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Perspectives on Warfighting
Number Four
Second Edition

CENTERS OF GRAVITY
&
CRITICAL VULNERABILITIES:

Building on the Clausewitzian Foundation So That We Can All Speak the Same Language

by

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Second Edition

Preface

Clarification, Minor Changes and Elaboration to the First Edition

(#1)

Think:

NOUN
Center of Gravity

VERB
Critical Capability

NOUN (and verb)[1]
Critical Requirement

NOUN (and verb)[2]
Critical Vulnerability

[1] See immediately below (#2) and (#3).
[2] See immediately below (#2) and (#3).

(#2)

I propose the following

Minor *Modifications* of Definitions

for your consideration:

(Definitions on pages 43 and 64 ONLY have been changed accordingly.)

Centers of Gravity:

Primary sources of moral or physical strength, power and resistance. (Minor change)

Critical Capabilities:

Primary abilities which merits a Center of Gravity to be identified as such in the context of a given scenario, situation or mission. (Major minor change) (See discussion below.)

Critical Requirements:

Essential conditions, resources and means for a critical capability to be fully operative. (No change)

Critical Vulnerabilities:

Critical requirements or components thereof which are deficient, or vulnerable to neutralization, interdiction or attack (moral/physical harm) in a manner achieving decisive results – *the smaller the resources and effort applied and the smaller the risk and cost, the better.* (Minor change) (See footnote 3, page 43.)

Discussion of Critical Capabilities (See also #3 below):

An enemy center of gravity (CG) has the moral or physical ability to prevent friendly mission accomplishment. The critical abilities or capabilities which we ascribe to a given CG answer the question: "Why are we afraid of or concerned about that particular entity?" Every answer to this question is **contextual** – that is, it is based on the context of a particular situation or mission. Therefore, I would suggest that we should step beyond the generic

"look, move, shoot and communicate" capabilities which are common to most military forces/units, and ask the $64,000-question: "Precisely what is it that a particular enemy force (moral or physical) can do to us to prevent us from accomplishing our mission in this particular situation/context? What particular capabilities are we especially concerned about?"

I thought about this recently while preparing for a class on "Centers of Gravity, Critical Vulnerabilities and the British-Canadian Raid on Dieppe in August 1942" conducted this month at the USMC Command and Control Systems School. I believe that we should zero in on those particularly 'attention-grabbing' or 'show-stopping' critical capabilities which, if allowed to be fully (or even partially) functional, will "eat the lunch" or "tear the heart out" of relevant friendly centers of gravity. I also suggest that we should describe said critical capabilities in language more specific than "move, shoot and communicate".

The table on the next page depicts the main critical capability and some supporting critical requirements for one of the German (tactical) centers of gravity capable of preventing the British and Canadians from achieving mission success in their raid on Dieppe on 19 August 1942. Your first thought about "**Generate & Direct Murderous Enfilade Fire on the Main Beach**" might be: 'That is nothing more than a mission statement for those defenders – that is their job, that is why they were put there.' BINGO! That is precisely why they were put there and why their commander(s) gave them the resources (bunkers, guns, etc.) to ensure that they would be able (have the capability) to do just that. (If it is just that easy to conceptualize and articulate an attention-grabbing, show-stopping critical capability, why make it more difficult?)

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DIEPPE

19 August 1942

One of the German (Tactical) Centers of Gravity and its "attention-grabbing" or "show-stopping" Critical Capability

CENTER of GRAVITY	CRITICAL CAPABILITY	CRITICAL REQUIREMENTS
Dieppe Headlands **Defenders** manning strong defenses	**Generate & Direct Murderous Enfilade Fire on the Main Beach.** KILL, DISRUPT & DELAY the main Assault Forces.	Sufficient Advance Warning.
		Assault troops stalled in Beach Kill Zones by Wire Obstacles.
		Observable fields of fire.
		Preregistered fields of fire.
	SHOOT	Plenty of ammunition.
	---	---
		Survive & Stay focused.
		Lack of effective interference by enemy supporting forces:
		✓ Air.
		✓ Naval Gun Fire.
		✓ Parachute Forces.
		✓ Tanks Landed on the Main Beach.
		Protected fire positions.
		Steady troops.
		✓ No Threats to their Rear from Flank Assault Forces.

The best book on the Dieppe raid remains Dieppe – The Shame and the Glory by Terence Robertson.

(#3)

Based on (#2)
I would recommend making a sharper distinction between Critical Capabilities and Critical Requirements within the context of specific situations and missions.

If we were to focus on just those 'attention-grabbing' or 'show-stopping' critical capabilities as discussed in (#2), then what about those generic capabilities under the broad umbrella of "see, move, shoot and communicate" which do not make the cut? My suggestion is that the latter be listed instead under the critical requirements column. For example, regarding the table on the previous page, you will note that just below the dotted line under CRs is listed "Survive and Stay Focused". That is a *condition* for the CG to remain effective, for it to be able to perform effectively its "attention-grabbing," "show-stopping" critical capability of raking the main assault beach with murderous enfilade fire.

Another example relates to a Canadian center of gravity for the Dieppe raid – the assault battalions of the 2nd Canadian Infantry Division. The 2nd Division did not possess the organic intelligence assets and staff capable of "looking" across the English Channel and collecting and interpreting the data available on the German garrison and defences. That intelligence mission was accomplished at a higher echelon of command, i.e., it was done for them (more or less) by somebody else. Nevertheless, adequate intelligence and the professional interpretation thereof (by whomever) was a critical requirement for mission accomplishment. Also, the 2nd Division could not transport itself across the English Channel; some other military organization/command provided the necessary assault ships and landing craft. "Look" and "move" (across the Channel) are verbs, but they did not reflect capabilities inherent within the 2nd Division.

But even if a reinforced, super division did have the assets to do those things by itself, do "look" and "move" (across the Channel) qualify as "attention-grabbing," "show-stopping," "eat-your-lunch" and "rip-your-heart-out" critical capabilities in the context of the Dieppe raid and mission – in the eyes of the German commander at Dieppe? If you believe they do (or did), then fine; get on with the CG-CC-CR-CV analysis. But if you believe they do (or did) not so qualify, those verbs still have to be performed effectively; in which case we can move them right on over into the CR column.

Finally, "look/examine" and "move" in this context are *"preconditions"* which must pertain before the 2nd Division's assault battalions (which they called regiments) can bring their own "attention-grabbing" critical capability into play. And **that critical capability was** "overwhelm enemy coastal defenders by the application of superior combat power via small arms fire and cold steel (the knife) in hand-to-hand combat" – by direct assault and maneuver from the sea where possible and necessary, and by expeditious maneuver from landing beaches to inland defenses and forces where necessary.

And that leads to (#4).

(#4)

Do not overlook "Conditions" as candidates for Critical Requirements.

The two infantry battalions (regiments) assaulting the main beach at Dieppe at 0520 relied heavily on supporting units also accomplishing their missions. Successful mission accomplishment by some minimum combination of these other units was considered to be a *condition* critical to the ability of the two battalions assaulting the main beach (just 30 minutes after the flank landings a mile or so distant!) to accomplish their mission:

CENTER OF GRAVITY	CONDITIONS CONSIDERED TO BE CRITICAL REQUIREMENTS
Two Battalions Assaulting the Main Dieppe Beach	Mission accomplishment of Bn landing at Blue Beach (to the east) Mission accomplishment of Bn landing at Green Beach (to the west) Mission accomplishment of two Squadrons of Hurricane Close Support aircraft strafing the Dieppe Sea Front defenses.
CRITICAL CAPABILITY	
Overwhelm enemy defenders by superior combat power via small arms fire and **cold steel in hand-to-hand combat**.	Ability of supporting Destroyers to keep down fire from the East and West Headlands defenses (overlooking the main beach) until flanking assault Bns overrun them from the rear. Ability of combat engineers to clear lanes through the barbed wire obstacles. Timely landing of supporting Tanks. Ability of those tanks to get off the beach.

A lot of disparate things – all important for mission accomplishment – fall under the category of "conditions" or "preconditions". List under the CR column everything you can think of. **The longer the list, the greater the number of potential candidates for critical vulnerabilities.**

(#5)

Centers of Gravity offer physical and moral resistance. Therefore, *Harvey* is the gang's center of gravity.

(See below, Chapter 3)

The concept of centers of gravity is greatly simplified when one considers for that distinction only candidates/entities that offer moral or physical resistance to a given course of action. Therefore, both the Army armor officer (for the wrong reason) and the SAMS graduate correctly identified Harvey as the gang's center of gravity. Harvey is neither a characteristic nor a capability; nor is he a locality. Harvey is a man – a moral and a physical force. True, Harvey possesses physical characteristics which give him an impressive capability (to knock somebody's teeth in – or out); and it is this capability which underlies his moral position within the gang. The reference to Clausewitz by the SAMS graduate is a bit imprecise in that Clausewitz clearly allowed for multiple centers of gravity and advised that they should be traced back to a single center of gravity **IF POSSIBLE**. (See below, Chapter 2, page 11.)

