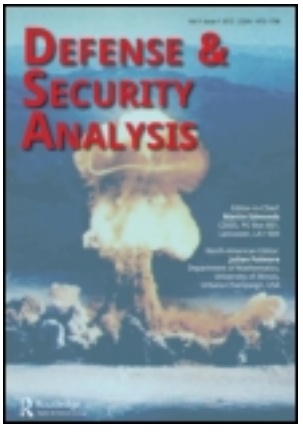

Defense & Security Analysis
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/cdan20

Unpacking the various meanings of redundancy: from refining the concept to military planning

Leo J. Blanken [a] & Jason J. Lepore [b]

[a] Department of Defense Analysis, Naval Postgraduate School, Monterey, CA, 93943, USA

[b] Department of Economics, Orfalea College of Business, California Polytechnic State University, San Luis Obispo, CA, 93449, USA

Version of record first published: 22 Nov 2012.

To cite this article: Leo J. Blanken & Jason J. Lepore (2012): Unpacking the various meanings of redundancy: from refining the concept to military planning, Defense & Security Analysis, 28:4, 326-342

To link to this article: http://dx.doi.org/10.1080/14751798.2012.730721

Defense & Security Analysis
Vol. 28, No. 4, December 2012, 326–342

Routledge
Taylor & Francis Group

Unpacking the various meanings of redundancy: from refining the concept to military planning

Leo J. Blanken[a] and Jason J. Lepore[b]*

[a]*Department of Defense Analysis, Naval Postgraduate School, Monterey, CA 93943, USA;* [b]*Department of Economics, Orfalea College of Business, California Polytechnic State University, San Luis Obispo, CA 93449, USA*

The authors engage in the debate over waste in military force structure planning by rigorously deconstructing the concept of "redundancy." First, a typology of redundancy is constructed that provides a common framework for identifying variety among redundant structures. These are labeled "true redundancy," "expanded capacity," "portfolio diversification," and "mission overlap." Further, a number of mechanisms are identified that produce these types of structures, and show the conditions under which planners may utilize redundant structure in the search for optimization. In sum, the article provides refined concepts for analysts and planners to identify when redundancy is deleterious or beneficial.

Keywords: redundancy; diversification; capacity; mission overlap; optimization

A person performing a redundant task is not contributing to our defense. (Donald Rumsfeld[1])

Redundancy is inherently a virtue in war. (Frederick Kagan[2])

Introduction

Bureaucracies are complex organizations that are created to execute tasks for some authority. The US military is one such organization; this bureaucracy is such a massive enterprise that its operating budget is larger than any other nation's *total* budget, and is larger than the gross domestic product (GDP) of all but a handful of nations.[3] It is generally assumed that those who design and monitor such expensive organizations value efficiency in the execution of tasks and this is, at least nominally, true of the Department of Defense (DOD). The most prominent reformer of the DOD, former Secretary of Defense Robert McNamara, implemented his massive Planning Programming and Budgeting System in search of such efficiency through "cost effectiveness, elimination of redundancy, and [improved] process management."[4] It may seem surprising, therefore, to find advocates of redundancy in military structure, and yet there is vociferous disagreement within the national security community as to whether redundancy within military structures is beneficial or deleterious. The authors contribute to this debate by refining the concept of redundancy and

*Email: jlepore@calpoly.edu

ISSN 1475-1798 print/ISSN 1475-1801 online

http://dx.doi.org/10.1080/14751798.2012.730721
http://www.tandfonline.com

showing the conditions under which it is optimal. They do so in an effort to improve analysis as well as policy-making.

On the one hand, critics of redundancy argue that it harms national security because it is wasteful. If one assumes that resources available to the military are finite, and these are being used to build an apparatus with superfluous components, then fewer capabilities are being fielded than might otherwise be the case. These observers might be labeled the advocates of *efficiency*. This position was often articulated by former Secretary of Defense Rumsfeld:

> Transformation of our military forces hinges on being able to reduce redundancy, focus organizations on executive goals, flatten hierarchies, and cut cycle times in the decision and execution process. If we can find ways to make real progress in these areas … [it] will help drive more effective operational performance.[5]

Such a point of view often explicitly or implicitly likens the DOD to a private firm, in which efficiency leads to survival in competitive markets.

On the other hand, there are those who advocate redundancy in military organizations. These supporters contend – *contra* Rumsfeld – that there is a trade-off between efficiency and the likelihood of success on the battlefield. They stress that war is a uniquely risky and troublesome environment, in which normal expectations of performance do not apply; it is far removed from the world of private firms. Clausewitz labels this phenomenon the "friction" of war: "Everything in war is simple, but even the simplest thing is difficult … Action in war is like movement in a resistant element … in war it is difficult for normal efforts to achieve even moderate results."[6]

In addition, failure in war, as opposed to failure in other bureaucratic or business enterprises, may result in the very extinction of the nation state; therefore, the penny-pinching tendencies of the "bean-counters" should be ignored. Rather, if redundant structures help in successfully executing tasks on the battlefield, then they are a boon. These observers might be labeled the advocates of *effectiveness*. They argue that the military "might not want to rush toward business-like efficiencies … because doing so might endanger effectiveness … Military redundancy is not always efficient, but can be effective, since in the peculiar environment of war, business models are not always best."[7]

Under what conditions is either position correct? How are these disparate attitudes toward redundancy to be reconciled to an observer – or policy-maker? A first step toward resolving this disagreement is to recognize that there are a variety of concepts trapped within common usage of the term "redundancy." A major contribution toward improving policy outcomes is to unpack the disparate meanings of the term and identify the conditions under which such redundant structures in a military force structure are deleterious or beneficial and also to identify multiple sufficient drivers of these various redundancy types within modern military structures. Some of the mechanisms articulated in this analysis are readily observable, while others are more abstract in nature – but all represent important factors that may shape policy outcomes.

This is not, however, a claim to present an exhaustive list of sufficient causes of redundancy in organizational structures, but simply present those most pertinent to modern defense issues. These include redundancies manifested in research and development, procurement, force structure planning, as well as actual battlefield military operations. By exploring these issues, this article seeks to both reconcile the debate over redundancy in military structures as well as assist policy-makers in creating and monitoring such organizations in time of growing fiscal austerity.[8] It should be noted that the argument presented here is general, yet the author pays particular attention to the specific case of the USA, both in terms of examples used and recommendations offered.

