
MEASURING MILITARY CAPABILITY

The ultimate yardstick of national power is military capability. Because countries subsist in an environment where internal and external threats to security are both common and ever-present, the effectiveness of their coercive arms becomes the ultimate measure of power. Military capabilities allow countries to defend themselves against all adversaries, foreign and domestic, while simultaneously enabling their state managers to pursue whatever interests they wish, if necessary over and against the preferences of other competing entities. As Peter Paret summarized it, “military power expresses and implements the power of the state in a variety of ways within and beyond the state borders, and is also one of the instruments with which political power is originally created and made permanent.”¹ For this reason, the ultimate “output” of national power should be—ideally—the ability of a military force to successfully prosecute a variety of operations against a country’s adversaries. Whether a force is in fact capable of overwhelming these adversaries requires a detailed analysis of the balance of power, the circumstances under which the engagement occurs, and the relevant constraints and objectives that condition the overall interaction between the two sides. This effort often requires dynamic combat analysis, including simulations and gaming, to determine the *relative* balance of effectiveness between any two forces.

¹Peter Paret, “Military Power,” *The Journal of Military History*, Vol. 53, No. 3 (July 1989), p. 240.

Besides the practical difficulties attending such work, detailed analysis of this sort will not be undertaken here, mainly for methodological reasons: since the objective is not to assess power as an “outcome” but only as a “resource,” measuring military capability here will focus mainly on understanding which ingredients are necessary for the creation of an effective force and how the effectiveness of this force can be conceptualized in an intellectual sense. The measures of military capability suggested here, therefore, remain “input measures”² in the specific sense used by Stephen Biddle: they focus on understanding what “goes into” the making of an effective national military capability and how such effectiveness can be compared across countries in a comparative-static sense without either doing any military balance analysis or pretending that it can explain how any given force-on-force encounters will actually turn out in practice. In that sense, the framework in this chapter is intended to be a *prelude* to dynamic combat analysis, but emphatically not a substitute for it.

The notion of military capability as the output level of national power is premised on the understanding that a country’s military organizations receive national resources and transform them into specific warfighting capabilities. The warfighting capabilities thus generated are effective to the degree that they enable a country’s leaders to impose their will on enemies, existing and potential. Thus, the larger logical framework developed for examining national power can be applied writ small to examining how national military establishments generate effective military forces. Put simply, the question is, “What resources does the military get, and how successfully can they be transformed into effective military power?” Military effectiveness thus becomes the outcome of the resources provided to the military and its capability to transform these resources into effective warfighting capability. A country may provide its military with generous budgets and large cadres of manpower, but if the military’s doctrine is misguided, the training ineffective, the leadership unschooled, or the organization inappropriate, military capability will suffer.

²Stephen D. Biddle, “The European Conventional Balance: A Reinterpretation of the Debate,” *Survival*, Vol. 30, No. 2 (March–April 1988), pp. 99–121.

The problems of measuring military capability are, in many respects, quite similar to the difficulties faced in measuring national power. Certainly one or two individual measures—the number of personnel under arms, for example, or the number of tanks or missile launchers in a nation’s inventory—are unlikely to capture the key factors for assessing military power, just as a single measure does not provide a useful assessment of a country’s overall power. A single measure may be useful for ranking states by particular dimensions of military capability, but it will not capture more than a small part of the variance in the effectiveness of military forces. It is obvious, for example, that the largest armies may not necessarily be the most effective. In the 1960s and 1970s, Israel’s small forces defeated larger opponents. The People’s Liberation Army is numerically the largest military in the world, but today China cannot project significant power beyond its borders. The capability of a military force, therefore, depends on more than just the resources made available to the coercive arms of the state. Consider, for example, the contrast in the military capabilities of Israel and New Zealand. Both have modern economies, well-educated populations, access to world markets and modern technologies, and freely elected governments. Yet their armed forces are quite different. Though their resources are significantly different (Israel’s GDP is twice that of New Zealand), Israel is directly threatened by nearby neighbors and defends itself without formal allies. New Zealand is an island nation, faces no apparent external threats, and is allied with Australia and the United States. So military threats, geography, and alliances also help shape a country’s force architecture and, ultimately, its effective military capabilities.

The framework for examining military capability as the output dimension of national power is patterned analogously to the larger framework for assessing national power. It seeks to identify the strategic resources a military receives from the government it serves; the variables bearing upon the means by which these resources are converted into effective capabilities; and, finally, the capabilities of the combat force itself understood via a spectrum of warfighting competencies that may be attained to a greater or lesser degree and which may be compared across countries.

STRATEGIC RESOURCES

Any consideration of a country's military capabilities or its military effectiveness must begin with an examination of the resources—financial, human, physical, and technological—that the national leadership makes available to its military organizations. These resources are clearly a function of the larger national-level assets possessed by a country (examined earlier under the rubric of “national resources”) as well as the imperatives emerging from national performance, that is, the pressures levied by external threats, the power of the state vis-à-vis its society, and the ideational acuity with which both state managers and society as a whole can perceive problems and develop satisfactory solutions. These two dimensions, operating interactively, then define the kind of resources transferred to the military; any analysis that seeks to measure national power in military terms, especially in the context of a country's ability to undertake the “information-dominant” operations that are seen to revolutionize warfare, must gather and assess information pertaining to the following variables.

Defense Budgets

The size of the defense budget is, in principle, the most general single measure of the resources provided to a military by its political masters. The size of the defense budget serves to identify the relative importance of the coercive arm in comparison to other organs of state, and it conveys a general sense of the size of the military establishment in absolute terms. Toward that end, data revealing the size of the defense budget as a percentage of both overall public spending and of GDP/GNP are essential. In addition, however, these macro-indices should be refined by an analysis of the internal heads of account. Specifically, understanding the distribution of resources among the various services provides a preliminary view of a country's understanding of the salience of relative threats, its desired structure of combat proficiency, as well as the relative power of various military bureaucracies. Similarly, understanding the patterns of disbursement in functional terms, that is, with respect to pay and allowances, operations and maintenance, force procurement, and research and development, also provides critical information about a country's military power. When such data are aggregated in the form