The Army infantry officer is clearly wrong. Harvey's "testicles" is a critical vulnerability if there ever was one. The definition given by that officer for a center of gravity applies instead to critical requirements and critical vulnerabilities. The Air Force officer initially appeared to realize that Harvey was the gang's CG, but then he jumped the rails when he advised how to attack Harvey's "four centers of gravity" – which are instead some of Harvey's critical requirements (eyes, ears, knees and an in-tact skull housing his brain). The Marine officer (as per FMFM 1 at that time) simply ignored the concept of center of gravity and spoke instead of seeking a critical vulnerability. The Navy officer's remarks were not directly germane to the CG-CV concept.

(#6)
"Strong-willed people."

The "will of the people" can be strong, weak, or in between. The "will of the people" can therefore be either a CG or a CV, or neither. Even if popular will is not exceptionally strong, it may be strong enough – in which case it can be viewed as a critical requirement. Consider, for example, the statement: "As long as popular support for our course of action remains at the 50% level, we can stay the course; but if it falls much below that level we are in deep trouble." The speaker is thinking of the 50% level as a minimum critical requirement, not as a source of great strength.

(#7)
It is what the Capital *contains.*

When Clausewitz wrote "Capital" (see below, Chapter 2, page 7), he was referring to "the center of administration" and also the hub of a nation's "social, professional and political activity." If the government (the leaders and bureaucrats) and the social and professional elites are able to flee the capital (before an enemy captures it) and function effectively elsewhere, then it is they – not the city – which is the true center of gravity. The phrase "function effectively elsewhere" is the key; a judgment reserved for the people of that country, not the enemy. Why hang one's hat on capturing the enemy's capital, if by that point it is likely to have lost all meaningful value and significance in anyone's eyes other than those of the captor? Just a thought.

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September 1997

Chapter 1

The Problem and The Solution
—
A Brief Summary Introduction

The Problem quite simply is the considerable confusion regarding concepts and definitions of "centers of gravity" (CGs) and "critical vulnerabilities" (CVs) which exists in the current array of Joint and Service doctrinal manuals/publications. This is a self-inflicted wound on the DOD community writ large. To begin with, the current Joint/Service definition is a remarkably curious and confusing oddity. By stipulating that centers of gravity are **not** moral or physical forces themselves, but only the "characteristics, capabilities, or locations" which contribute to their effectiveness,[1] the definition is at odds with both Clausewitz and the commonly understood meaning of the term. This means that Saddam Hussein and the Republican Guard; Ho Chi Minh and the North Vietnamese Regular Army; Emperor Hirohito, Admiral Isoroku Yamamoto, and the Imperial Japanese Navy; and General Robert E. Lee and the Army of Northern Virginia were **not** moral and physical centers of gravity. This would be news to Generals Norman Schwarzkopf, Colin Powell, William Westmoreland, Douglas MacArthur, and Ulysses S. Grant, and to the authors of a few hundred classics on modern military history. This alone is reason enough to modify the current Joint/Service definition.

This confusion is further exacerbated by FMFM 1 Warfighting, which has turned the Clausewitzian definition of

[1] Joint Pub 3-0, Doctrine for Joint Operations, 1 February 1995, p III-20; and Joint Pub 1-02, Department of Defense Dictionary of Military and Associated Terms, 23 March 1994, p 63.

centers of gravity inside-out: "Applying the term to modern warfare, we must make it clear that by the enemy's center of gravity we do not mean a source of strength, but rather a critical vulnerability." [1] So, CGs are not sources of strength but are **instead** critical weaknesses? FMFM 1 is not alone. Naval Doctrine Publication 1 - Naval Warfare explains that while a center of gravity is a source of strength it is "not necessarily strong or a strength in itself." It states for example that "a lengthy resupply line supporting forces engaged at a distance from the home front could be an enemy's center of gravity." [2] (Far more often than not in military history long supply lines have been major weaknesses contributing to failure and defeat.) So, CGs are sources of strength which **may also be** critical weaknesses?

These are but three examples of the confusion on this fundamentally important concept which the array of current Joint and Service doctrine has generated – a confusion which cannot help but inhibit precision of thought and clarity of communication at all levels of war throughout the DOD community.

The Solution is simple. We should as a minimum return to the Clausewitzian meaning of centers of gravity as moral and physical sources of strength, while simultaneously retaining the concept of "critical vulnerabilities" as critical weaknesses as explained in USMC FMFM 1, Warfighting, without of course the infamous footnote 28.[3] Beyond that, we should also incorporate into Joint/Service doctrine two new conceptual terms – "critical capabilities" (CCs) and "critical requirements" (CRs) – which bridge the gap and explain the relationship between centers of gravity and critical vulnerabilities. Chapter 4 offers the following definitions and fully explains the CG-CC-CR-CV concept:

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[1] FMFM 1 Warfighting (Washington DC: Dept of the Navy, HQUSMC, 6 March 1989), footnote 28, p 85 (referring to page 36 in the text).

[2] Naval Doctrine Publication 1 - Naval Warfare, 28 March 1994, p 72.

[3] FMFM 1 Warfighting (Washington, DC: Dept of the Navy, HQUSMC, 6 March 1989) – footnote 28 on p 85 refers to pages 35-36 in the text. (See below chapter 3 page 37, and chapter 5 pages 130 and 136.)

Centers of Gravity:

Primary sources of moral or physical strength, power and resistance.

Critical Capabilities:

Primary abilities which merits a Center of Gravity to be identified as such in the context of a given scenario, situation or mission.

Critical Requirements:

Essential conditions, resources and means for a critical capability to be fully operative.

Critical Vulnerabilities:

Critical requirements or components thereof which are deficient, or vulnerable to neutralization, interdiction or attack (moral/physical harm) in a manner achieving decisive results – the smaller the resources and effort applied and the smaller the risk and cost, the better.

When we reinvent the definition of centers of gravity, what are we to do with the thousand or so books on military history written during the 20th Century – books which fill our military libraries and support a great deal of our Professional Military Education curricula? We can't rewrite even one single page dealing with strategy, operations and centers of gravity so as to make it harmonize with the latest doctrinal notion. **What we can do, however, is build on the traditional concept of centers of gravity, instead of destroying it.** The CG-CC-CR-CV concept does just that. Chapter 5 suggests how our current Joint/Service manuals/publications could be revised accordingly.

Best of all, the CG-CC-CR-CV concept does not challenge any existing Joint or Service warfighting philosophy, whether it be 'maneuver warfare' or anything else. It requires only a few simple but important changes in vocabulary and definitions. And as we continue to formulate strategy and conduct operations consistent

with the sound warfighting advice found in **all** of the current Joint and Service doctrine manuals and publications, when it comes to centers of gravity and critical vulnerabilities it asks only **that all of us speak the same language regardless of Service and regardless of level of war**.

Chapter 4

The Fix:
The CG-CC-CR-CV Concept

The fix for the "Butch Cassidy" phenomenon is the adoption and application of the following definitions and concepts by the entire DOD community:

Centers of Gravity: Primary sources of moral or physical strength, power and resistance.

Critical Capabilities: Primary abilities which merits a Center of Gravity to be identified as such in the context of a given scenario, situation or mission. [1]

Critical Requirements: Essential conditions, resources and means for a Critical Capability to be fully operative. [2]

Critical Vulnerabilities: Critical Requirements or COMPONENTS THEREOF which are deficient, or vulnerable to neutralization, interdiction or attack (moral/physical harm) in a manner achieving decisive results – the smaller the resources and effort applied and the smaller the risk and cost, the better.[3]

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[1] **Ability:** Physical, mental, financial, or legal power to perform. **Function:** The activity for which one is specifically fitted or employed. Assigned duty or activity. [Webster's II.]

[2] **Operative:** Exerting influence or force. Functioning effectively : efficient. [Webster's II.]

[3] Thus involving the concept of disproportionality. **Disproportional:** Being out of proportion, as in relative size, shape, or amount. [Webster's II.]

Moral and Political Centers of Gravity

Leaders

Moral CGs are fairly straightforward and commonly understood. Examples: General Robert E. Lee for the Confederacy at both the national strategic level for the nation, and the operational and tactical levels for the troops in the field. The presence of Napoleon on the battlefield was a powerful moral CG for any army which he led and directed; same for Rommel and Patton. Prime Minister Winston Churchill is one of the greatest examples of a national leader being a moral and political CG at the strategic level. So too was President Franklin D. Roosevelt for the United States. While his leadership might not have made all that much difference regarding the fate of Japan (given the mood and determination of the American public after 7 December 1941), he made a great deal of difference regarding strategy against Nazi-Germany. "By a purely intellectual effort," it was largely he who sustained the Germany-first strategy at the national strategic level during the first year after Pearl Harbor (when the public favored a Japan-first strategy by a two-to-one margin). Operation TORCH, the invasion of French Northwest Africa in November 1942, happened because of President Roosevelt (not the American public) who overruled the (Joint) Chiefs of Staff. It was President Roosevelt who refused to wait until the spring of 1943 to mount and execute the first major Anglo-American offensive in Europe. President Roosevelt was clearly a moral and political CG at the strategic level vis-a-vis the war against Hitler's Germany. Hitler remained a moral and political CG in Nazi-Germany until near the end.