The analysis starts with a simple set of assumptions. In particular, the executive political leadership is identified as the actor who determines national security goals, and seeks to build a

military apparatus for pursuing those goals. Any departure from the pursuit of that stated national security goal we treat as sub-optimal, without considering the quality of the goal formulation itself.[9] These assumptions flow from Clausewitz's *dictum* that war is an extension of politics and that

> [c]onsequently, the political leadership should ultimately control and direct the conduct of war. That is not to say that it should displace soldiers in the planning and conduct of operations . . . but the armed forces do not exist for their own sake. They are an instrument to be used.[10]

In other words, any deviation from the national security goals as stated by the US President (in his or her role as Commander-in-Chief) is considered to be pathological, without making any judgment as to the wisdom or worth of those goals. Further, the issue of time is put to one side. In other words, the inherent inefficiencies introduced by "policy lag," defined as the "differences in the planning horizons, budgeting cycles . . . national security strategy development on the one hand and weapons system/force structure development on the other," are assumed, with the former extending only 4–5 years and the latter being closer to 15 years.[11] This may result in superfluous weapons systems, in which "[s]uch purchases are designed to keep the industrial base 'warm' and avoid costly and lengthy reconstitution efforts at a later date or in a national emergency when the Defense Department needs new equipment quickly."[12] Such a mismatch in planning and execution timelines introduces many additional wrinkles, which, though important, are not considered here for the sake of clarity. These assumptions help to limit the scope of our discussion and allow us to focus solely on the issues at hand.

There are some strong implications of taking the national security goals as fixed. Particularly, we treat the military budget as a predetermined or a fixed parameter. When dealing with a fixed budget the military is *efficient* if it utilizes all its resources in the most productive way. In other words efficient production implies that expected effectiveness cannot be increased without increasing resources or improvements in technology.[13] In the words of former Assistant Secretary of Defense, Charles Hitch:

> [M]ilitary effectiveness or military worth of any given weapon system cannot logically be considered in isolation. It must be considered in relation to its cost – and in a world in which resources are limited, to the alternatives uses to which the resources can be put. Military requirements are meaningful only in terms of benefits to be gained in relation to their cost. Thus, resource costs and military worth have to be scrutinized together.[14]

Thus, in a fixed budget context, the effectiveness is maximized by way of efficient use of resources. To reconcile the use of terms, we will use the term *optimal* instead of either efficient or effective.

In the following section, a typology of four related, but distinct, organizational structures is created that is frequently folded under the common usage of the term "redundancy." The authors label these: true redundancy, expanded capacity, portfolio diversification, and mission overlap. Next, the distinction between deleterious and beneficial causes of redundancy in military structures is established. The deleterious causes of redundancy as coming from bureaucratic interests, domestic politics, and financial interests are identified, while the beneficial drivers are in pursuit of optimization in force structure planning. The deleterious sources have commonly been cited in the literature, while the latter has received much less attention.

In response to this lacuna, considerably more space is taken up discussing how a political leadership might utilize redundancy to pursue an optimal military structure, laying out conditions under which a reasonable principal might build various types of redundancy into organizational structures. In conclusion, policy recommendations are offered, identifying the criteria by which either the critics or advocates of redundancy are correct. Further, practical guidance is proposed to policy-makers to take advantage of existing redundancies within the military, which might otherwise be wasteful.

Types of Redundancy

	Principal Uses only Highest Output	Principal Uses all Outputs
Agents are Identical	True redundancy	Expanded capacity
Agents are Differentiated	Mission overlap	Portfolio diversification

Figure 1. Types of redundancy.

Four types of redundancy

A simple typology of concepts is presented, those which are commonly lumped under the general rubric "redundancy." The first dimension of the typology concerns the principal utilizing all of the output of multiple agents, rather than using only the "highest" or "best" output among multiple agents. In other words, is the principal only interested in at least one agent achieving some goal, or can he/she also utilize the production of the second, third, fourth etc. agents as well? The second dimension of the typology concerns whether agents are identical or differentiated. In other words, are the agents uniform with one another? Or do they possess distinctive attributes and tackle the assigned task in a distinctive manner? These two dimensions produce four types of redundancy, which are labeled: true redundancy, expanded capacity, mission overlap, and portfolio diversification (see Figure 1 above). Examples are provided for each below.

True redundancy

In true redundancy, multiple identical agents perform identical tasks, and the principal only needs to utilize the best output among the agents. An example is the parallel structure that is often built into military communications networks: "Command and control systems . . . need to be robust. They need to work in a variety of environments . . . In many ways this robustness is well served by redundancy."[15] The actor only requires the reception of the message content from any single pathway, even if all others are destroyed or disrupted.

Expanded capacity

In expanded capacity, multiple identical agents perform identical tasks, and the principal can use the output of all of the agents. This can be thought of simply as increased production. The USA entered the Second World War with five armored divisions. During the course of the War, the number of such units was eventually increased to 16.[16] These were uniform units, each was designed to perform identical tasks, the output of which could be simultaneously be utilized by the principal.

Portfolio diversification

In portfolio diversification, multiple, differentiated agents perform identical tasks, and the principal utilizes the output of all agents. During the Allied strategic bombing campaign over Germany in the Second World War, the Luftwaffe invested in two distinct types of air defense: interceptor fighter aircraft wings and ground-based anti-aircraft battalions (employing the infamous 88 mm

high-velocity gun). These were units differentiated in their attributes and methods, yet were designed to perform the same mission (defend German cities from aerial bombing).

Mission overlap

In mission overlap, multiple differentiated agents perform identical tasks, and the principal utilizes only the highest output among the agents. The US triad of nuclear warhead delivery systems is an example. Any one of the three systems (manned bombers, submarine launched ballistic missiles, and ground-based inter-continental ballistic missiles) was designed to deliver enough destructive power to inflict massive damage to the former Soviet Union, yet each was designed and deployed with significantly distinct technological and doctrinal attributes.

Distinguishing between deleterious and beneficial redundancy

Given these four types of redundancy, various mechanisms can drive them to emerge in military force planning: deleterious and beneficial. The sources of these deleterious motivations are identified briefly below, as they are commonly cited by observers as sources of wasteful redundancy. By contrast, considerably more space is devoted to the second, under-theorized subject: exploring how a reasonable principle may use redundancy within the structure of military agents to pursue policy optimization.

Deleterious redundancy

The common response to the question of redundancy in US military organizations is that it is pervasive and wasteful. It is common to describe these organizations as Byzantine, self-serving, and characterized by "overcomplexity, indifference, and obstructionism . . . unnecessary expenditures, wastage of scarce resources [and] operational redundancy."[17] There are two oft-cited sources of such wasteful redundancy: the military services themselves, and the external political and financial stakeholders who benefit from overspending on defense.