RAND MR110A-17

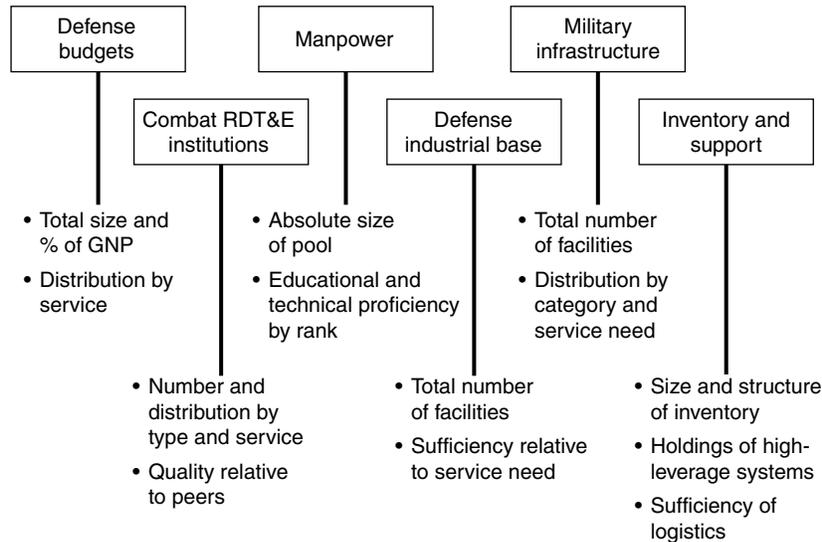


Figure 17—Strategic Resources and Illustrative Indicators

of a time series, they identify important trends as far as changes in national military effectiveness are concerned. The defense budget of a country can be analyzed in multiple ways, but an analysis that focuses on understanding the character of national military capabilities must assess budgetary allocations and movements in terms of the disbursement of resources among combat forces, support and maintenance, operational and physical infrastructure, and defense management and command accounts.³ In many countries, however, budgetary data at such a high level of disaggregation and specificity may be unavailable. So analysis and estimation is required. Analysis of military budgets in this instance may require examining the observable physical resources possessed by a given military and then working “backward” to compute their costs to the national

³For a revealing analysis of the value of such a breakup, see Kevin Lewis, “The Discipline Gap and Other Reasons for Humility and Realism in Defense Planning,” in Paul K. Davis (ed.), *New Challenges for Defense Planning* (Santa Monica, CA: RAND, 1994), pp. 101–132.

exchequer. While such assessments are always less than precise, they are nonetheless valuable as broad yardsticks for assessing a state's commitment to its coercive arms and as such remain a crucial first step for measuring the outputs of national power.

Manpower

The size and quality of military manpower is the second kind of resource that yields insight into a country's national power. Very obviously, the size of a military force is important, first, as a crude index of military strength, and second, because quantity has a quality all its own in many, still relevant, combat environments. As a first cut, therefore, measures of military strength, which focus on examining the size of the total force, the breakup between active and reserve components, and the distribution of numbers across the services, would yield useful information that depicts, if nothing else, at least the relative mass of raw power that a country could bring to bear in some warfighting situations. In an era increasingly defined by information-intensive means of war, however, the most useful information about military manpower consists of data relating to qualitative variables: in particular, the educational levels of both the officer corps and the enlisted ranks and the levels of technical proficiency demanded of the recruiting base would provide critical information about the ability of a given military force to integrate and exploit the kind of sophisticated military technologies now being diffused throughout the international system. In this connection, data about force management issues within the military would also be very illuminating: whether a regimental tradition or its equivalent exists; whether national societal divisions are reflected or attenuated in the military sphere; whether issues of integration by gender, class, race, or ethnicity are salient in the force. All such information—quantitative whenever possible, qualitative whenever necessary—contributes toward evaluating the character of the military manpower pool and its potential effectiveness in conflict.

Military Infrastructure

The extent and quality of military infrastructure is the third kind of resource that has an impact on the quality of military capability. This category subsumes the physical infrastructure possessed by a mili-

tary force, normally labeled “bases and installations.” In addition to the facilities normally used to house military personnel and their equipment, this category should assess the number and quality of test and training ranges, medical facilities, military construction projects, and the like. Since military infrastructure must ultimately be assessed by its ability to support the warfighter, quality assessments ultimately become part and parcel of the analysis: thus, for example, when examining air warfare capabilities, analysis pertaining to the number of bases relative to the size of the air force will also incorporate more detailed examination about the kind of protection offered to aircraft, the mix between active and passive protection, the degree of hardness embodied by the shelters, and the survivability of crucial assets like command, control, and communications (C³), petroleum, oil, and lubricants (POL), and munitions. While all these resources can be conceived of as constituting part of the military capital stocks of a given country (and, by implication, a contributor to military effectiveness), their value from the perspective of measuring national power derives from additional considerations that involve not simply data collection but also analytical judgment. Two questions become particularly pertinent in this regard: Does the country in question have the necessary number and range of facilities and installations to adequately train its military personnel in the combat and combat support tasks facing the force? Is the quality of these facilities comparable to those in the country’s peer competitors and/or the United States?

Combat RDT&E Institutions

The number and quality of combat research institutions is the fourth kind of resource that affects military capability. The rapid transformations in both technology and the military arts have resulted in a need for increasingly specialized institutions that focus on research, development, test, and evaluation (RDT&E) activities relating to combat. These institutions could be: academic institutions, which specialize in training soldiers in the history of war or the higher requirements of command; specialized establishments, which focus on honing certain specific warfighting skills; technical centers, which either develop, test, and evaluate new equipment for various combat elements or advance new concepts of operations for military technologies developed by other institutions; or research organizations,

which focus on studying foreign military forces and their organization, equipment, patterns of training, and doctrine. The presence of a large number of such institutions provides an important clue to the professionalism of a country's military force and the relative emphasis laid on solving certain strategic or operational challenges and learning from others. As with the issue of military infrastructure considered earlier, the value of the combat RDT&E institutions from the perspective of measuring national power derives from the intelligence community's ability to discern, first, whether the target country has the necessary number and range of institutions to adequately support its military forces in their operational tasks, and second, whether the quality of these institutions is comparable to those in the country's peer competitors and/or the United States.

