cannot be reduced to a single center of gravity and when, as we have once put it, two almost wholly separate wars have to be fought simultaneously. Even then, one must be treated as the *main* operation, calling for the bulk of resources and activities. Seen in this light, it is advisable to operate *offensively* only in this main theater and to stay on the defensive elsewhere.” (Book Eight, *War Plans*, Chapter Nine, “The Plan of War Designed to Lead to the Total Defeat of the Enemy,” 623.)

- Level of War: Operational – Strategic.
- Nature: The primary source of the enemy’s whole resistance. (Strongest Physical Force = Queen, Source of Moral Power to Resist = King)
- Effect: Concentrate to attack in one theater while defending in another theater to achieve a decision by gaining superior force. (Decisive Results)

23. “But while the main operation must enjoy priority over minor actions, the same priority must also be applied to all its parts. Which forces from each theater shall advance toward the common center of gravity is usually decided on extraneous grounds; all we are saying, therefore, is that there must be an *effort* to make sure that the main operation has *precedence*. The more that precedence is realized, the simpler everything will be and the less will it be left to chance.” (Book Eight, *War Plans*, Chapter Nine, “The Plan of War Designed to Lead to the Total Defeat of the Enemy,” 624.)

- Level of War: Operational.
- Nature: Concentrated force. (Strongest Physical Force = Queen)
- Effect: During a simultaneous advance to defeat the common center of gravity, give precedence to the main operation to minimize chance and reach a decision. (Decisive)

24. “The center of gravity of France lies in the armed forces and in Paris. The allied aim must, therefore, be to defeat the army in one or more major battles, capture Paris, and drive the remnants of the enemy’s troops across the Loire.” (Book Eight, *War Plans*, Chapter Nine, “The Plan of War Designed to Lead to the Total Defeat of the Enemy,” 633.)

- Level of War: Operational – Strategic.
- Nature: Armed Forces and Paris. (Strongest Physical Force = Queen, Source of Moral Power to Resist = King)
- Effect: Defeat the enemy’s physical means and moral will to resist. (Decisive)

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