The first commonly recognized source of deleterious redundancy is the bureaucratic agent itself. This argument accords with a well-developed literature on bureaucracy that stems back to the 1970s. In this vein, bureaucratic managers seek to expand their organization's overall budget, their discretionary budget, or their mission.[18] In this conceptualization, there exists a strategic relationship between a political principal and its bureaucratic agent, in which the principal uses its design, budgeting, and monitoring powers to counter the agent's use of expertise and asymmetric information.[19] The degree to which the agent succeeds in this struggle depends on how much it can expand its budget, size, and mission beyond the intention of the political principal. The US Air Force's Thor and the Army's Jupiter missile programs of the 1950s are examples of one such redundancy. Both were medium-range ballistic missile programs that, in the words of one general officer were, "about as alike as the Ford and the Chevrolet."[20] Bureaucratic desire for expansion coupled with asymmetric information, therefore, provides a sufficient condition for deleterious redundancy.

The second most commonly cited source of redundancy is external advocacy. The term "external" is used here to denote any actor outside of the bilateral principal–agent relationship between the executive branch and the military bureaucracy. The most common source of external advocacy is the "military-industrial complex," which involves not only the military services mentioned above, but political and private firm interests as well.[21] Politicians desire jobs for their constituents and corporations want increased profits; the resulting "pork-barrel" relationship among Congress and defense industry lobbyists is "a fellowship between the service, the contractor and their patrons in the Congress, and they work very hard not to leave anyone hanging out to dry."[22]

This arrangement can result in redundancy in military structures, even when such redundancy serves no military purpose – and in some cases may not even be desired by the military forces upon which the money is being spent.[23] Consider, for example, former Commandant of the Marine Corps Charles Krulack's lamentations:

> I wanted to do away with the Hawk [antiaircraft missile] the second I became commandant . . . Do you know how long it took me? . . . Four years! . . . There's a lot of power out there. When you say 'I'm going to stop a program' the military industrial complex rolls in there and says, "No you aren't." So there's a real problem with industry, with the political side.[24]

External advocates, therefore, may constitute a sufficient condition for redundancy. General Krulack sums up the position thus: "Do you remember a guy named Eisenhower? He hit the problem right on the head."[25]

Former Secretary of Defense Gates similarly invoked President Eisenhower and his warnings concerning such wasteful spending on the military, especially in a new era of fiscal austerity: "Eisenhower was wary of seeing his beloved republic turn into a muscle-bound, garrison state – militarily strong, but economically stagnant and strategically insolvent."[26] Gates went on to define an optimal policy in which Washington "should spend as much as necessary on national defense – and not one penny more,"[27] but implied that the USA is currently overspending on expensive systems: "for example . . . United States maintains 11 aircraft-carrier strike groups at a time when no other country has more than one" and he went on to question "whether that huge advantage amounts to overkill."[28] Simply being aware of this deleterious redundancy does not, however, ensure that one has the political will to correct it. With regard to the question of saving $10–$15 billion by scrapping a single aircraft carrier, Gates said, "I may want to change things, but I am not crazy."[29]

Beneficial redundancy

On the one hand, the deleterious side of redundancy is well known. An underexplored source of bureaucratic redundancy, on the other hand, is that which may be used in pursuit of optimization; that is, maximizing military effectiveness given some fixed resources. In contrast to the story considered above, redundancy here results in the most efficient and effective organizational structure. Five drivers of redundancy in pursuit of optimization are considered here: efficient scale, probabilistic failure rates, measurement problems, transaction costs, contract enforcement, and political reliability. The author discusses each of these drivers of redundancy in turn.

Efficient scale

Military organizations are inherently characterized by redundancy. Infantry companies contain more than one rifleman; armored divisions contain more than one tank. The question that needs to be answered is: how many riflemen need to be in each company and how many infantry divisions need to be in the Army? The concept of efficiency of scale allows an analyst to more rigorously answer this most basic force structure planning question: "how much is enough?"[30]

A standard definition of minimum efficient scale of production is the size of production unit that minimizes average cost. This concept can be directly extended to the analysis of military organization. An alternate definition, specifically applicable to this context, is given a fixed set of resources; an efficient scale of production is an organization size that maximizes military effectiveness per resource utilized. Hence, the term military effectiveness is an abstract concept, which can encompass strategic considerations; in other words, effectiveness here includes both force

structure and the attendant doctrine. In terms of accomplishing some tasks, the efficient scale of production might vary. Suppose, for example, a task is best done by exactly N different military personnel in one location. The military might use many teams (say 10) of size N to accomplish a large task instead of creating one organization of size $10N$. In such an example, each of the teams' outputs is useful to the principal. Thus, the efficient scale argument is only relevant as a cause for expanded capacity, not true redundancy.

This may seem a straightforward planning task, and yet it can be difficult in an evolving, dynamic environment:

> [J]udgments reflect[ing] the doctrinal capabilities of [units] ... Only seldom[ly are] sensitive to the precise size of the division or its constituent units ... This raises questions such as: Could the division be smaller? ... do we still need as many tanks per platoon given the increased range and lethality of our tanks and modern battlefield surveillance? Could independent combined-arms brigades fulfill some of the tasks now performed by divisions?[31]

The US Army, as a stark example, engaged in such a discussion in the 1950s concerning the size and nature of its divisional unit in the face of tactical nuclear weapons – resulting in the short-lived "Pentomic Division" structure.[32] The appropriate size and structure of US ground forces is again under debate – rising and falling as beliefs over the impact of changing technology (Revolution in Military Affairs) and the operational tempo of multiple protracted counterinsurgencies (COINs) (as part of the "Global War on Terror") clash.[33]

Since all modern armies are hierarchical structures that include multiple undifferentiated units, this is the most basic question concerning redundancy. In fact, it is so basic as to often be left implicit in the discussion. An optimizing principal, however, must devote considerable thought to expanding the capacity of the organization to an appropriate size – both in terms of number and size of undifferentiated units needed to achieve strategic goals. This efficiency of scale argument, therefore, drives expanded capacity.

Probabilistic failure rates

Military thinkers and practitioners are understandably concerned about uncertainty that is generated on the battlefield.[34] One way to mitigate uncertainty is through redundant structure; this is the use of organizational structure to increase the likelihood of success based on the relationship among success probabilities of parallel mechanisms.[35] Redundant forces may serve to mitigate risk of failure, in a manner akin to the concept of diversification of investments in finance.[36] Let us use two simple examples to motivate this discussion. First consider a situation where identical technologies can be implemented to accomplish a task. The principal only cares if the task is accomplished or not. If the task is accomplished, then it is of value V. Suppose two given units have independent probabilities of success p. It costs C to field a unit. If one unit is used then the expected payoff of the operation is $pV - C$.