Defense Industrial Base

The structure, extent, and quality of a country's defense industrial base constitutes the fifth kind of resource affecting military effectiveness. The defense industrial base essentially consists of firms or industries that depend on a country's defense spending for survival and upon which the country itself depends for the production of military technologies and instruments. Understanding the structure and quality of the defense industrial base allows the intelligence community to assess the quality of the military instruments domestically available to a country's military forces while simultaneously discerning its degree of dependence on others. The latter issue is particularly relevant from the viewpoint of understanding a country's potential vulnerabilities in the context of conflict. One generic approach to assessing the defense industrial base would be to classify by quality and the degree of self-sufficiency a country's ability to produce: large and small weapons; nonlethal but strategic products; and supporting consumables. Another, more sophisticated, approach that has been suggested⁴ consists of developing a spectrum of

⁴See W. Walker et al., "From Components to Integrated Systems: Technological Diversity and Interactions Between Military and Civilian Sectors," in P. Gummert and J. Reppy (eds.), *The Relation Between Military and Civilian Technologies* (Dordrecht: Kluwer Academic Publishers, 1988), pp. 17–37, and S. Schofield, "Defense Technology, Industrial Structure and Arms Conversion," in R. Coopey et al. (eds.), *Defense Science and Technology: Adjusting to Change* (Reading: Harwood, 1993).

capabilities in which a country's manufacturing proficiency could be rated along a hierarchy of products ranging from complete systems at one end to low-level components at the other. At the higher end, the products concerned would be more clearly military, with decreasing differentiation between military and civilian products at the lower end. This approach can be schematically depicted in the following way:

Integrated weapon-information systems (ADGES)	Major weapons platforms (battleships)	Complete weapon-component parts (torpedoes)	Subsystems (gyroscopes)	Sub-assemblies (gun sights)	Components (integrated circuits)	Materials (semi-conductors)
---	---------------------------------------	---	-------------------------	-----------------------------	----------------------------------	-----------------------------

While this schema represents simply one classification among many others, it illustrates the general point: creating an empirical map of a country's defense industrial base along this (or some other) line provides a means of assessing both the relative sophistication of its military supplies and the robustness of access enjoyed by its military forces to a range of defense products.

Warfighting Inventory and Support

The character of a country's military inventory and its combat support capabilities is the last, but obviously not the least, important category of military capability and effectiveness. In fact, collecting detailed information about the military inventories of other countries remains one of the staple pursuits of the intelligence community, and for good reason: when combined with the manpower component referred to earlier, a country's military inventory and its combat support assets constitute the usable "front-end" dimensions of force, force that can be used to defend one's own national interest as well as prevent others from reaching their own goals. The importance of such information has by no means diminished today. The intelligence community will continue to collect information pertaining to the number and kinds of tanks, guns, ships, airplanes, and other such instruments possessed by various countries. This information is generally easier to collect, since it consists of tangible components that can be seen and counted. But its utility ultimately derives from the fact that it pertains to the capacity for harm that one

country can inflict on another. It also serves as a good substitute for estimating the extent of a state's commitment to its military when good information about defense budgets is unavailable. The investments made in such "bulk" military capabilities may in fact only grow with time, since it is quite possible that several countries not as sophisticated as the United States might respond to the incipient "revolution in military affairs" by simply increasing their numbers of combat systems—a solution that may be very consequential if the increases consist of modern, even if not revolutionary, warfighting components.

When the raw equipment possessed by countries is matched against the changing nature of warfare, the need for good data about some categories of inventory holdings and combat support—those relating to the ability to wage information-dominant war—has become more important than ever before. This does not imply that "bulk" military power appearing in the traditional forms of "dumb bombs and bullets" can be neglected, only that these forms have ceased to be instruments of high leverage. Thus, military holdings in various forms must continuously be monitored, but collection and assessment of such capabilities should be secondary to evaluating the presence and significance of more critical categories of equipment. These include the following:

- RSTA capabilities, which refer to reconnaissance, surveillance, and target acquisition technologies required for a "God's-eye view" at all levels—tactical, operational, and strategic—of the battlefield.
- Integrated battle management systems, which involve technologies that "net" together "sensors-to-shooters" in a seamless way.
- Precision strike weaponry, which refers to the congeries of guided and smart munitions that bequeath order-of-magnitude increases in accuracy, lethality, and effectiveness, again at all levels, tactical, operational, and strategic.
- Weapons of mass destruction, which refer to nuclear, biological, and chemical weapons that, together with their associated delivery and command-and-control systems, can cause high destruction and mass casualties among both military forces and civilian populations in relatively compressed timeframes.

- Agile, integrated, and protected logistics systems, which allow combat forces to sustain their military operations at high levels of intensity without either running out of crucial war materials or sustaining losses of such materials at possibly crucial moments of battle.

Each of these categories subsumes a large and diverse set of discrete technologies and organizational systems. Each, however, is critical for success on the modern battlefield, and the possession of such capabilities will enhance a military force's ability to prosecute a wide spectrum of operations. Consequently, collecting information about a country's holdings and capabilities in these areas will provide critical insight about its military's preparedness and ability to wage modern war.

CONVERSION CAPABILITY

While the availability of strategic resources is a critical ingredient of military capability, it is but part of the story. An effective military is one that can take these resources and "convert" them to create a modern force capable of conducting effective operations against a wide range of adversaries. This conversion process is critical because it determines whether the resources garnered from the country as a whole will finally produce a military force with operational competencies that make a strategic difference on the battlefield. Successfully converting available resources into effective military capability is therefore one real test of the quality of military leadership (success in battle is the obvious other key test), but as the discussion below will indicate, success in this arena may be dependent on structures and entities that go beyond the military itself.

Of the many factors that affect a military's ability to convert resources into operational capability, the following are the most important: (1) the threats facing a country, which change in a reactive fashion, and the strategy developed to cope with those threats; (2) the structure of civil-military relations, including the military's access to national leadership, which enables it to understand changing national goals, make its case for additional resources, and obtain the freedom to operate as required; (3) the density of foreign military-to-military relations, which determines access to other military forces

and possible opportunities for learning, emulation, and analysis; (4) the nature of doctrine, training, and organization within a force, which functions as the glue that allows raw military resources to bind themselves into operationally effective social forms and combat practices; and (5) the potential and capacity for innovation, which determines whether a military force can cope with changing strategic and operational problems while continuously improvising solutions that keep it a step ahead of potential competitors. All these variables condition the ability of a military leadership to link the achievement of military effectiveness against its enemies with the resources it has available. Consequently, understanding how these qualitative factors affect military capability are important to the analysis of national power.