Public/popular[1]/national[2] support

The "cause" of independence was a strong moral CG for the Confederacy at the national strategic level, as were strong state loyalties (Lee considered himself first and foremost a Virginian). American desire for vengeance and retribution against the Japanese after 7 December 1941 turned American public opinion into a powerful moral national CG in the war against Japan. Communism and Premier Joseph Stalin were not particularly popular among the peoples of the Soviet Union in 1941; nevertheless the latter strongly supported Stalin's resistance to Hitler's invading Nazi hordes. Strong belief in a cause or leader or both is the foundation for all national public/popular/people CGs.

Physical Centers of Gravity

Physical centers of gravity fall into three categories. The first category is armed forces, strength, and power at all levels of war. The second and third categories pertain to the strategic level: national economic/industrial power, and power stemming from large populations.

Armed forces/strength/power

Pretty straightforward – armies, navies, air fleets (at the strategic and theater-strategic level); military units (at all levels) which have the capability to exert power, to influence (offensively or defensively) unfriendly opponents.

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[1] Popular: Of, representing, or carried on by the people at large. Originating among the people. [Webster's II.]

[2] National: Of, relating to, or belonging to a nation as an organized whole. [Webster's II.]

National industrial/economic [1] power

Industrial/economic centers of gravity are the foundations of national physical strength. Commonly cited as World War II economic/industrial centers of gravity are the Ruhr for Germany, the factories which the Soviet Union moved and built east of the Urals, and the industrial strength of Great Britain and the United States. Our industrial strength (ten-to-one over Japan on 7 December 1941) was a critical American center of gravity sustaining an enormous American war machine – and dwarfing the loss of a few old battleships at Pearl Harbor. Total United States Lend-lease aid to our allies in World War II was the financial and physical equivalent of **555 armored divisions**. Now that was power, generated by one awesome center of gravity.

In World War II, all American centers of gravity at the national/strategic level could be traced back to American political will (the will to fight) and American industrial strength. All moral and physical centers of gravity stemed from, or were dependent upon, those two bedrock CGs. This explains why the Japanese "victory" in the battle of Pearl Harbor on 7 December 1941 was such a monumental disaster. The role and importance of the US Pacific Fleet (including its three aircraft carriers) as a center of gravity needs to be understood in the perspective of American national power. On 7 December 1941, the United States was building a fleet of warships which would more than double the size of the entire US Navy. When these were completed, we had the money, the resources, and the will to again double the size of the Navy. Admiral Yamamoto knew this. He understood the bedrock foundations of American national power. Because there was nothing he or Japan could do about our industrial capacity, Admiral Yamamoto banked on "Operation Hawaii" to destroy or seriously degrade our national will to fight. His miscalculation and terrible blunder lay in his method, not his objective.

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[1] Economic: Of or relating to the development, production, and management of material wealth, as of a country, household, or business enterprise. Of or relating to matters of finance. [Webster's II.]

Large national populations

Large populations can be strategic centers of gravity. Just ask the Japanese and Germans who fought the Chinese and Russians during World War II. As one high-ranking Japanese officer pleaded just before being executed for failure: "For every one [Chinese soldier and guerrilla fighter] we kill, two more appear!" Likewise, the common (incorrect) post-war refrain from some German Russian-front generals that "We won all the battles but lost the war," reflected their awe of the seemingly limitless Soviet manpower resources and industrial strength.

Centers of Gravity are
Dynamic [1] **Agents** [2] **of Action or Influence**

Moral CGs at all levels, and political CGs at the strategic level, cause things to happen by virtue of their will, influence, and leadership. Moral and political CGs are based upon persons and people. Moral and political CGs must possess such qualities as determination; courage (moral and physical); and the power to persuade, inspire, or intimidate. Examples: a strong political leader; public opinion, or an influential segment of it, galvanized and motivated by a cause; a strong (effective/capable) military leader influencing the course of a battle or campaign by virtue of his strong will and/or effective plan or stratagem.

Physical CGs at the strategic level can include direct sources and/or centers of military strength, as well as principal indirect sources of that strength to include economic/industrial power and power stemming from large national populations. At the operational and tactical levels, physical CGs are primary

[1] Dynamic: Of or relating to energy, force, or motion in relation to force. Marked by vigor and energy. [Webster's II.]

[2] Agent: One that acts or has the authority to act. A force or substance that causes change. A means of doing something : instrument. [Webster's II.]

sources and/or centers of military strength (i.e., military units and formations), which cause things to happen by virtue of their military power.

CENTERS OF GRAVITY ARE NOT "critical requirements" such as C2 systems, transportation nodes, LOCs, and the like. Although the latter facilitate communication and movement, they do not harbor and express fears, hopes, and expectations; make demands; make decisions; lead people; or direct units; as do moral and political CGs. Nor do they manufacture essential products, hold ground, or oppose enemy forces, as do physical CGs. Furthermore, and contrary to the current Joint Pub definition discussed in chapter 5, **centers of gravity are not characteristics, capabilities, or locations**; they are the moral, political and physical entities which **possess** certain characteristics and capabilities, or benefit from a given location/terrain. [1]

The Relationship Between Critical Capabilities & Critical Requirements

A National Leader: Critical Capabilities

What does a national leader have to be able to do, to function as a moral or political center of gravity (i.e., to govern effectively, to direct or influence national policy and political and military courses of action, to lead and/or inspire "the people")? Likely answers would suggest that normally such leaders must be able to (i.e., have the "ability" to):

[1] See below, chapter 5, page 93. If we apply the term "center of gravity" only to certain characteristics, capabilities or locations which affect designated military forces, then what do we call the military forces themselves?

(1) remain alive – unless he is more valuable as a dead martyr;

(2) stay informed (receive critical intelligence and information);

(3) communicate with government officials, military leaders, and the nation; and

(4) remain influential

Communication can be in person, word of mouth, electronic means, or letters and written proclamations. Whatever the means, the "people" must continue to believe that a leader-CG is alive and providing leadership even when they see no direct evidence. Dispossessing a leader-CG of some or all of these "critical capabilities" will degrade his overall ability to direct, govern, lead, and inspire. If this "overall ability" is degraded far enough, the leader will cease to be (cease to function as) a center of gravity.

A National Leader: Critical Requirements

There is a difference between "theoretical" critical capabilities and "real" critical capabilities. "Real" critical capabilities do not materialize out of thin air – they are created and sustained by the conditions, resources, and means[1] which are **required/essential** to make them real. Such conditions, resources, and means are in fact **critical requirements** which enable a critical capability to be fully operative (as opposed to being only theoretical,[2] notional,[3] or abstract [4]).

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[1] Means: ... a method or instrument by which an act can be accomplished ... [Webster's II.]

[2] Theoretical: Lacking verification or practical application : restricted to theory. [Webster's II.]

[3] Notional: Speculative or theoretical. Existing in the mind : imaginary. [Webster's II.]

[4] Abstract: Considered apart from concrete existence <an abstract idea>. Not applied or practical : theoretical. [Webster's II.]

A National Leader (who is a Center of Gravity)

Critical Capability (to) (examples of functions)	**Corresponding Critical Requirements** (examples of essential conditions, resources and means)
Remain alive:	☑ resources and means to be protected from all threats
Stay informed:	☑ resources and means to receive essential intelligence
Communicate: (Govern/command)	☑ resources and means to communicate with government officials, military leaders, national elites and "the people"
Remain influential:	☑ the leader's determination to persevere in a "cause" or course of action (whether for positive or negative reasons) (a condition)
	☑ a reason to maintain confidence or hope, or the realization that there is no viable alternative (either for his country, or for him personally, or both) (a condition)

(continued on next page)

Critical Capability (to)	Corresponding Critical Requirements
	☑ the continued support of the people and other powerful government and military leaders (regardless of whether said support stems from positive or negative motivations) (a condition)
	☑ (perhaps even) the freedom and means to travel and make public appearances safely

National Will/Public Support: Critical Capabilities

To function as a moral and political CG, what must a national public be capable of doing? Likely answers would suggest that normally the "people" must be able to (i.e., have the "capability" to):

(1) receive communications (information, propaganda, inspiration and instructions) from the national leadership and government;

(2) to communicate desires to a national leader/government;

(3) believe in and/or support a "cause" or particular course of action;

(4) believe in and/or continue to support a national leader and government; and

(5) impact/influence positively other CGs

National Will/Public Support: Critical Requirements

Again, each "critical capability" has to be supported by one or more corresponding "critical requirements":

Critical Capability (to) (examples of functions)	**Corresponding Critical Requirements** (examples of essential conditions, resources and means)
Receive communications:	☑ the means to receive communications
Communicate desires:	☑ the means to communicate (usually via strata of government or bureaucracy – lower to higher)
Believe in and/or support of a cause, course of action, or leader/gov't:	☑ motivation stemming from: ✓ confidence or hope in ultimate victory or success ✓ voluntary belief/support in a noble/necessary cause ✓ situations where the "people" see no viable alternative even in the absence of confidence or hope ✓ fear and intimidation (of/by own leaders)

(continued on next page)

Critical Capability (to)	Corresponding Critical Requirements
	☑ a popular perception that the cost of resistance will not exceed the anticipated benefits from victory or success (except in situations where the "people" see no viable alternative even in the absence of confidence or hope – as in a war of national extermination or suchlike)
Positively impact or influence other CGs: (a nat'l leader or gov't already covered above)	☑ means for effective mobilization of human resources for: ✓ labor for war industries, mining, agriculture, transportation, and other essential services ✓ manpower for active/auxilliary armed forces ✓ financial support and related activities ✓ armed resistance (guerrilla-type conflicts/operations) ✓ critical political activities (from local to national, on both sides of the front lines)

War/Defense Industrial Base: Critical Capabilities

To function as a physical CG, what must a national war/defense industrial base be capable of doing? Essentially it boils down to:

- Obtain essential physical resources,
- Transport them to manufacturing centers,
- Process them into effective weapons and related essential/supporting products, and
- Transport finished products to military forces.