On the other hand, consider the use of two independent units. Now only one unit needs to accomplish the task to achieve success. At least one unit is successful with probability $(2 - p)p$. If two units are used the expected payoff of the operation is $(2 - p)pV - 2C$. Thus, employment of two units is better than one if $(1 - p)pV > C$, that is, if the cost of implementing a new unit is smaller than the expected added value of success of the new unit. Suppose a second type of technology becomes available with the same probability of success, but that is perfectly negatively correlated with the first. Employing the second unit with this deferent technology would result in the expected payoff $V - 2C$, since the task will now be completed with certainty. This is better than employing a second unit with an independent failure rate. Using the second unit with negative correlated success rate is optimal if $(1 - p)V > C$.

One ready example is that of the US military's ability to destroy enemy armored vehicles.[37] US forces have a variety of anti-armor capabilities at their disposal: the 30 mm depleted uranium rounds from the A-10 ground attack aircraft, precision-guided munitions from other fixed-wing aircraft, the main gun on a M-1 tank, the TOW missiles affixed to Bradley fighting vehicles, the Apache helicopter, anti-tank landmines, etc. Each of these weapons systems has distinct characteristics, even though each has the capacity to accomplish a single mission: destroy enemy armor vehicles. Further, the production of all of these units can be used additively to whittle down enemy armor forces – each in its own manner.

Kagan lauded this type of multiplicity of anti-armor capabilities in the 2003 Iraq War "weather conditions restricted the Air Force's ability to fly [A-10] sorties against enemy armor concentrations. The ability of the [M-1] tanks . . . to survive encounters with those enemy forces saved American lives."[38] The advantage in employing redundant systems with probabilistic failure rates, as Kagan notes, is the independence among the rates (or, even better, failure rates that are negatively correlated) of these systems due to their differing characteristics.

Imagine an armor campaign that stretches from winter to spring: during the winter air missions may be restricted due to poor weather whereas anti-tank ground forces may continue to destroy enemy armor, but the spring thaw immobilizes ground units in mud while aircraft may now resume their anti-armor sorties. In portfolio diversification, a principal weighs the costs of developing and assigning a variety of distinctive units to the same mission versus simply expanding the capacity of a single type of unit. Additional costs may arise from more research and development, as well as more complex training and doctrine. Benefit comes from the ability of some units to continue operating while entire classes of units have been nullified by enemy action or exogenous forces.

Probabilistic failure rates are a sufficient condition for all four types of redundancy. Most cases fit under the portfolio diversification or mission overlap, because slightly different forces are more likely to have negatively correlated failure rates. Mission overlap is similar to true redundancy in that the principal only needs one successful agent, but, as in portfolio diversification, the differentiation among the characteristics of the agents gives them independent failure rates. An example would be the deterrent effect provided by US strategic nuclear forces. The US deterred the Soviets by threatening an unacceptable level of damage through the use of its nuclear arsenal. The USA did not, however, rely on a single type of delivery system to transport the warheads to their targets, but rather spread its nuclear bombs among a three-legged "Triad."[39]

These three systems were redundant in the respect that:

> a force structure entirely of bombers, or ICBMs, or SLBMs could satisfy the [damage] requirement . . . But the issue of force structure involves building a force which . . . is not highly dependent upon a single tactic which may be overcome by the enemy over time.[40]

When making a decision concerning mission overlap, a principal should weigh the cost of buying additional units versus the resulting marginal increase in the probability of success. Versus true redundancy (and like portfolio diversification), however, the principal also considers the cost of developing variety among these units, weighing the additional cost against the likelihood that enemy strategy or other forces will nullify whole classes of units.

Measurement problems

In a seminal work, Downs argues that the central obstacle to bureaucratic efficiency is the fact that performance "is not directly or indirectly evaluated in any markets external to the organization by means of voluntary quid pro quo transactions."[41] In other words, the level and nature of the

agents' efforts can be measured against competitors' in a free market among private firms, while the quality of bureaucrats' efforts is largely hidden from the principal. When comparing the military to other bureaucracies through this lens the problem becomes more intransigent, as their core function (combat) is further removed from market activity than other bureaucracies (such as the US Postal Service).[42] This is essentially a problem of measurement with which the principal must contend.

In such a context, creating competition through redundancy can sometimes increase the incentives for agents to take more effective actions. These situations are those where the principal does not know how to map the agents' efforts to the expected output; put another way, times in which the principal is extremely uninformed about agents' activities. In this case, it is very hard to measure the agents' contribution toward the principal's goals; is it "good" or "bad" based on the resources used? The principal can solve this measurement problem by creating another agency and rewarding the agency that does better according to some crude ordinal ranking. There is a large literature on such incentive problems, which are typically labeled "contests."[43] Based on relative performance evaluations, the principal can use the contest to induce strong incentives for effective actions, despite the measurement problems. It is possible that over time measurement issues do not resolve themselves and the principal needs to keep at least two agencies active in order to evaluate the output of either agency.

This is an optimization-based motivation for pure redundancy, since similarity of the agents helps resolve the measurement issues. The founding of the Lawrence Livermore National Laboratory is an empirical case in point, as it was created as a direct competitor to the Los Alamos Laboratory in the search for more advanced fusion weapons. When the navy, for example, sought a small nuclear device with a one-megaton yield for their Polaris missile program, they discussed it with representatives from both labs. Edward Teller recalled that the "representatives from Los Alamos said it could not be done … But I stood up and said 'We at Livermore can deliver it in five years'" and the resulting missile was, indeed, operationally tested by the USS Ethan Allen in May of 1962.[44]

When a principal cannot easily measure the agents' efforts, redundancy may be a remedy. The redundancy assists the principal by engendering competition among the agents. This is useful when the principal cannot assess the agents' work, but can weigh the results of the agents' activity against one another. In the case of the nuclear laboratories, the political leadership may not have had the scientific knowledge to assess the Los Alamos scientists' claims regarding the difficulty of the project, but could see the product (a working missile) generated by the competition with the Livermore scientists. Measurement issues, therefore, may drive true redundancy or expanded capacity.