Threats and Strategy

As Williamson Murray and Mark Grimsley have noted, “the concept of ‘strategy’ is notoriously difficult to define.”⁵ At its broadest level, military strategy is the process by which a force matches its means (the resources provided to it) to its external problems. This process, being conditioned by developments occurring outside the military, in the final analysis involves “the rational and reciprocal adjustment of ends and means by rulers and states in conflict with their adversaries.”⁶ Strategy is what gives concreteness to the term “military power” insofar as it asks, and links, two crucial questions: What are the state’s security objectives? What are the military capabilities needed to attain those objectives? Several specific external factors determine strategy. Fear, or its absence, importantly shapes strategy. States that believe they are insecure have a powerful incentive to develop an effective military strategy to protect themselves from those they perceive as threatening. The nature of a state’s aims also affects its military strategy. A state with revisionist objectives must develop a strategy that is offensively oriented and maximizes its chances of prevailing over the adversary most likely to attempt frus-

⁵Williamson Murray and Mark Grimsley, “Introduction: On Strategy,” in Williamson Murray, MacGregor Knox, and Alvin Bernstein (eds.), *The Making of Strategy: Rulers, States, and War* (Cambridge: Cambridge University Press, 1994), p. 1.

⁶MacGregor Knox, “Conclusion: Continuity and Revolution in the Making of Strategy,” in Murray, Knox, and Bernstein, *op. cit.*, p. 614.

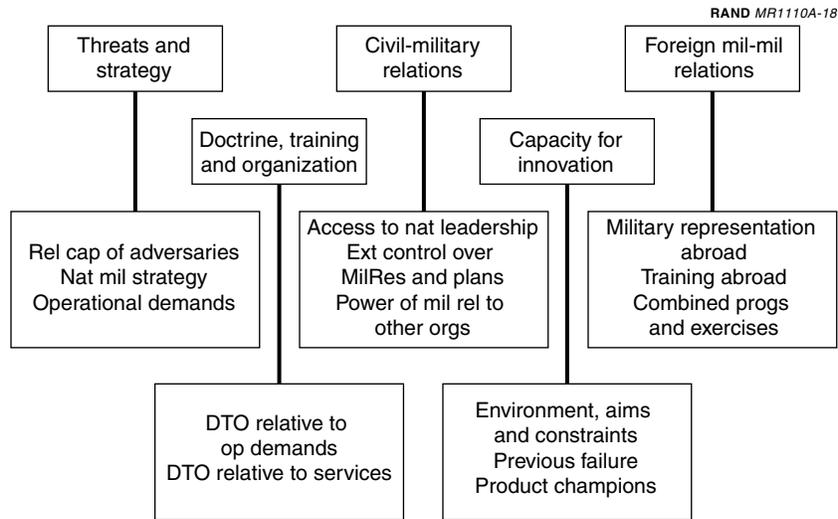


Figure 18—Components of Conversion Capability and Illustrative Indicators

trating the attainment of its aims. A state with extensive overseas interests must develop a deterrence-oriented strategy (to prevent challenges to those interests) and a power-projection strategy (to defend its overseas interests if deterrence fails).⁷ Geography, of course, is also a very important factor affecting a state’s military strategy.

Unlike orders of battle or weapons inventories, military strategy is impossible to quantify. But because a country’s strategy is related so crucially to its military capability and effectiveness, understanding the nature of its strategy is vital because it identifies the kinds of military competencies that would have to be acquired and the ways in which military forces would generally be used. The generic signposts relating to these issues would be: the country’s prior military strat-

⁷Barry Posen has pointed out that insular powers with important overseas interests invariably rely heavily on extended deterrence strategies. Barry Posen, *The Sources of Military Power: Britain, France, and Germany Between the World Wars* (Ithaca: Cornell University Press, 1984).

egy; existing doctrinal writings; extant equipment inventories; pattern of force deployments; and past training exercises.⁸ When such information is integrated with geopolitical analysis assessing the country's

- geographic position, including critical geophysical features defining possible opportunities and vulnerabilities;
- most likely adversaries and allies in the event of conflict;
- historical roots, and continuity, of external policy and goals; and
- declaratory policy with respect to its strategic aims,

it is possible to discern whether a country's present military capability is adequate to the strategic tasks facing it and, if not, whether it is likely to respond by changing its present military size, structure, inventory, or warfighting strategy. To the degree that alterations in any of these arenas are seen to provide useful solutions to the outstanding political problems facing a country, it is likely that—*other things being equal*—its military leadership would gravitate toward, or argue for incorporating, such solutions. The threats facing a country and the strategy developed to cope with those threats thus become the first important conversion factor that allows resources to be transformed into effective warfighting competencies.

Structure of Civil-Military Relations

The structure of civil-military relations is another crucial variable that affects the conversion process, because the relationship between the holders of political and military power affects both the creation and the effective use of military forces. The problematic nature of civil-military relations is rooted in the fact that war often makes contradictory demands on the holders of political and military power. From the perspective of the latter, the extremity inherent in the application of military power is what makes it effective, and since success in the military realm often arises from the application of

⁸These generic signposts are adapted from Jeffrey A. Isaacson, Christopher Layne, and John Arquilla, *Predicting Military Innovation* (Santa Monica, CA: RAND, DB-242-A, 1999), p. 56.

decisive and overwhelming violence, military leaders generally feel compelled to design, procure, and employ force in a way that maximizes the prospects of victory on the battlefield. From the perspective of the former, however, military power is a lethal but volatile instrument whose successful use often depends on its susceptibility to control. Such control may have to be exercised at all levels: at the level of designing forces, to avoid giving needless offense to one's competitors; at the level of procurement, to avoid undercutting other critical social goals; and at the level of employment, to avoid strategies and tactics which however militarily effective may be counterproductive to the larger interests of the state. Because of this inherent tension between political objectives and the military means necessary to secure them, the nature of civil-military relations within a country becomes critical.

There are several models of civil-military relations. The most familiar are:

- The liberal model, characterized by integrated boundaries between the civil and the military, strong civilian control, and a military force oriented to coping with external threats;
- The authoritarian model, characterized by permeated boundaries between the civil and the military, strong civilian control, and a military oriented to coping with both external and internal threats; and
- The praetorian model, characterized by fragmented boundaries between the civil and the military, continual civil-military competition accompanied by occasional but tenuous civilian control, and a military oriented to coping with external threats and internal challenges to both the state and its own existence simultaneously.