War/Defense Industrial Base: Critical Requirements

These four basic capabilities (above) involve a host of critical requirements:

Critical Capability (to) (examples of functions)	**Corresponding Critical Requirements** (examples of essential conditions, resources and means)
Obtain essential physical resources:	☑ National ownership of accessible essential physical resources, or international access to them (meaning, countries being willing to sell them to you) ☑ Financial resources (for mining or international purchase) ☑ Skilled labor required for mining
Transport essential physical resources to manufacturing centers:	☑ Effective/efficient transportation system, to include ☑ Power to run vehicles/carriers (POL, electricity, etc.) ☑ The means to maintain the systems' essential components: ✓ Financial resources ✓ Skilled labor ✓ Equipment & resources

(continued next page)

War/Defense Industrial Base: Critical Requirements
(continued)

Critical Capability (to)	Corresponding Critical Requirements
	☑ The means to protect the system's essential components
Process physical resources into effective weapons and related essential/supporting products:	☑ Requisite manufacturing centers, to include ☑ Power to run the plants (electricity, etc.) ☑ The means to maintain the plants/ manufacturing capacity ✓ Financial resources ✓ Skilled labor ✓ Equipment, machine tools, other resources ☑ The means to protect vital manufacturing centers
Transport finished products to military forces:	(Same as "Transport ... to manufacturing centers.")

The above represents only a general depiction of "critical capabilities" and associated "critical requirements" at the strategic level. Nevertheless, it is easy to see how this concept could be applied to the "operational" and "tactical" levels, where the focus would be on individual components and even sub-components of the four main functions – obtain, transport, process, transport – of the overall system. (Looking ahead a bit, the relationship between "critical requirements" and "critical vulnerabilities" will become readily apparent.)

The Difference Between Economic/Industrial Centers of Gravity and Critical Requirements at the Strategic Level of War

"The first task ... in planning for a war is to identify the enemy's centers of gravity, and if possible trace them back to a single one." [1] The difference between an economic/industrial center of gravity and an entity which we would label as a critical requirement at the strategic level is **a matter of strategic perspective**. Admittedly, one could view the enormous American industrial strength in World War II as a "critical requirement" necessary to create and sustain our armies, fleets and air forces, and label it accordingly. That label and characterization, however, would misrepresent the strategic importance and status of our national industrial strength, especially in relation to the individual components (such as oil, coal, iron ore, railroads, electricity, factories, skilled workers, etc.) which contributed to it.

How Are We Doing So Far?

[1] On War, p 619. See this monograph, chapter 2, page 9.

"Centers of Gravity," "Critical Capabilties" and "Critical Requirements"

Examples Relating to the U.S. Pacific Fleet in WWII

U.S. Physical Centers of Gravity in the Pacific:

- **US Pacific Fleet**
  - **Submarines (Attacking the Japanese Merchant Marine)**
  - **Third/Fifth Fleet**
  - **Amphibious Assault Task Forces**
- Joint/Combined forces under MacArthur's command
- B-29s based in the Mariana Islands after June 1944

The next six pages contain examples relating **only to the U.S. Pacific Fleet's three major components** during World War II. **The examples listed are suggestive and not exhaustive.** Not listed, for example, are such things as doctrine and C2 systems. Although several tactical examples are provided, there is no end to the possible lists of tactical requirements associated with any single operational or tactical critical requirement, such as, for example, communication gear and systems for task force communication to higher headquarters, inter-task force communication (as with Operation Forager in June 1944), and the coordination of naval gun fire and close air support during an amphibious assault.

Submarines
(Attacking the Japanese Merchant Marine)

Critical Capability (examples of functions)	**Corresponding Critical Requirements** (examples of essential conditions, resources and means)
Project (theater-strategic) **Power** **Long Distances:** **(MOVE / REACH)**	☑ Forward bases (Darwin, Midway, Tulagi, Saipan/Guam) ☑ Long-legged, fuel-efficient, high-fuel capacity "boats"
Locate (operational) **Targets:** **(SEE / FIND)**	☑ Excellent intelligence (ULTRA, etc.) ☑ General knowledge of shipping and convoy routes
(tactical)	☑ Excellent optics, RDF gear ☑ Sub-borne radar (later in war)
Surprise (tactical) **Targets and their Escorts:** **(SURPRISE)**	☑ Quiet "boats" ☑ Long-range optical gear (later, sub-borne radar) ☑ Ability to fire at long ranges ✓ Long-range torpedoes ✓ Long-range targeting system
Hit and Destroy Targets: **(KILL)** (tactical)	☑ Excellent optics and targeting system ☑ Good torpedoes (explode on contact/proximity) ☑ Good tactics (good firing angles at effective ranges)

(continued next page)

Submarines
(Attacking the Japanese Merchant Marine)
(continued)

Critical Capability		**Corresponding Critical Requirements**
Escape: (SURVIVE)	(tactical)	☑ Submarines capable of (after firing torpedoes): ✓ Diving deep, ✓ Getting away before convoy escorts close in, ✓ Remaining quiet, or otherwise hiding
Take Punishment: (SURVIVE)	(tactical)	☑ Well-built submarines able to withstand depth charges (except for very near or direct hits) ☑ Damage control procedures (for minor damage) ☑ Well-trained, well-steeled crews
Maintain Sub Fleet Strength: (RECOVER and EXPAND)	(national-strategic) (theater-strategic)	☑ Capacity to more than replace losses in boats and crews ☑ Excellent permanent repair facilities (Pearl Harbor)

Up Next: U.S. Third/Fifth Fleet

Third/Fifth Fleet

Critical Capability (examples of functions)		Corresponding Critical Requirements (examples of essential conditions, resources and means)
Project Power	(theater-strategic)	☑ Secure bases/anchorages (Pearl Harbor, Ulithi)
Long Distances:	(theater-strategic)	☑ Well-provisioned forward logistics bases
(MOVE)	(operational)	☑ Robust, long-legged sea train
(REACH)	(operational)	☑ Fast, fuel-efficient, high-fuel capacity large warships
	(operational)	☑ Large fleet carriers
	(tactical)	☑ Excellent carrier aircraft, flown by skilled airmen
	(tactical)	☑ Excellent ship-to-ship refueling and supply system
Locate Enemy Fleet Units: (SEE)	(theater-strategic)	☑ Excellent theater-strategic intelligence (ULTRA, etc.)
	(operational)	☑ Long-range recce aircraft; RDF; submarine patrols
	(tactical)	☑ Carrier-borne reconnaissance aircraft; shipboard radar

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Third/Fifth Fleet
(continued)

Critical Capability		Corresponding Critical Requirements
Parry and Survive Enemy Air & Sub Attacks: (DEFEND) (SURVIVE)	(tactical)	☑ Excellent anti-aircraft defenses ✓ Shipboard radar ✓ Excellent defensive fighter control system ✓ Heavy & effective AAA ☑ Excellent damage-control procedures ☑ Rugged, well-built ships ☑ Excellent anti-submarine escort vessels ☑ Well-trained, highly-motivated sailors
Destroy Enemy Fleet Units: (KILL)	(tactical)	☑ Effective carrier-borne attack aircraft ☑ Effective surface warships (if ship-to-ship engagements) ✓ Shipboard radar, fire-control systems, etc.
Maintain Fleet Strength: (RECOVER) (& EXPAND)	(national-strategic)	☑ National capacity to more than replace losses ✓ Warships and aircraft (all types) ✓ Superb pilot training program ✓ Sea train units ✓ Logistics, logistics, logistics
	(theater-strategic)	☑ Excellent permanent repair facilities (Pearl Harbor)
(Applies also to Amphibious Assault Task Forces, next page)	(operational)	☑ Excellent mobile repair facilities (floating dry docks)