Contracting issues

One normally does not think of the various components of a modern military as engaging in contracting amongst one another, and yet it may be useful to do so. In doing so, we present two arguments that deal with issues of coordinating among distinct organizational units. The first, labeled "transaction costs," is concerned with the time and effort it takes to negotiate contracts. The second, labeled "contract enforcement," refers to the *ex post* reliability of agreements that are made among units.

Transaction costs

If two separate military services require that some specific task needs to be handled by a specialist, then why not employ a single, centralized unit to execute the task across services? Sometimes we

find this to be the case, and sometimes not. For example, each service provides its own motor pool services, whereas all of the services contract with a central agency (the National Reconnaissance Office) to receive satellite imagery. Therefore, when such redundancy (such as multiple motor pools) exists across units, it can be optimal if the required interactions are so regular and uniform that internalizing the service is less costly than continually renegotiating with an outside supplier. This approach to analyzing organizational structure is referred to as transaction costs.[45]

Every time either service interacts with the unit terms must be reached for the task to be accomplished. This is essentially a re-contracting problem studied extensively in the literature on organization structure and the theory of the firm.[46] The cost to constantly re-contract with an outside body can be substantial enough that each service would prefer to create their own internal unit to do the task. These redundant components are common across services, rather than all services contracting with a central repository for such activities, but this is optimal if it would be too wasteful to constantly re-negotiate these uniform "mini-contracts." For example, suppose that the opportunity cost of re-contracting is $t > 0$, and the service expects to need to contract $k > 0$ times in the future. If the cost $t \times k$ is greater than the cost of creating a specialized inter-service unit that will complete the task, then the creation of a redundant unit is optimal.

There are many ready examples of this in the support functions across services. Each service has organic motor pools, administrative personnel, food services, laundry, and medical units – resulting in expanded capacity across services. This may extend beyond mere support activities and into core combat functions as well. In the 1930s, for example, debates formed about the proper use of tanks on the battlefield. Heinz Guderian describes the development of his thinking on this point:

> It was principally the books and articles of the Englishmen, Fuller, Liddell Hart, and Martel that excited my interest … These far-sighted soldiers were even then trying to make of the tank something more than just an infantry support weapon … I learned from them the concentration of armour … for long-range strokes, operations against the opposing army's communications, and also … a type of armored division combining panzer and panzer-infantry units.[47]

This quote captures the trade-off nicely. One school of thought proposed that tanks be dispersed as tactical fire-support weapons throughout existing infantry units, integrated with such units and routinely supplying direct fire on hard targets as an organic function. Others argued that tanks should be massed in centralized units that could contract with infantry divisions at the operational level, necessitating the need for tailored re-contracting (combined-arms planning) to be used successfully in each campaign.[48] In the first school of thought, the redundant tanks across units are optimal due to the uniformity of routine contracts, while in the second, the complexity and uniqueness of contracting at the operational level precludes such redundancy. Therefore, in this argument it is the degree to which contracts are routine and uniform determines whether such redundancy is optimal.

Contract enforcement

Modern warfare requires careful coordination across various units and various services. Modern US military parlance uses the term "jointness" to characterize such coordinated inter-unit operations.[49] Each current US military service is such a powerful and complex organization in its own right, however, that an outside enforcer may not have the acumen or the will to enforce inter-unit contracts in such operations. Redundancy can be optimal, therefore, if inter-unit contracts are not being honored.[50]

For example, service 1 is contracted to do a task for service 2 in particular situations. If service 1 does not find it individually beneficial to do the task at the time it is needed, it will not do it. Any enforceable contract in this environment can include only weak stipulations on contingent behavior. An alternate solution is for service 2 to create its own subdivision to handle the task it currently relies on service 1 to accomplish. As long as the cost creating this internal division is less than the loss incurred by service 1 not providing the necessary support, it is better for service 2 to create its own subdivision and avoid the hold-up problem.

The US Marine Corps currently fields roughly 20 squadrons of fixed wing attack aircraft. Why would this amphibious force require air-to-air combat and ground attack capabilities, when these should be provided by the US Air Force? Builder argues that this is simply the result of a past history of broken contracts:

> For the Marines the issue is self-reliance, and that means the certainty of their air support. The Marines never forget a lesson once learned, and one of those lessons was not to trust anyone else to provide support from the air . . . For the Marines, air support means security from attack from the sky over their heads, transport through the air, and supporting fire from the air. The Marine Corps will not give up any of those critical functions and rely on another service to provide them, even if they are assured that all operations are joint.[51]

More specifically, this state of affairs arose after perceived failures by Navy and Air Force (and earlier, Army Air Corp) air assets to prioritize support for Marine ground operations in the Pacific Theater in World War II and the Korean War.[52] Even to this day, Marines feel strongly on this topic: "the Marine Corps should use [its own air support] so those strong Marine Corps bonds are there . . . to get a little bit more out of one another when they're all in a gunfight because they're all Marines."[53]

In some cases, this redundancy is caused by lack of principal efforts at enforcement. Such redundancy is optimal for the agent, if it is cheaper to provide its own service rather than risk broken contracts. Such redundancy is optimal for the principal if the cost of redundancy is easier to bear than the monitoring costs necessary to enforce contracts between services.

Political reliability

A final sufficient driver of redundant structure in military organization is the problem of political reliability. This is similar to the probabilistic failure rate problem above, but instead involves the willful disobedience, or outright mutiny, among politically suspect units.[54]

To correct political reliability problems, redundant command structures or completely parallel military structures are sometimes implemented. The Bolsheviks, for example, implanted a political commissar command structure within the early Soviet Army: "the commissars were instructed to take part in all forms of activities of the military specialists and were to . . . countersign all orders. Only orders so countersigned were to be considered valid."[55] This redundant system was, however, a trade-off:

> Throughout the war, but especially in the 1941–43 period, one crucial issue was never resolved . . . how the imperative of maintaining tight political control over military commanders and troops with the attendant diminution of the professional soldier's authority and freedom of action was to be reconciled with the equally strong imperative of developing an efficient professional war machine.[56]

The needs of political reliability may compel a leader to move beyond redundant command structure to almost fully parallel military structures. Adolf Hitler, for example, often displayed a profound

distrust of the traditional German military ("Wehrmacht") leadership; Josef Goebbels recorded this sentiment in his diary in May of 1943: "He is absolutely sick of the generals. He can't imagine anything better than having nothing to do with them . . . All generals lie. All generals are disloyal. All generals are opposed to National Socialism."[57] Hitler mitigated the risk of this politically unreliable force by creating a parallel and fiercely loyal "army," the *Waffen-SS* (the armed wing of the Nazi party's paramilitary *Schutzstaffel* organization); in

> June 1941 it only numbered 165,000 men . . . by the end of the war [it was] 700,000 men organized as separate corps, having 1/5th of the panzer divisions and equaled over 10% of army . . .. [it] also [included] 200,000 Luftwaffe men, organized as 22 Luftwaffe Field Divisions.[58]

This force, then, constituted a significant redundant military organization that not only increased combat capacity on the battlefield, but also provided political buttressing of the *Wehrmacht* forces. This was increasingly to be the case in the wake of the attempted assassination of Hitler by senior *Wehrmacht* generals in the summer of 1944.