Unfortunately, there is relatively little work to suggest which of these models might be better from the perspective of a country's ability to increase its military capability or effectiveness.⁹ The utility of these models in the context of measuring national power, therefore,

⁹The best work to date on this question is Michael C. Desch, *Civilian Control of the Military: The Changing Security Environment* (Baltimore: The Johns Hopkins Press, 1999).

derives primarily from their being ideal flowcharts that help to identify various patterns of power and authority relations: irrespective of which model applies to a given country, intelligence analysts will still have to identify the personalities involved, the relative power of these individuals, and the general patterns of interaction between them, with an eye to uncovering answers to those critical issues identified earlier: What is the nature and level of access enjoyed by the military to the national leadership (if the two are in fact different)? What is the bureaucratic power of the military with respect to securing funding, controlling procurement, and directing its internal organization? What is the institutional structure that regulates the development of military strategy and tests its coherence with other national goals?

Foreign Military-to-Military Relations

In an era where knowledge is diffusing at a relatively rapid rate, the nature and extent of the relationships enjoyed by a country's military forces with their counterparts abroad can become an important ingredient that enables more effective conversion of national resources into usable military power. Military-to-military relations come in various forms. At the simplest level, the presence of defense attachés in embassies abroad functions as one conduit for monitoring new developments in technology, force structure, and organization. Participating in military education programs abroad and observing various foreign military exercises represents an interaction at a deeper, more significant level, especially if such participation is fairly continuous, is diverse with respect to the kind of instruction offered, and involves individuals who eventually return to postings in force training and combat development establishments back home. At the most sophisticated level, military-to-military relations take the form of combined exercises, combined training programs, and combined deployments for military missions. While there is no doubt a significant gradation even within this sophisticated level of interaction, military-to-military relations here offer the weaker participants an opportunity to deepen their problem-solving skills and to learn new techniques and concepts of operation. Ultimately, they are challenged to develop solutions relevant to their own situations, solutions which may incorporate alternatives devised by others.

Assessing the nature and extent of a military force's participation in such activities, then, becomes a useful indicator of a country's desire to increase its conversion efficiency. To the degree that a military force is given the opportunity and eagerly participates in such relationships, it can more effectively assess where it stands relative to other militaries while learning about new technologies, concepts of operations, and modes of employment. While learning is the most obvious effect of such encounters, it may not be the only one. In fact, a competent but relatively poorly endowed force may utilize its military-to-military experience to develop dissimilar solutions (or "asymmetric" responses) to common problems. The best test, therefore, of whether military-to-military relationships are having any effect on the conversion capability of a country's military would be to look for new developments in its force structure, doctrine, training, organization, or equipment that could be derived from its intercourse with other foreign military organizations.

Doctrine, Training, and Organization

Possessing resources in the form of raw equipment inventory and manpower is inadequate if these two assets are not appropriately structured and trained to solve certain operational tasks in a coherent way. Having sophisticated military technologies and a large mass of soldiers is one thing. Being able to use them effectively is something else. Today, more than ever before, the ability to *integrate* technology and manpower through doctrine, training, and organization becomes the crucial determinant of a military's ability to use its power effectively and thereby increase its battlefield capabilities.¹⁰

Doctrine is the first vital integrative threshold. Doctrine refers to the body of principles that specify how a military uses its assets on the battlefield. In effect, it details how the military plans to fight and as such provides the framework within which both technology and manpower interact to secure certain operational outcomes. Ineffective doctrine can negate all the advantages offered by superior

¹⁰See James F. Dunnigan, *Digital Soldiers: The Evolution of High-Tech Weaponry and Tomorrow's Brave New Battlefield* (New York: St. Martin's Press, 1996); Stephen Biddle, "Victory Misunderstood: What the Gulf War Tells Us About the Future of Conflict," *International Security*, Vol. 21, No. 2 (Fall 1996), pp. 139–179.

equipment and fighting men: as the history of armored warfare suggests, the doctrinal innovation of massing even modestly capable armored elements and using them as part of combined-arms teams made an operational difference that could not be emulated or countered even by technically superior armored forces when employed in “penny packets” and bereft of combined-arms support.¹¹

Training represents a second key integrative threshold. Military forces that are inadequately trained will fail to make effective use of the equipment at their disposal, no matter how sophisticated it is: the Iraqi army in the Gulf War is a classic example of how a relatively modern military force can crumble under pressure if it cannot exploit the technology at its command because poor doctrine and even poorer preparation prevent effective use of its assets. In fact, the best evidence for the value of training derives from the experience of visiting units at U.S. training ranges like Fort Irwin and NAS Fallon, where the resident “OPFOR” and “Aggressor” units routinely humiliate often technically superior visiting formations during training exercises simply by virtue of their exceptional training, cohesion, doctrine, and preparation for “combat.”

Organization is a third crucial integrative threshold because suboptimal command and coordinating structures can inhibit military effectiveness. For example, militaries with very rigid command structures, highly compartmented internal organizations, and/or officers chosen for political loyalty rather than operational competence are unlikely to display the initiative and flexibility needed to employ their weaponry with maximum effectiveness. The issue is not simply one of centralization versus decentralization: as several analyses have shown, information technology today can support either organizational form with equal felicity and probably with comparable effectiveness.¹² The crucial issue therefore may be one of “appropriateness”: is the organizational structure of a force optimal for the missions it is tasked with executing? Other desiderata may include “adaptability,” meaning the ability to shift from one

¹¹The effects of superior doctrine in explaining the effectiveness of German armor have been detailed in James S. Corum, *The Roots of Blitzkrieg* (Lawrence: University Press of Kansas, 1992).