Amphibious Assault Task Forces

Critical Capability (examples of functions)	Corresponding Critical Requirements (examples of essential conditions, resources and means)
Select (theater-strategic) **Targets:** **(LOOK)** (operational) **(EXAMINE)** (tactical)	☑ Intelligence on enemy plans, capabilities (ULTRA, etc.) ☑ Intelligence on suitability of target vis á vis strategic and campaign objectives (airfields/sites for) ☑ Intelligence on enemy defenders and defenses and terrain obstacles (submerged coral reef)
Project (theater-strat) **Power** (operational) **Long Distances:** **(MOVE/REACH)**	☑ Forward troop bases/assembly ports ☑ Long-legged troop transports ☑ Robust, long-legged sea train
Parry (operational) **Enemy Threats in Transit to** (tactical) **Target Area:** **(ARRIVE INTACT)**	☑ Protection by US Pacific Fleet or the ☑ Absence of threat by the Imperial Japanese Navy ☑ Escort screen (against submarines)
Amphibious (tactical) **Assault -- Ship-to-Shore Movement:** **(MOVE to CLOSE)**	☑ Air supremacy over the objective area ☑ Noninterference by the Imperial Japanese Navy/subs ☑ Sufficient, suitable landing craft ☑ Well-trained landing-craft crews ☑ Well-trained, well-steeled assault troops

Amphibious Assault Task Forces
(continued)

Critical Capability	Corresponding Critical Requirements
Amphibious Assault -- Suppress/Destroy Enemy Defensive Firepower: (SUPPRESS or KILL) (tactical)	☑ Air supremacy over objective area ☑ Effective naval bombardment force ✓ Older battleships dedicated, trained and equipped for Naval Gun Fire (NGF) against enemy defenses ☑ Close Air Support (CAS) from escort-carrier force ✓ Pilots trained/dedicated to close air support ✓ CAS aircraft ✓ CAS ordnance
Capture Heavily-defended Objectives: (tactical)	☑ Suppression of enemy (ground) firepower by NGF/CAS ☑ Elite units able to function while suffering high casualties ☑ Ship-to-shore logistical support ✓ Transports off shore for the duration of the operation
Preserve Infantry Assault Units: (PRESERVE & RECOVER) (oper/tac) (operational) (strategic) (unit level)	☑ Rotate/replace units during operations (if possible) ☑ Withhold units from current operation to prepare for the next ☑ Capacity to replace losses; create new units ☑ Excellent Esprit de corps of assault units (old and new) ☑ Veteran soldiers maintain perseverance and will to win

Look at "Critical Requirements" to Discover "Critical Vulnerabilities"

Critical Vulnerabilities: Critical Requirements or COMPONENTS THEREOF which are deficient, or vulnerable to neutralization, interdiction or attack (moral/physical harm) in a manner achieving decisive results – the smaller the resources and effort applied and the smaller the risk and cost, the better.

For three years the Japanese sought desperately to find critical vulnerabilities among the critical requirements [1] associated with American amphibious operations leap-frogging across the Pacific toward the Japanese Home Islands. The Japanese failed time and again; but they came uncomfortably close on at least five occasions:

Guadalcanal
8-9 August 1942

Betio (Tarawa Atoll)
20 Nov 1943

Leyte Gulf
24 October 1944

Iwo Jima
19 February 1945

Okinawa
April - June 1945

[1] Although they did not use the CG-CC-CR-CV vocabulary, Japanese commanders thought and planned in accordance with at least a rough approximation of this concept in each of the five occasions described.

Guadalcanal
8-9 August 1942

U.S. Critical Capability: Seize Island Objectives (Japanese-held islands)

U.S. Critical Requirement Considered by the Japanese to be a Critical Vulnerability: Ship-to-shore logistical support

In quick reaction to American landings on Tulagi & Guadalcanal, Japanese aircraft at Rabaul launched a series of daylight attacks against the supporting U.S. cargo ships, so disrupting their activities that by nightfall (8 August) some of them were only 25 percent offloaded. Heading toward the area at full speed was a Japanese force of five heavy and two light cruisers and a destroyer, commanded by Vice Admiral Gunichi Mikawa. His mission was to break up the invasion by a night attack on the transports. In a confused night battle which began one hour after midnight, Mikawa's ships sank 4 Allied cruisers with only minor damage to themselves. At 0220, Mikawa ordered his ships to regroup north of the battle area. Mindful that he had not completed his mission, Mikawa considered reentering "Iron-bottom" Sound to blast the transports. He instead elected to retire speedily northwestward, so as to escape retaliatory daylight air strikes from nearby American carriers, and also to lure those carriers closer to Rabaul-based Japanese aircraft.

In the heat of battle, Mikawa changed his priorities (and his mission) from destruction of the American transports to the preservation of his own force and the destruction of the American carriers. Understandable as his decision might be, he thereby lost his opportunity to sink the critically important American cargo ships.

Betio (Tarawa Atoll)
20 Nov 1943

U.S. Critical Capability:	Suppress Japanese Defensive Firepower
U.S. Critical Requirements Considered by the Japanese to be Critical Vulnerabilities:	Adequate Intelligence on Japanese Defenses, and an Effective Naval Bombardment Force

The Japanese on Betio conceived, constructed and concealed their defenses to ensure that enough troops and defensive firepower would survive a preinvasion American air and naval bombardment to slaughter the American assault troops in the water and on the beach, thereby defeating an invasion of Betio island (even if the Japanese Navy could not come to their aid). The Japanese commander on Betio was banking that hoped-for deficiencies in two American critical requirements would be great enough to turn them into critical vulnerabilities:

(1) **"Adequate" Intelligence**. The Americans knew the extent of the Japanese defenses, but failed to appreciate their "hardness" or invulnerability to ordinary high explosive bombs or shells. Nor did the American planners heed vital information (written into Admiral Turner's operation plan) about the depth of water over an offshore coral reef during periods of neap tides. This omission, miscalculation or mistake meant that on D-Day the conventional non-tracked landing craft carrying the 4th, 5th and 6th waves of Marines grounded on the edge of the reef. Unexpectedly their passengers had to wade through six hundred yards of chest-deep, machine-gun swept water just to reach a beach which was itself under intense enemy fire.

Betio (Tarawa Atoll)
20 Nov 1943
(continued)

(2) <u>An Effective Naval Bombardment Force</u>. Whereas the Americans thought that it would be more than adequate, the preparatory bombardment was woefully insufficient because the ammunition used failed to penetrate bunkers sheltering Japanese troops. When the naval bombardment was lifted (to avoid friendly casualties) the first wave was still 15 minutes from the beach – plenty of time for the relatively unscathed Japanese defenders to emerge from their bunkers and man their defenses. Although the amtracs carrying the first three waves of Marines were able to crossover the coral reef, they did so under a crescendo of anti-boat, machine-gun and rifle fire that killed or wounded many of the passengers.

The Marines succeeded in seizing the tiny island in a gruesome four-day battle in which they paid a shockingly high price in dead and wounded. Had there not been enough Marines in the task force to compensate for the terrible D-Day casualties, or had they been ordinary soldiers, history would have recorded a Japanese victory in the battle for Betio on 20 November 1943. Fortunately significant deficiencies in two American critical requirements (i.e., "potential" critical vulnerabilities) were more than compensated for by a third critical requirement: a sufficient number of elite assault troops able to function – to close with and destroy the enemy – while suffering horribly high casualties.

Leyte Gulf
24 October 1944

U.S. Critical Capability: Seize Island Objectives (Japanese-held islands)

U.S. Critical Requirement Considered by the Japanese to be a Critical Vulnerability: Ship-to-shore Logistical Support

The Japanese responded to the American invasion of Leyte on 20 October 1944 with their SHO-1 plan. SHO-1 was designed to defeat the invasion by destroying the US cargo ships which supported it – if necessary by sacrificing most of what remained of the Imperial Japanese Navy. The success of SHO-1 depended on Admiral Takeo Kurita's "Center Force" of 5 battleships, 12 cruisers and 15 destroyers, which would be assisted by a smaller "Southern Force". The mission of both forces was to destroy the American transports and cargo ships in Leyte Gulf in a simultaneous attack from two different directions. A third Japanese "Northern Force" under Admiral Ozawa acted as a decoy to lure Admiral Halsey's US Third Fleet – including its fast battleships – northward. The plan started well in that Halsey took the bait – but only after his big fleet carriers had given Kurita's ships a good pounding and reported them retreating. But Kurita reversed course again, and shortly after midnight emerged undetected from the San Bernardino Strait with most of his force intact. Reassured by Japanese reports that Halsey was (finally) off to the north in pursuit of Ozawa's decoy force, Kurita sped east, then cut south along the coast of Samar toward Leyte Gulf.

Leyte Gulf
24 October 1944
(continued)

Between 0600 and 1130 Kurita's ships engaged in a running battle with aircraft and destroyers from three groups of American escort carriers supporting the invasion. Although inflicting little serious damage, the intensity and aggressiveness of the air attacks in particular confused and unnerved Kurita. He believed that such furious attacks could come only from Halsey's big fleet carriers which must be nearby (despite Japanese reports to the contrary), and that Halsey's fast battleships must also be closing rapidly behind him. Kurita therefore ordered his entire force to (again) turn about. It is not clear whether he was motivated by fear (to preserve his force to fight another day) or glory (to engage a target far more worthy of a warrior than a bunch of lowly cargo ships). Regardless, by the time he discovered that Halsey's battleships were not in his rear, he had steamed too far north to turn back around in pursuit of his original mission.