> Ever since the SS increased its power over the Army so suddenly in July 1944, rumors have persisted that individual members of the *Waffen-SS* became attached to regular Army units, especially in the low echelons, in order to increase the reliability of these troops. The fact that units of the *Waffen-SS* were used to prevent mass desertions or withdrawals contrary to orders is established.[59]

These examples show that political reliability issues may drive a leader to build redundancy into a military bureaucracy to mitigate risks associated with a military coup, mutiny, or some other form of willful non-compliance.

Conclusions and recommendations

This article began by citing a recent debate concerning redundancy in military force structure; the authors now return to it. The position that redundancy should be avoided altogether was expressed by former Secretary of Defense Rumsfeld: "Inefficiency is always unfortunate, but in the Department of Defense, it can be deadly . . . A person performing a redundant task is not contributing to our defense."[60] Such a position reflects a managerial view of the military as a cost-effective organization akin to a private firm. Other observers reject this position outright.

Frederick Kagan was widely seen as the architect of the Bush Administration's "surge" strategy in Iraq. He argues, *contra* Rumsfeld, that

> [r]edundancy in war can yield flexibility and security. It ensures that when one system fails for whatever unforeseen reason, another can take its place. It provides the ability to meet unexpected challenges . . . Above all, the US must avoid the search for "efficiency in military matters. Redundancy is inherently a virtue in war."[61]

This position harks back to a central tenet of strategic planners, that war is characterized by uncertainty and therefore planners should err on the side of caution:

> Secretaries of defense are expected to argue for a higher DOD budget . . . Ultimately, planning defense capabilities under uncertainty is deciding how much insurance to buy against unlikely but plausible events. There is no rigorous and objective means for judging how much insurance is enough . . ..[62]

This is a serious debate that stands squarely between the Scylla of national security and the Charybdis of fiscal constraint.

New tools have been provided for adjudicating between the positions of Rumsfeld and Kagan. Neither is correct that redundancy is inherently good or bad, but it may be wasteful or useful under

Drivers of Redundancy in Military Structures

Drivers of optimizing redundancy	Logic	Likely type of redundancy observed
Efficient scale	Driven by cost per unit needed to achieve strategic goals	Expanded capacity
Probabilistic failure rates	Driven by independent or negatively correlated failure rates	Mission overlap, portfolio diversification
Measurement	Driven by principal's inability to accurately track agent performance	True redundancy, expanded capacity
Contracting issues (Transaction costs and contract enforcement)	Driven by costliness of coordination among units	Expanded capacity
Political Reliability	Driven by untrustworthy agents	True redundancy

Figure 2. Drivers of redundancy in military structures.

specified conditions. More explicitly, the authors have defined five sufficient conditions under which a reasonable principal would utilize redundancy to pursue an optimal military organization (see Figure 2). The first is *efficient scale*; the authors have helped define the optimal size of increasing undifferentiated units. Second, they have explored the role of *independent probabilistic failure rates*, showing how these can justify differentiated redundant units. They have shown how inducing competition among redundant units can mitigate *measurement problems*. They have explored how *transaction costs* and *contract enforcement* issues may justify redundancy across services when contracts for activities are either too costly to be constantly re-negotiated or contracts that are not being upheld by a third-party enforcer. Finally, problems of *political reliability* can justify redundant structures.

This analysis provides a tool for policy-makers, simply by elucidating the various types and drivers of redundancy in military force structures. Take, for example, the case of special operations forces (SOF) in the wake of 11 September. As the "global war on terror" began to take shape, a need was recognized for an expansion of highly trained, independently operating units capable of both counterterrorism and COIN missions.[63] Rather than assigning a single agency to train and field these forces, however, the US military has SOF units across multiple services – including Army Special Forces (Green Berets) and Navy Sea, Air and Land Teams. The most recent addition to the SOF arsenal is the Marine Special Operations Command (MARSOC), announced by former Secretary of Defense Rumsfeld in 2005 to

> to take on more of the load historically shouldered by other special operations forces (SOF) units . . . Like our joint United States Special Operations Command (USSOCOM) counterparts, our mission typically falls under the following core activities: foreign internal defense, security force assistance, counterinsurgency, special reconnaissance, and direct action.[64]

This newly minted SOF force is difficult to justify in terms of optimal use of resources. This is true for at least three reasons. First, given economy of scale, it would have been far cheaper to simply expand the capacity of existing SOF units to meet the demand. Second, the existence of "elite"

forces runs contrary to the ethos of the Marine Corps, as the entire service sees itself as made up of elite warriors.[65] Finally, initial deployments of MARSOC forces to Afghanistan resulted in unfortunate scandal, which was attributed to the "growing pains" of a newly minted unit being deployed prematurely.[66] Given these points, it is easy to make the case that the creation of MARSOC was an example of deleterious redundancy.

The analysis, however, provides policy-makers an opportunity to utilize MARSOC more efficiently *ex post*, even though its initial creation was sub-optimal. The core missions assigned to MARSOC – such as COIN – are exceedingly thorny and complex:

> COIN is a *complex* effort that integrates the full range of civilian and military agencies . . . It is an extremely *difficult* undertaking, is often highly controversial politically, involves a series of *ambiguous* events that are extremely difficult to interpret, and often requires vastly more resources and time than initially anticipated.[67]

Based on this assessment, two things are clear. First, there may be disagreement about what is the best policy to pursue in any given COIN campaign. Second, it is exceedingly difficult for a principal to monitor and assess the performance of military agents in a COIN setting.[68] In this case, the principal may utilize MARSOC units in "competition" with existing SOF units in COIN – ordinal ranking achieved outcomes in lieu of the ability to accurately measure agent progress. It may further induce MARSOC to develop entirely novel techniques to conduct COIN, utilizing the logic of independent failure rates among the rival techniques, thereby using portfolio diversification to "search" for the most successful COIN strategy.