¹²See, for example, Robert R. Leonard, *The Art of Maneuver* (Novato: Presidio Press, 1991).

pattern of structuring to another as the situation demands, and “internal connectivity,” meaning the degree of structural rigidities within a military force that keep the organization’s information and resources from being appropriately disseminated.¹³ Many nominally large military powers like China and India are much weaker than they appear at first sight simply because the organizational structures of their forces actually reduce the combat power they can bring to the battlefield. Even the United States is not immune to this problem, and many observers have argued, quite persuasively, that whatever its technological superiority, the U.S. military is unlikely to change its organizational structure sufficiently to truly revolutionize its combat power.¹⁴

In the final analysis, integration is more determinative of a military’s capabilities than its inventory of equipment or its mass of manpower. Any military force can leap over the technological complexity thresholds that separate the various domains of warfare simply by acquiring the technologies in question. But surpassing the integrative thresholds to utilize these technologies effectively is much more difficult. For the intelligence community, evaluating the doctrine, training, and organization of a foreign military force therefore becomes all the more important if it is to reach credible assessments of a given military’s conversion capabilities. Here too, a nested analysis becomes necessary. First, what is the country’s military strategy? Second, what operational tasks are predicated by that strategy? Third, does the country possess the equipment and manpower to undertake those operational tasks? Fourth, is the doctrine, technol-

¹³In this connection, Glenn Buchan notes, for example, that “the U.S. track record in using satellites effectively to support military operations” is far from reassuring, “considering how long we have been in the satellite business.” During the Gulf War, apparently “in some cases it worked very well, usually between organizations that dealt informally on the basis of handshakes and mutual support. In other cases, however, the ‘ships passed in the night’ and users who might have benefited from the information that space systems could have provided couldn’t ‘plug in’ effectively. These problems have long been recognized, which makes the fact that they have not been solved adequately all the more frustrating.” See Glenn C. Buchan, *One-And-A-Half Cheers for the Revolution in Military Affairs*, P-8015 (Santa Monica, CA: RAND, 1998), p. 19.

¹⁴See Richard Szafranski, “Peer Competitors, the RMA, and New Concepts: Some Questions,” *Naval War College Review*, Vol. 49, No. 2 (1996), pp. 113–119.

ogy, and organization in each warfighting domain appropriate and adequate for the tasks sought to be attained?

Capacity for Innovation

The final dimension of conversion capability is a military force's potential and capacity for innovation. This variable generally determines whether a force can cope with the ever-changing strategic and operational problems facing it, while simultaneously being able to develop solutions to stay one step ahead of its potential adversaries. Innovation is a multidimensional phenomenon. At one level, it may refer to the ability to develop new warfighting concepts. At another level, it may refer to the ability to develop new integrative capacities: reorganized command structures, better doctrine and tactics, improved logistics, new training techniques, and the like. At a more trivial level, it may also refer to the ability to develop new technology or devise new technical solutions for an operational problem at hand. Irrespective of what kind of innovation is being discussed, the capacity of a given military force to be innovative is crucial to its ability to extract maximum mileage from its equipment and manpower. The analytical challenge from the perspective of measuring national power, then, consists of identifying those factors which might facilitate a high capacity for innovation within a given military force and, subsequently, translating these factors into indicators that could be tracked by the intelligence community.

From the extensive literature on military innovation, it is possible to identify three dominant perspectives that explain the possibility of military innovation: neorealist, societal, and organizational theory. Each offers distinctive, often competitive, views on what produces a capacity for military innovation.¹⁵

¹⁵There is also a fourth perspective on military innovation which could be called cultural theory, and it appears in the guise of theories of strategic and organizational culture. The cultural perspective is not discussed here, for several reasons. First, the concept of culture is amorphous and its use as an analytical category is controversial. Second, when the cultural perspective is used, each case becomes *sui generis*; the use of culture-based perspectives makes generalizations impossible. Third, the track record of culture-based analyses is generally weak from the perspective of producing systematic generalizations; other perspectives have far more explanatory power. With respect to the issue of military innovation, the strategic culture argument suffers from a very specific weakness: this perspective may tell the analyst something about a

The neorealist perspective on innovation is simple and straightforward: military forces having a high capacity to innovate are those which face a hostile security environment or are committed to supporting expansive foreign and strategic national policies. This perspective, in effect, identifies countries that have strong incentives to encourage their militaries to be innovative. Societal perspectives, in contrast, draw attention to internal factors that are necessary to facilitate innovation and in particular argue that the ability of military organizations to innovate is affected crucially by the relationship between the military and its host society.¹⁶ In this view, the most effective and innovative militaries are those subsisting in a cohesive society. That a military is set in a divisive society does not necessarily mean that it will not or cannot innovate, but rather that this innovative capacity cannot be sustained over the long term. As Rosen argues:

Military organizations that are separated from their host society and which draw on that society for resources are in tension with that society. They extract resources while being different from and under-representative of the larger society. This tension can and has created problems in prolonged war or prolonged peacetime competition. An innovative military that extracts resources but is isolated from society may not be able to sustain that innovation in periods of prolonged conflict.¹⁷

In contrast to the neorealist perspective, which identifies states that have incentives to innovate, and the societal perspective, which identifies states that have the kind of society-military relationships that can facilitate innovation, the organizational perspective identi-

state's grand strategic preferences, but it says nothing about the probability of whether the state will innovate militarily.

¹⁶See Stephen Peter Rosen, *Societies and Military Power: India and its Armies* (Ithaca: Cornell University Press, 1996), and Stephen Peter Rosen, "Military Effectiveness: Why Society Matters," *International Security*, Vol. 19, No. 4 (Spring 1995), pp. 5–31. A very useful discussion of the utility of societal perspectives—which often implicitly draw on notions of culture—can be found in Michael C. Desch, "Culture Clash: Assessing the Importance of Ideas in Security Studies," *International Security*, Vol. 23, No. 1 (Summer 1998), pp. 141–170.

¹⁷Stephen Peter Rosen, "Societies, Military Organizations, and the Revolution in Military Affairs: A Framework for Intelligence Collection and Analysis," unpublished manuscript, June 1996, p. 1.

fies states with particular organizational characteristics that can facilitate innovation. Although there are many approaches here, like the rational systems approach, the open systems approach, and the natural systems approach,¹⁸ the last approach in organizational theory is the most appropriate framework for analyzing the capability of militaries to innovate, because organizations in real life act as less-than-rational systems thanks to cognitive constraints. The natural systems model is the dominant organizational theory paradigm. However, as applied to military innovation, this paradigm can be subdivided further into two different approaches: the “institutionalist” and “professionalist” schools.¹⁹ Each of these has different implications with respect to military innovation.