Under SHO-1, it was clearly understood that Kurita's force was expendable in the context of an opportunity to destroy the American cargo ships and transports. Kurita, however, changed his priorities and mission in the heat of battle. In so doing, he squandered a "possible" opportunity to accomplish his original mission – had, of course, he been able to deal successfully with the older American Seventh-Fleet battleships (which had already destroyed the Japanese "Southern Force" in the Surigao Strait) as he entered the mouth of Leyte Gulf.

Iwo Jima
19 February 1945

U.S. Critical Capability:	Suppress Japanese Defensive Firepower
U.S. Critical Requirements Considered by the Japanese to be Critical Vulnerabilities:	Adequate Intelligence on Japanese Defenses, and an Effective Naval Bombardment Force

With all hopes of victory long since gone, by 1945 the Japanese had adopted a strategy designed to inflict maximum casualties on American ground and naval forces in the hopes of securing something more than unconditional surrender. The Japanese conceived, constructed and concealed their defenses on Iwo Jima toward that end. There would be no defiant, futile direct defense of the landing beaches. Instead all likely landing areas were covered indirectly with all manner of weapons dug into the volcanic rock of Iwo Jima in deadly combinations of reverse and frontal slopes. A successful Japanese defense was predicated on the expectation that American intelligence resources would be unable to detect the full extent and nature of their defenses – and that the American preinvasion air and naval bombardment plans would be flawed accordingly.

The Japanese plan almost worked. H-Hour on D-Day, 19 February 1945, was preceded by an intense three-day bombardment which culminated in the heaviest "prelanding" bombardment of the war (85 minutes of deliberate, aimed shelling; followed by rocket, machine gun, and bombing attacks by more than a hundred Fifth Fleet aircraft; followed by a fast "neutralizing fire"; fol-

Iwo Jima
19 February 1945
(continued)

lowed by planes again strafing the beaches just prior to touchdown by the first wave of landing craft). Nevertheless, most of the Japanese defenses and defenders remained intact – to the horrible surprise of the Marines hitting the beach.

The US bombardment force had been relatively ineffective in neutralizing the Japanese defenses. Had there not been enough Marines in the task force to compensate for the terrible D-Day casualties, or had they been ordinary soldiers, on 19 or 20 February 1945 history would have recorded a Japanese victory in the battle for Iwo Jima. As was the case at Betio, the inherent strength in a third critical requirement prevented significant deficiencies in two other critical requirements from becoming critical vulnerabilities. Once again, an American amphibious task force contained sufficient numbers of elite assault troops able to suffer horribly high casualties and still close with and destroy the enemy – even though total American casualties exceeded those suffered by the Japanese defenders.

Okinawa
April - June 1945

U.S. Critical Capability:	Seize Island Objectives (Japanese-held islands)
U.S. Critical Requirements Considered by the Japanese to be Critical Vulnerabilities (i.e., deficient or lacking in effectiveness):	Intelligence on Japanese Defense Capabilities, Air Defense Fighter Screen, and Anti-Aircraft Armament (AAA) on US Fifth Fleet Warships Protecting Ship-to-Shore Logistical Support

The Japanese based their defense of Okinawa on the Shuri line and the *kamikaze*. As was the case at Peleliu and Iwo Jima, the Japanese established their main line of resistance inland – constructing an elaborate system of caves and pillboxes with deadly fields of fire in naturally hilly terrain at a narrow waist of the island about five miles north of the port of Naha. From that position the Japanese believed that their 77,000 defenders could defend the southern third of the island for a good long while. Time enough for *kamikaze* air attacks to inflict decisive losses on U.S. Fifth Fleet warships, which shielded the transports and cargo ships which supported the American ground forces. The Japanese imagined two possible victorious scenarios. The *kamikazes* might compel the Americans to quit the invasion outright. If not, a serious weakening of the Fifth Fleet would permit the Japanese to redirect their *kamikazes* against the American ship-to-shore logistical support. Deprived of full air support and critical supplies and ammunition, the American ground forces would themselves be vulnerable to counter-attack by the carefully husbanded Japanese gar-

Okinawa
April - June 1945
(continued)

rison. The Japanese perceived two American critical vulnerabilities: (1) poor U.S. intelligence regarding Japanese defenses on Okinawa as well as the existence of large numbers of *kamikazes* in the Japanese Home Islands, and (2) the vulnerability of American warships to large-scale *kamikaze* attacks.

It was a good plan. Several Marine and Army divisions took nearly three months to break through the Shuri line, at a cost of 7,613 killed and 31,800 wounded. Fifth Fleet fighters could not form an impenetrable barrier, and the relentless *kamikazes* sank 34 vessels (none larger than a destroyer) and damaged 368 others (many seriously). Fortunately the fighters were able to break up most of the *kamikaze* formations and to shoot many of them down. Shipborne AAA accounted for many more; while thousands of skilled and courageous sailors made damage control an effective last line of defense. Once again, strengths in several critical requirements enabled the vast armada of warships, transports and cargo ships to continue supporting the battle ashore, while it inflicted and suffered serious damage in its own deadly battle at sea. When it was all over, American intelligence had proven to be somewhat deficient, and the vast American invasion armada had proven to be somewhat vulnerable. But because the American fighter screen and ship-borne AAA and damage control parties were more effective than the Japanese had anticipated, because of the sheer size of the invasion armada, and because of the fighting spirit and stamina of the soldiers and Marines ashore – there were no American "critical" deficiencies or vulnerabilities.

A Precise Relationship Exists Between "Centers of Gravity" and "Critical Vulnerabilities"

Critical Vulnerabilities are weaknesses which can be exploited to undermine, neutralize and/or defeat an enemy center of gravity. **By definition, a center of gravity cannot also be a critical vulnerability.** Currently, there is considerable confusion on this point. Understanding the relationship among CGs, critical capabilities, and vulnerable critical requirements (i.e., critical vulnerabilities) not only permits, but compels, greater precision in thought and expression. In our business, greater precision is important.

Take for example an enemy air defense system that is well developed and equipped, robust, and manned with well-trained crews. The friendly commander regards it as an enemy center of gravity – an agent/instrument of strength and power. But his planners have also identified a number of critical vulnerabilities: the system's primary power supply, its command and control net, and its radar sites (the latter to advanced technology missiles when the sites are 'turned on'). There are two ways to express/brief this situation:

> First: "Sir. The enemy air defense system is a vital component of the enemy's overall military power in this theater of operations; it is one of his principal centers of gravity in this theater of operations. It must be destroyed or neutralized before we can conduct effective, sustained air attacks against any of his front-line ground forces or his mobile, elite reserve units. Fortunately, the air defense system is highly vulnerable. In fact, we consider it to be the enemy's

> number one critical vulnerability, which we intend to exploit in the following manner. Prior to D-Day we will use our advanced technology missiles to destroy or neutralize the system's radar sites while we simultaneously target the system's primary power supply and principal command and control centers. Sir, with the air defense system disposed of, the rest of our plan will unfold in the following manner. ...."

OK. What do you think? Not bad? Think that was clear enough? Despite calling the air defense system both a center of gravity and a critical vulnerability, the briefing probably is clear enough and good enough. But consider the alternative:

> Second: "Sir. We regard the enemy's air defense system to be one of his principal centers of gravity in this theater of operations. It must be destroyed or neutralized before we can conduct effective, sustained air attacks against any of his front-line ground forces or his mobile, elite reserve units. To be effective, the vital components of the air defense system have to be able to see us, communicate internally, and shoot us. See, talk, shoot – these are the system's critical capabilities. Based on our examination of the system's critical requirements, which enable it to see, talk, and shoot, we have identified and plan to exploit three critical vulnerabilities: prior to D-Day we will use our advanced technology missiles to destroy or neutralize the system's radar sites while simultaneously targeting the system's primary power supply and principal command and control centers. Sir, with the air defense system no longer able to see, talk, or shoot, the rest of our plan will unfold in the following manner. ...."

The second version expresses more clearly the relationship and linkage between center of gravity and critical vulnerabilities. The power supply, command and control net, and radar sites are the "critical vulnerabilities," **not the air defense system itself.** The Imperial Japanese Navy in World War II provides another example. The fleet oilers necessary to refuel the fleet at sea and the fuel supply itself (critical requirements) were both "critical vulnerabilities". **A critical vulnerability is the thing which makes a center of gravity vulnerable. Even when a center of gravity itself contains/possesses a critical vulnerability, CG still does not equal CV.**

Furthermore, only vulnerabilities related to centers of gravity are "critical" vulnerabilities. If something is vulnerable but relatively irrelevant, then so what? We can list it as vulnerability, but not as a "critical vulnerability".