The authors' analysis, therefore, has made a number of contributions. First, they have provided a typology of redundancy that will allow for a common framework for labeling various redundant structures. Second, they have provided a definitional distinction between deleterious and beneficial redundancies. Third, they have identified a number of common sufficient drivers of redundancy, many of which allow for planners to utilize redundant structure in the search for optimization. Finally, they have provided an example of how this logic of optimization can even be utilized *ex post* to retrieve some efficiency, even when redundant structures are the result of deleterious pressures.

Notes

1. Donald Rumsfeld, *Annual Report to the President and Congress* (Washington, DC: GPO, 2005).
2. Frederick Kagan, 'The Art of War', *The New Criterion* 22, no. 3 (2003): 4–16.
3. Charles A. Stevenson, *SECDEF: The Nearly Impossible Job of Secretary of Defense* (Washington, DC: Potomac Books, 2006), 4.
4. Stuart E. Johnson, 'The New PPBS Process to Advance Transformation', *Defense Horizons*, no. 32 (2003): 2.
5. Rumsfeld, *Annual Report*, 21.
6. Carl von Clausewitz, *On War*, trans. M. Howard and P. Paret (Princeton, NJ: Princeton University Press, 1989), 119–20.
7. Christopher R. Paparone and James A. Crupi, 'What is Joint Interdependence Anyway?', *Military Review* 84, no. 5 (July–August 2004): 41.
8. Todd Harrison, *The Fiscal Commission and Defense: Strategy in an Age of Austerity* (Washington, DC: Center for Strategic and Budgetary Assessment, 2010).
9. Leslie H. Gelb and Richard K. Betts, *The Irony of Vietnam: The System Worked* (Washington, DC: Brookings), 181.
10. Peter Paret, 'Clausewitz', in *Makers of Modern Strategy from Machiavelli to the Nuclear Age*, ed. Peter Paret (Princeton, NJ: Princeton University Press, 1986), 200.
11. Kevin Reynolds, *Defense Transformation: To What, for What?* (Carlisle Barracks, PA: Strategic Studies Institute, 2006), ix.

12. William L. Stanley, 'Assessing the Affordability of Fighter Aircraft Force Modernization', in *New Challenges for Defense Planning: Rethinking How Much is Enough*, ed. Paul K. Davis (Santa Monica, CA: RAND, 1994), 567.
13. For a discussion of efficient production in the private firm context see Dennis W. Carlton and Jeffrey M. Perloff, *Modern Industrial Organization*, 4th ed. (Reading, MA: Addison Wesley, 2004).
14. Cited in D. Novick, *Resource Analysis in Military Long-range Planning* (Santa Monica, CA: RAND, 1964), 2 and see also Charles J. Hitch and Roland N. McKean, *Elements of Defense Economics* (Washington, DC: Industrial College of the Armed Forces, 1967), 67–72.
15. David S. Alberts et al., *Understanding Information Age Warfare* (Washington, DC: CCRP Publication Series, 2001), 90–1.
16. US Army Center of Military History, 'Armored Divisions', http://www.history.army.mil/html/forcestruc/cbtchron/armdiv.html (accessed December 1, 2010).
17. Alan Ned Sabrosky et al., 'Organized Anarchies: Military Bureaucracy in the 1980s', *Journal of Applied Behavioral Science* 18, no. 2 (1982): 138, 147.
18. William A. Niskanen, *Bureaucracy and Representative Government* (Chicago, IL: Aldine Atherton, 1971); William A. Niskanen, 'Bureaucrats and Politicians', *Journal of Law and Economics* 18, no. 3 (1975): 617–44; and Morton H. Halperin, *Bureaucratic Politics and Foreign Policy* (Washington, DC: Brookings, 1974).
19. Randall L. Calvert et al., 'A Theory of Political Control and Agency Discretion', *American Journal of Political Science* 33, no. 3 (1989): 588–611; Morris P. Fiorina, 'Legislative Choice of Regulatory Forms: Legal Process or Administrative Process?', *Public Choice* 39, no. 1 (1982): 33–66; Matthew McCubbins et al., 'Structure and Process as Solutions to the Politician's Principal Agency Problem', *Virginia Law Review* 74, no. 2 (1989): 431–82; and Barry R. Weingast and Mark J. Moran, 'Bureaucratic Discretion or Congressional Control? Regulatory Policymaking by the Federal Trade Commission', *Journal of Political Economy* 91, no. 5 (1983): 765–800.
20. Samuel P. Huntington, 'Interservice Competition and the Political Roles of the Armed Services', *American Political Science Review* 55, no. 1 (1961): 41; see also Samuel P. Huntington, *The Common Defense: Strategic Programs in National Politics* (New York: Columbia University Press, 1961) and Paul Y. Hammond, *Organizing for Defense: The American Military Establishment in the Twentieth Century* (Princeton, NJ: Princeton University Press, 1961).
21. For a recent analysis of the history and development of this argument, see James Ledbetter, *Unwarranted Influence: Dwight D. Eisenhower and the Military–Industrial Complex* (New Haven, CT: Yale University Press, 2011).
22. L.R. Jones and Jerry L. McCaffery, *Budgeting, Financial Management, and Acquisition Reform in the US Department of Defense* (Charlotte, NC: Information Age Publishing, 2008), 9.
23. For a detailed case study, see Nick Kotz, *Wild Blue Yonder: Money, Politics, and the B-1 Bomber* (New York: Pantheon, 1988).
24. Quoted in George C. Wilson, *This War Really Matters: Inside the Fight for Defense Dollars* (Washington, DC: CQ Press, 2000), 63.
25. Ibid., 62.
26. Greg Jaffe, 'Gates Vows to Shrink Pentagon Bureaucracy', *Washington Post*, May 9, 2010.
27. John T. Bennett, 'Gates Seeks Pentagon Overhaul', *Defense News*, May 8, 2010.
28. Jaffe, 'Gates Vows'.
29. Ibid.
30. Alain Enthoven and K. Wayne Smith, *How Much is Enough? Shaping the Defense Program, 1961–1969* (New York: Harper and Row, 1971).
31. Stanley, 'Assessing the Affordability', 39–40.
32. Jonathan M. House, *Toward Combined Arms Warfare: A Survey of 20th-Century Tactics, Doctrine, and Organization* (Carlisle Barracks, PA: US Army Combat Studies Institute, 1984); Andrew Bacevich, *The Pentomic Era: The US Army between Korea and Vietnam* (Washington, DC: NDU Press, 1986); and for a study on optimal unit size in the case of special forces units, see Jessica Glicken Turnley, *Cross-Cultural Competence and Small Groups: Why SOF are the Way SOF Are* (MacDill Air Force Base: Joint Special Operations University, 2011).
33. Edward F. Bruner, *Military Forces: What is the Appropriate Size for the United States? CRS Report No. 21754* (Washington, DC: Congressional Research Service, 2004).
34. For recent discussions see Thomas Waldman, 'Shadows of Uncertainty: Clausewitz's Timeless Analysis of Chance in War', *Defence Studies* 10, no. 3 (2010): 336–682; Barry D. Watts, *Clausewitzian Friction and Future War*, Revised ed. (Washington, DC: National Defense University, 2004); and for a more formal analysis, see Hitch and McKean, *Elements*, 123–48.