The institutionalist approach holds that like all organizations, militaries are driven primarily by considerations of institutional well-being. As such, it is pessimistic about the likelihood that military organizations will innovate successfully.²⁰ This is because organizations are viewed as innately conservative. They are more concerned with the internal distribution of status and power than with organizational goals. In this milieu, new ideas are perceived as threatening.²¹ Organizations are driven by the need to maintain organizational well-being (defined in terms of budget, manpower, and territory/domain) and to reduce uncertainty. Consequently, in organizations the focus is on short-term problem solving rather than long-term planning; standard operating procedures are used to maximize control over, and minimize uncertainty from, the external

¹⁸See, by way of example, W. R. Scott, *Organizations: Rational, Natural, and Open Systems* (New York: Prentice Hall, 3d ed., 1992); Graham Allison, *The Essence of Decision: Explaining the Cuban Missile Crisis* (Boston: Little, Brown, 1971); T. Farrell, “Figuring Out Fighting Organizations: The New Organizational Analysis in Strategic Studies,” *The Journal of Strategic Studies* (March 1996); and James G. March and Herbert A. Simon, *Organizations* (New York: John Wiley & Sons, 1958).

¹⁹This typology is based on Emily O. Goldman, “Institutional Learning Under Uncertainty: Finds from the Experience of the U.S. Military,” unpublished manuscript, Department of Political Science, University of California, Davis, 1996.

²⁰Examples of this approach are Posen, *Sources of Military Doctrine*, and Jack Snyder, *The Ideology of the Offensive: Military Decisionmaking and the Disasters of 1914* (Ithaca: Cornell University Press, 1984).

²¹V. A. Thompson, *Bureaucracy and Innovation* (University, Alabama: University of Alabama Press, 1969), p. 22.

environment; and research is oriented to problem solving, undertaken to solve an immediate issue, not to innovate.²² These impediments to innovation are likely to be overcome only when specific conditions are fulfilled. First, organizations that have recently experienced major failure are likely to be stimulated into innovation. Second, organizations with “slack” (that is, substantial uncommitted resources) are more likely to engage in innovation. Third, innovation will occur when the civilian leadership intervenes to force military organizations to innovate. This intervention is held to be necessary to overcome the status quo bias that is imputed to military organizations.

The professionalist approach, however, views militaries as organizations driven by the goal of maximizing their state’s security.²³ The professionalist school is relatively optimistic about the likelihood that military organizations will innovate successfully, since it posits that under favorable conditions, organizations are capable of learning. In contrast to the institutionalist approach, the professionalist model assumes that military organizations undertake innovation on their own; that is, outside stimulus in the form of civilian intervention is not required to spur innovation. Military organizations will take the initiative to innovate because they are professional organizations driven by the goal of providing security for the state. The requisites for successful innovation are existence of senior officers with a new vision of future warfare (“product champions”); reform-minded junior officers; and the creation of new career paths within the organizations that allow the reform-minded younger officers to be promoted. Innovation is stimulated by competition and debate either within a branch of the military or between branches of the military.

From the perspective of assessing the prospects for innovation within a military force, these theoretical perspectives suggest that the

²²Matthew Evangelista, *Innovation and the Arms Race: How the United States and the Soviet Union Develop New Military Technologies* (Ithaca: Cornell University Press, 1988), pp. 11–12; Posen, *Sources of Military Doctrine*, p. 54.

²³See Stephen Peter Rosen, *Winning the Next War* (Ithaca: Cornell University Press, 1991).

intelligence community ought to be directing its gaze along the following lines.²⁴

- Deriving from neorealist perspectives, the relevant questions are:
 - Does the country in question face a high threat environment?
 - Does the country in question seek to pursue revisionist aims?
 - Does the country in question face high resource constraints?
- Deriving from the societal perspective, the relevant question is:
 - Does the country in question exhibit high societal cohesion, and how is this cohesion (or lack thereof) reflected in the military?
- Deriving from the organizational perspective, the relevant questions are:
 - Has the country/military force in question experienced conspicuous failures in the past?
 - Are there identifiable “product champions” within the military?
 - Are there plausible paths for career enhancement as a result of resolving existing technological, organizational, or doctrinal problems facing the military?

Asked systematically, these questions provide a basis for anticipating military innovation. They cannot provide specific predictions about the particulars of any given innovation because the level of information about the problem to be resolved may never be available. However, these approaches provide a means of ordering the complexity of the problem in certain determinate and, hopefully, manageable ways.

The preceding discussion should suggest why conversion capability remains a critical dimension of a military’s ability to transform its resources into warfighting competencies that are effective on the

²⁴For a different approach to this question, see Thomas G. Mahnken, “Uncovering Foreign Military Innovation,” *Journal of Strategic Studies*, Vol. 22, No. 4 (December 1999).

battlefield. But because these variables are for the most part qualitative, they are also difficult to track from the perspective of the intelligence community. They are nonetheless identified because their presence or absence makes a difference in the ability of a military force to attain the kinds of warfighting competencies identified in the next section. Reviewing a country's threats and the strategy developed to cope with those threats, the nature of its civil-military interaction, the level of emulation and/or counterresponses derived from its experiences with foreign militaries, and its own internal attempts at improving its doctrine, training, and organization as well as its capacity to innovate pays rich dividends, at any rate, because the ability to pose effective threats may often derive from the possession of high technology but certainly does *not* require the acquisition of such resources. Many countries, in fact, simply cannot afford to invest in either acquiring or mastering the use of leading-edge systems. Yet these countries can, in principle, be very consequential military threats. By coupling low technology with creative operational or tactical concepts, these countries can attain a high degree of military capability and may even be able to prevail against opponents employing superior military technology. This is a point that must not be lost sight of when "resource"-based conceptions of national power, like this one, are used for purposes of analysis.

At a time when U.S. military planners are increasingly concerned about "asymmetric strategies" or "asymmetric threats," this cautionary reminder becomes relevant *a fortiori*. As Bruce W. Bennett et al. have noted, "*asymmetric strategies are not so much about weapons as about the concepts of how war will be fought.*"²⁵ The bottom line for intelligence analysts thus is clear: without the context provided by a state's threat environment and its military strategy, conditioned further by how it handles other conversion factors relating to civil-military and foreign military relations, doctrine, training, and organization, and finally capacity for innovation, evaluating the capability or effectiveness of a country's military force is all but impossible.