The CG-CC-CR-CV Concept Applied to the 1986 Version of Army FM 100-5

Because chapter 5 will review only **current** Joint/Service doctrinal manuals/publications (regarding discussions of centers of gravity and critical vulnerabilities), it will address the June 1993 version of FM 100-5, which contains a briefer discussion of centers of gravity with far fewer examples compared to the 1986 version of Army FM 100-5. But because so many folks are familiar with it, and because its treatment of centers of gravity is more elaborate with many more examples (than the 1993 version), the 1986 version will be analyzed below in light of the CG-CC-CR-CV concept. (The passage dissected below was reprinted above on pages 33-35.) Much of what the 1986 version said regarding centers of gravity applies instead to critical requirements. If its

definition of centers of gravity were modified *à la* the CG-CC-CR-CV concept, the following two sentences **would apply directly to the concept of critical requirements** (instead of centers of gravity):

> "As with any complex organism, some components are more vital than others to the smooth and reliable operation of the whole. If these are damaged or destroyed, their loss **unbalances the entire structure**, producing a cascading deterioration in cohesion and effectiveness which may result in complete failure, and which will invariably leave the force vulnerable to further damage."

According to the CG-CC-CR-CV concept, most of the items listed as examples of centers of gravity in the 1986 version of FM 100-5 are instead critical requirements as is indicated below and on the next four pages:

Examples Centers of Gravity according to 1986 FM 100-5:	**As indicated below, most of these items are "Critical Requirements" (CR) (corresponding CCs and CGs are indicated in parenthesis):**

Tactical:

• a key command post	**Caution!** CG only if "command post" = the commander himself; but if it = the whole works, then it is a CR. (CC = capability to exercise effective C2) (CR = required equipment and staff)
• a key piece of terrain	CR (CC = capability of a given force to defend an area – either via superior firepower, possession of "good" ground, or some other advantage) (CG = the force defending the area/key piece of terrain)

Operational:

• the mass of the enemy force	CG (but see chapter 2, page 9, "A Word of Caution Regarding 'Mass' Since Clausewitz' Day")
• boundary between two major combat formations	**CV: boundaries are usually prime candidates for being weaknesses** CR = the means to coordinate and to cover gaps, seems and flanks. (CC = the capability of the two formations to coordinate operations side-by-side) (CG = the formations themselves or the larger force to which these formations belong, or a related entity such as a commander controlling the formations)
• vital command and control center	CR (see "a key command post" above)
• logistical base or LOCs	CR (CC = capability for logistical sustainment) (CG = forces being sustained, and/or the commander controlling the forces being sustained)
• St. Vith (Battle of the Bulge 1944)	St. Vith itself should <u>not</u> be referred to as a CG, CC, or CV. (CRs = surrounding terrain and road network.) (CC = the capability of the outnumbered American forces to disrupt and delay German spearheads long enough to permit General Eisenhower to assemble a strategic response to the German offensive.)

	(Local CG = the American forces defending St. Vith.) (Potential CV = a US command **decision** to defend St. Vith too long with too many US forces which would have been surrounded and lost.) (See discussion on "Obstacles" later in this chapter.)
• (Abstract) cohesion among allied forces	CRs = factors which contribute to cohesion (CC = the capability of Allied forces to work well together) (CG = the forces themselves)
• (Abstract) mental, psychological balance of a key commander	CR = mental/psychological balance of a commander. (CC = the capability of a commander to exert a positive influence on battles, campaigns, and strategies.) (CG = the commander himself and/or the forces he commands)

Strategic:

• a key economic resource or locality	CG(?) The words "manufacturing asset" would be more appropriate. The word "resource" can apply to specific components of the total economic system, such as for example, oil, coal, or iron ore, which – even if they exist in great abundance – do not by themselves manufacture anything. (The CG is not the "locality" per se but the manufacturing assets capable of producing significant quantities of vital strategic finished products –

such as the assets located in the Ruhr, Silicon Valley, or the Youngstown-Pittsburgh area in WWII. Oil, coal, minerals, electricity are supporting critical requirements.)

- strategic transport capabilities

CC (See pages 53-55, this chapter.)
CR = strategic transport assets

- vital part of the homeland

CG – but only if it is a base for manufacturing or human assets, or a capital city. Plain old "key terrain" does not qualify as a CG. (See the discussion on "Obstacles" later in this chapter.)

- a wholly intangible thing – such as the moral importance of Verdun in 1916

Caution! At the national strategic level the French will to fight would be considered a moral CG – since the people of France might continue to resist even if most of her field armies were destroyed, as in 1870. However, at the operational level the following terms would apply:

CRs = French **will** to fight for Verdun, and the terrain and defenses surrounding Verdun.

CC = the capability of French forces to defend Verdun against the German onslaught.

CG = the French forces defending Verdun (and, to a higher level commander, those which could be committed to its defense). Without forces to

defend Verdun, it will be lost to the Germans whether France continues to resist or not. The forces are the CG; the CC is their capability to defend Verdun; the CRs are the conditions, resources, and means necessary to make the CC a reality.

(Potential CV = If the Germans had possessed enough forces to envelop Verdun, and the French High Command remained determined to hold it at all costs, sizable French forces could have been surrounded.) (See the discussion on "Obstacles" later in this chapter.)

- popular and political support of the war (struck directly by enemy attacks at Dien Bien Phu in 1954 and TET in 1968)

Caution! French and American popular support for the respective war efforts had already begun to wane before these battles (especially in 1954). Far then from being a Clausewitzian center of gravity, **"the existence of a <u>minimum level</u> of popular support for the war effort"** had become a problematical CR in support of a CC – the ability of the gov't to continue waging war. In 1954 Dien Bien Phu was merely the last nail in the French coffin. While TET in 1968 was not the last nail in the American coffin, neither was it the first. If French and American public support ever was a genuine CG in either conflict, it ceased to be well before Dien Bien Phu and sometime before TET.

(Discussion of 1986 version of FM 100-5 continued)

True, extensive knowledge of an enemy's "physical and psychological strengths and weaknesses" **is** necessary to identify his centers of gravity, as well as his critical vulnerabilities. However, knowledge of his "organizational make-up," and "operational patterns" is likely to be more directly applicable to the identification of critical capabilities, critical requirements, and critical vulnerabilities. The "replacement of a key enemy commander [or] the fielding of new units" can in fact produce changes in an enemy's center(s) of gravity. However, a "major shift in [his] operational direction" is more likely to affect his critical capabilities and corresponding critical requirements than it is to change his operational center(s) of gravity – unless the change in "direction" is accomplished with new units. "New weaponry" may or may not change an enemy's center of gravity. On the one hand, it may merely enhance capabilities of units already identified as CGs. On the other hand, it may involve a totally new type of enemy unit, or transform the capabilities of existing (nonCG) units so dramatically that they are upgraded to CG status.

Finally, the 1986 version of FM 100-5 admonished commanders to adopt "indirect means" to deal with enemy centers of gravity, because in all likelihood they will be well protected.[1] While this is sound advice *à la* the CG-CC-CR-CV concept, it is confusing in the context of what it was meant to say in 1986 – which was: do not attack **directly** those things listed on the above four-and-a-half pages (examples of the source of an enemy's *balance*) because they are likely to be strongly defended; instead use "indirect means" to force the enemy to "expose" these things to attack. **The irony is that most of the things listed on the above four-and-a-half pages are typical of objectives commonly targeted by indirect attacks against enemy critical vulnerabilities (vulnerable critical requirements). If we are not to attack things such as these, what are we to attack?** The admonition cited at the beginning of this paragraph makes sense

[1] FM 100-5 Operations. HQ Department of the Army, May 1986, pp 179-180, Appendix B "Key Concepts of Operational Design".

only according to the Clausewitzian meaning of CGs: that we should use indirect means to degrade, destroy, or neutralize "vulnerable" critical requirements relative to selected enemy CGs; and not attempt to attack well-defended or otherwise inaccessible critical requirements. In the future, our enemies will present us with two kinds of critical vulnerabilities: those which he presents to us through negligence (faulty strategies and operations) and those which will exist (despite the enemy's best efforts) because of our superior national military and supporting capabilities (see Appendix, pages 149-152). But there are no guarantees that either kind of critical vulnerability will exist; which is why we should retain the capability to pit strength against strength successfully in situations where it will be required.

(End discussion of 1986 version of FM 100-5)

O.K.

How Do Force Multipliers & Obstacles Fit into the CG - CC - CR - CV Concept?