35. Martin Landau, 'Redundancy, Rationality, and the Problem of Duplication and Overlap', *Public Administration Review* 29, no. 4 (1969): 346–58; Jonathon B. Bendor, *Parallel Systems: Redundancy in Government* (Los Angeles and Berkeley: University of California Press, 1985); and C.F. Larry Heimann, 'Understanding the Challenger Disaster: Organizational Structure and the Design of Reliable Systems', *American Political Science Review* 87, no. 2 (1993): 421–35.
36. Paul Samuelson, 'General Proof that Diversification Pays', *Journal of Financial and Quantitative Analysis* 2, no. 1 (1967): 1–13.
37. For a similar example see Michael E. O'Hanlon, *The Science of War: Defense Budgeting, Military Technology, Logistics, and Combat Outcomes* (Princeton, NJ: Princeton University Press, 2009), 47–9.
38. Kagan, 'The Art of War'.
39. For a discussion of the strategic implications of these various delivery systems, see Kevin N. Lewis, *US Strategic Force Planning: Restoring the Links between Strategy and Capabilities* (Santa Monica, CA: RAND, 1982).
40. George J. Seiler, *Strategic Nuclear Force Requirements and Issues* (Maxwell Air Force Base: Air University Press, 1983), 59.
41. Anthony Downs, *Inside Bureaucracy* (Boston, MA: Little Brown, 1967), 25.
42. Frank Camm, 'Adapting Best Commercial Practices to Defense', in *New Challenges, New Tools for Defense Decisionmaking*, eds. S.E. Johnson et al. (Santa Monica, CA: RAND, 2003), 227–30.
43. For a review of this literature, see Stefan Szymanski, 'The Economic Design of Sporting Contests', *Journal of Economic Literature* 41, no. 4 (2003): 1137–87.
44. Paul Chrzanowski and Pamela MacGregor, *Lawrence Livermore National Laboratory: Serving the Nation for Fifty Years* (Washington, DC: GPO, 2002), 12.
45. For the foundational work on the impact of transaction costs on organizational structure, see Ronald Coase, 'The Nature of the Firm', *Economica* 4, no. 16 (1937): 386–405.
46. Oliver E. Williamson, *The Mechanisms of Governance* (New York: Oxford University Press, 1999).
47. Heinz Guderian, *Panzer Leader* (Cambridge, MA: Da Capo 1952/1996), 20.
48. Shimon Naveh, *In Pursuit of Military Excellence: The Evolution of Operational Theory* (New York: Routledge, 1997).
49. Roger Beaumont, *Joint Military Operations: A Short History* (Westport, CT: Greenwood Press, 1993).
50. Benjamin Klein et al., 'Vertical Integration, Appropriable Rents, and the Competitive Contracting Process', *Journal of Law and Economics* 21, no. 2 (1978): 297–326 and Oliver E. Williamson, 'Transaction-Cost Economics: The Governance of Contractual Relations', *Journal of Law and Economics* 22, no. 2 (1979): 233–62.
51. Carl H. Builder, 'Roles and Missions: Back to the Future', *Joint Force Quarterly* , no. 4 (Spring 1994): 35.
52. Thomas C. Linn, 'Joint Operations: The Marine Perspective', *Joint Force Quarterly*, no. 10 (Winter 1995–1996): 16–8.
53. M.E. Woodard, *Marine Special Operations Companies Need Marine Air* (Quantico, VA: USMC Command and Staff College, Marine Corps University, 2009), 11.
54. For broader discussions of civil–military relations see Samuel P. Huntington, *The Soldier and the State: The Theory and Politics of Civil–Military Relations* (Cambridge, MA: Belknap Press, 1981) and Samuel Finer, *The Man on Horseback: The Role of the Military in Politics* (New York: Transaction, 1988/2002).
55. D. Fedetov White, 'The Military Commissars', in *Soldiers and States: Civil–Military Relations in Modern Europe*, ed. D.B. Ralston (Boston, MA: DC Heath and Company, 1966), 161.
56. Seweryn Bialer, 'Professional Soldiers Versus Political Leaders', in *Stalin and His Generals: Soviet Military Memoirs of World War II*, ed. S. Bialer (New York: Pegasus, 1969), 440.
57. Cited in Matthew Cooper, *The German Army, 1933–1945* (Chelsea, MI: Scarborough House, 1990), 448.
58. Ibid., 449–51.
59. United States War Department, *Handbook on German Military Forces* (Baton Rouge, LA: Louisiana State University Press, 1945/1990), 201.
60. Rumsfeld, *Annual Report*, 3.
61. Kagan, 'The Art of War'.
62. Stanley, 'Assessing the Affordability', 18.
63. David Tucker and Christopher J. Lamb, *United States Special Operations Forces* (New York: Columbia University Press, 2007).

64. Mastin M. Robeson, 'Forging Marine Special Operators', *Joint Force Quarterly*, no. 56 (January 2010): 86.
65. See, for example, the arguments in R.L. Diefenbach, *Do Not Sacrifice the Marine Corps for MARSOC to Succeed: The MARSOC Closed Loop Personnel Policy Proposal* (Quantico, VA: USMC Command and Staff College, Marine Corps University, 2006).
66. Robert Burns, 'Marine Unit Ordered Out of Afghanistan', *Associated Press*, March 4, 2007.
67. United States Government Interagency Counterinsurgency Initiative, *US Government Counterinsurgency Guide* (Washington, DC: GPO, 2009), 12, emphasis in original.
68. On the case of Afghanistan, see Anthony H. Cordesman, *Afghanistan and the Uncertain Metrics of Progress* (Washington, DC: Center for Strategic and International Studies, 2011) and on the case of Vietnam, see Gregory A. Daddis, *No Sure Victory: Measuring US Army Effectiveness and Progress in the Vietnam War* (New York: Oxford University Press, 2011).