"FORCE MULTIPLIERS" are Critical Requirements in support of Critical Capabilities; They are NOT Centers of Gravity

A "force multiplier" is not a center of gravity. It is instead an advantage derived from a stratagem; deception; or superior training, equipment, technology, command and control, etc., which enables a force to fight with an effectiveness beyond that which would normally be indicated by force ratios. A force multiplier,

for example, could transform a 1-1 actual force ratio into a 3-1 effectiveness force ratio; a 1-2 into a 2-1 ratio; or a 2-1 into a 10-1, etc. A laser-based targeting system and long-range main armament, for example, are "force multipliers" which made each M1A1 tank worth "X" number of Iraqi tanks during the Persian Gulf War. The Seventh Corps was an operational Allied CG. A critical capability relative to that CG was the ability of American tanks to shoot farther and with greater accuracy than enemy tanks in good and poor visibility. The M1A1's targeting system and armament were "critical requirements" for that capability. **Force multipliers are "critical requirements" (or components thereof) which support "critical capabilities". (To avoid confusion, the converse is not always true; CRs are not always force multipliers.)**

Radar and The Battle of Britain

British CG:	RAF Fighter Command
Critical Capability:	To meet Luftwaffe attacks in a timely manner
Critical Requirement:	Advance warning regarding the timing, strength and location of Luftwaffe attacks

Because of its critical importance, radar is sometimes (mistakenly) referred to as a British center of gravity during the Battle of Britain. More accurately, it was a vital component of a critical requirement supporting one of Fighter Command's critical capabilities – other components were ULTRA and forward air observers. Advance warning acted as a force multiplier for an outnumbered and beleaguered RAF Fighter Command. The fragility and vulnerability of the radar system made it a classic critical vulnerability; but not realizing its full importance, the Germans failed to follow up their early desultory attacks against it.

Operation FORTITUDE
and
Operation OVERLORD
(examples)

Allied CG:	Capable amphibious and airborne divisions
Critical Capability:	To deceive the Germans as to the precise timing, location and scale of the invasion
Critical Requirement:	An effective deception plan

The FORTITUDE deception plan was a critical requirement in support of a critical capability deemed necessary by Eisenhower for the success of OVERLORD. FORTITUDE acted as a force multiplier by freezing critically important German reserve divisions in place while Eisenhower's assault forces seized and secured a beachhead. FORTITUDE itself had a vast array of components (dummy equipment, false radio traffic, false intelligence, the double-cross system of turned enemy agents, etc.) which contributed to its amazing success. Neither the plan nor the capability it reflected should be referred to as a center of gravity.

The P-51 Mustang
and
Operation OVERLORD
(examples)

Allied CG:	Strategic and Tactical Air Forces under General Eisenhower's command or direction
Critical Capabilities:	To gain and maintain air supremacy over northern France (dominate the Luftwaffe), and simultaneously provide air support to Allied ground forces (attack ground targets)
Critical Requirements:	Superior air-to-air, long-range fighter planes, and capable air-to-ground attack aircraft

Allied possession of a superior air-to-air long-range fighter plane in the P-51 Mustang was an effective force multiplier that made all other aircraft in the Allied strategic and tactical air forces supporting Operation OVERLORD far more effective. As did the P-47 Thunderbolt ground-attack aircraft, the P-51 Mustang possessed performance characteristics which met a critical requirement in support of a critical capability necessary for Allied air forces to function as a center of gravity in relation to OVERLORD. Examples of related critical requirements would be on-the-ground forward air controllers, a ground-to-air communication system, a targeting and sortie allocation system, etc. The P-51 Mustang should not be referred to as an Allied center of gravity for Operation OVERLORD.

It Is More Precise To Say ....

Thinking about British radar, FORTITUDE, and the P-51 Mustang as "critical requirements" or vital components thereof (instead of centers of gravity) permits us to be more precise about the relationship between CGs and CVs – whereas the current doctrinal menu encourages some folks to call radar in 1940 a British CG and others to call it a critical vulnerability. British radar was a force multiplier serving as a vital component of a critical requirement. Because it was extremely vulnerable to Luftwaffe attack, it was also a critical vulnerability. It is less precise to say that Fighter Command (a center of gravity) was vulnerable, or to call Fighter Command itself a critical vulnerability. **It is more precise to say that the vulnerability of the radar system – if fully exploited by the Luftwaffe – could have made the pilots and machines of Fighter Command much less effective.**

CRITICAL OBSTACLES (Geographical, Topographical, Terrain and Meteorological Features) [1] – Though Less Easily Dismissed – Are Also NOT Centers of Gravity

The same goes for critical obstacles, which are closely related to "force multipliers". Both enable fewer forces to accomplish a task or mission than would otherwise be the case;

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[1] Geographical: Of or relating to geography. Concerning the topography of a specific region.
Topography: The physical features of a place or region.
Terrain: The physical character of land : topography.
Meteorological: Atmospheric phenomena, esp. weather and weather conditions. [Climatical]
[Webster's II.]

both can be powerful force effectiveness enhancers; neither are centers of gravity. (That is not to say that a CG cannot produce a force multiplier effect – such as Napoleon's appearance on the field of battle galvanizing French troops, or overwhelming air support for advancing ground forces.)

A Mountain Range. Let's take the case of a rugged mountain range which is impassable except via two long, narrow passes. A defending force of only four high-quality, appropriately-equipped divisions stands a good chance of holding off an attacking force three times its number. The defenders have two key advantages: (1) defending on "good ground," and (2) in all likelihood only two of the attacking divisions can be used simultaneously. This situation "enhances" the effectiveness of the four defending divisions well beyond what it would be in ordinary open ground. But suppose three of the attacker's divisions are air-assault divisions, akin to the 101st Air-Assault Division, and another is an airborne division – with the capability to fly over the mountain range and operate in the enemy's undefended rear area. Are the narrow mountain passes still an obstacle for the attacker, or a death-trap for the defender?

A Wide Desert. A wide desert can have a similar effect. Having ten armored divisions to pit against the defender's three loses its pizzazz if the ten have to cross a 400-mile wide desert with a two-division logistical support system (i.e., to get them across the desert and to support them on the far side in sustained combat operations). In this case the desert hugely enhances the effectiveness of the three defending divisions. But suppose the attacker has a ten-division logistics capability, total air supremacy, and the ability to conceal/mask his route(s) of approach across the desert. Is that desert an obstacle enhancing the effectiveness of the defenders, or is it a highway offering the attacker multiple avenues for surprise attack?

The two examples above show that an obstacle can in some cases be a double-edged sword depending on the capabilities of the combatants. We should not focus on obstacles being centers of

gravity; we should instead focus on critical capabilities and critical requirements as they are driven or influenced by obstacles.

The English Channel in World War II

The English Channel is commonly viewed as one of the greatest geographical or topographical obstacles in modern history. It is credited with saving Great Britain from invasion in 1940, following the sudden and unexpected collapse of the French Army. In 1942 and 1943, it gave Hitler a chance to economize on forces in the West so he could make maximum efforts in the East. In 1944, it gave a second-rate German garrison in France a chance to defeat the impressively superior Allied military power in England.

As an Obstacle. In 1944 two-thirds of the German garrison in France defending the "Atlantic Wall" consisted of second and third-rate divisions. German naval and air power was minimal. Nevertheless, the German defenders had two huge advantages: (1) General Eisenhower could conduct a D-Day amphibious assault with only a fraction of his available divisions, and (2) the limited number of suitable invasion beaches were defended by German units heavily dug in with plenty of firepower and backed by powerful panzer reserves. (The Germans had a third advantage in that any opposed amphibious assault is inherently risky business.) Although D-Day, 6 June 1944, was an overwhelming Allied success, that result should not obscure the fact that to achieve an acceptable level of risk required **monumental** planning, preparation, and air-sea-land forces. In a normal campaign or operation across open ground, the German forces in France could have been defeated handily with less than half the effort. This summary of German advantages supports those who would call the English Channel a German CG (or words to that effect).

As a Double-edged Obstacle, or even a Highway. On the other hand, the Channel also gave the Allies some important advantages in 1944. It was a huge barrier to German intelligence;

in many cases the Germans saw only what the Allies wanted them to see. Secondly, the world's oceans and seas offer sea worthy vessels an expanse of highways. Was a task force departing Southampton bound for Brest, Cherbourg, Le Havre, or Calais (assuming that the Germans even spotted it)? The Channel thus offered a mixed bag of pluses and minuses for both sides. **But what if General Eisenhower had been able to get his hands early and easily on enough landing craft to conduct an amphibious assault with thirty divisions simultaneously?** How would that alteration have affected the relationship between the Channel and German power? In all likelihood, far fewer folks would call the Channel a German CG (or words to that effect), because it would no longer have functioned as a force effectiveness enhancer for the Germans; their coastal defense formations and mobile reserves being unable to cope with what Eisenhower could have thrown at them on D-Day. That altered situation would have further magnified the negative consequences of having to defend the long coastline from Holland to Spain; Hitler's determination to defend the entire length of the French Channel coast would then have become a massive German strategic and operational liability.[1]

The foregoing is offered as an admonition to military planners and commanders to focus strictly and keenly on enemy and friendly "critical capabilities" and "critical requirements" as they are driven or influenced by obstacles, and to refrain from identifying an obstacle itself as an enemy or friendly CG. To do otherwise might lock a commander and his staff into an early mindset precluding them from realizing the full range of possible advantages and stratagems. Secondly, more often than not a good commander and his staff will devise a scheme which takes advantage of a barrier, using it as a mask, shield, or highway, or turning the enemy's preoccupation with defending it into **his** disadvantage. At that moment they will see the obstacle in a different light, and cease thinking of it, and referring to it, as an enemy center of gravity.

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[1] It can be argued that it was anyway, even in the actual historical event.