²⁵Bruce W. Bennett, Christopher P. Twomey, and Gregory F. Treverton, *Future Warfare Scenarios and Asymmetric Threats* (U) (Santa Monica, CA: RAND, MR-1025-OSD, 1999). Emphasis added.

COMBAT PROFICIENCY

When strategic resources are married to conversion capability, the result is a military force capable of undertaking a variety of combat operations against an adversary on the battlefield. The ability to undertake such combat operations remains the ultimate “output” of national power because it represents the means by which a country can secure its political objectives over and against the will of other competing entities if necessary. In a narrower sense, the ability to undertake combat operations also remains the ultimate “output” of the military establishment itself, because the latter too is created, sustained, and enlarged (if necessary) with the intent of being employed for the successful conduct of such operations.

Assessing the combat proficiency of a military force is by no means a simple matter. First, combat can occur in different, often multiple, realms simultaneously. Second, it involves numerous elements for success, elements which have been discretely identified earlier under the rubric of “strategic resources” and “conversion capability.” Third, the balance of contending forces also matters significantly and in complex ways. Fortunately, the task here does not require assessing the combat proficiency of any given force, but rather simply explicating a methodology that identifies how such an assessment can be done in a way that accommodates a wide variety of military operations, ranging from simple to difficult, while simultaneously allowing for some meaningful comparisons among a small, select group of countries.

The methodology, described below, is drawn entirely from the pioneering work of Jeffrey A. Isaacson et al., undertaken at RAND in recent years. Although this research was conducted independently of the effort at measuring national power in the postindustrial age, Isaacson and his associates developed a framework for evaluating warfighting competencies that is simple (in an analytic sense) yet extremely fecund in that it accommodates the complexity of warfighting operations along a spectrum of competencies in three different dimensions of combat: ground, naval, and air operations. This “capability-based methodology” is not intended to predict combat outcomes, just as the framework for assessing national power described in this report is not intended to suggest that the countries judged more “powerful” in terms of its analysis will always

prevail in interstate politics. Rather, it is meant to assess a country’s present and potential ability to engage in an increasingly complex set of military operations, which may then be compared both across time and among a small group of comparably situated competitors. Given the systematic methodological affinity between Isaacson’s approach to assessing warfighting competency and the framework for measuring national power offered in this report, it is easy to discern how the former becomes a fitting component of the latter’s effort to integrate military capability as the most important ultimate manifestation of national power.

Isaacson’s methodology, illustrated in Figure 19, is based upon the simple hypothesis that military capabilities (or warfighting competencies) may be arrayed along a spectrum of increasing complexity, with each realm of military operations—ground, naval, and air—having internal “domains” separated by “thresholds” of technology and integrative capacity.

Although Isaacson’s analysis uses only “technology” and “integrative capacity” as the relevant variables, it is important to recognize that these are essentially *economizing abstractions* which include almost

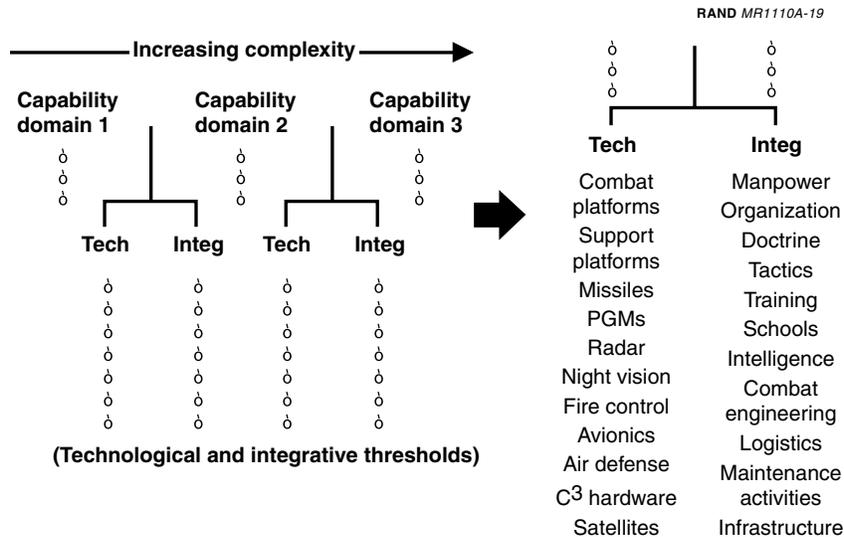


Figure 19—Understanding Military Competency

all the factors considered earlier under the rubric of “strategic resources” and “conversion capability.” The methodology, therefore, suggests that increasing military capability (or extending one’s warfighting competencies) requires a force to acquire not only new hardware, but actually develop the integrative dimensions that enable it to utilize its technology, manpower, and other supporting resources effectively. This simple idea is then applied to ground, naval, and air operations.

As Figure 20 shows, ground force competencies are arrayed along a spectrum ranging from irregular infantry operations at the simplest end to knowledge-based warfare at the complex end. *Irregular operations* consist mainly of ambushes, hit-and-run operations, and sniping activity, that can be prosecuted most efficiently in urban areas with limited equipment, mostly small arms, and small forces usually organized around the company level.

The next level of proficiency involves *coordinated infantry and artillery operations*, which impart the ability to mount static urban defense, including building robust fortifications backed up by artillery. Offensive capabilities at this level of proficiency usually are not manifested above battalion level and involve some vehicular assets, packets of armor, and portable ATGMs usually employed against vulnerable soft targets or fixed installations.

Elementary combined arms represents a qualitative leap from the previous levels of proficiency. With the capability for coordinated armor/mechanized mobile defensive operations at the brigade level, a military force can now carry out basic flanking and envelopment operations against attacking armor with mobile forces using both infantry and armored elements. The ability of these forces to conduct offensive armored/mechanized operations is still circumscribed and limited to heavily rehearsed, brigade-level attacks against exposed, vulnerable salients without subsequent exploitation or pursuit. Such capabilities, however, do allow for a deep attack capability against large, stationary targets like ports and airfields that may even be crudely coordinated with mobile defensive operations, and might include the use of offensive biological or chemical weapons.

Basic combined arms forces represent a greatly expanded version of the maneuver skills manifested at the previous level of competency.

Such forces can execute reasonably sophisticated division-level mobile defensive operations, featuring complete combined-arms operations: their defensive operations would include echeloned concentrations of armor, pinning attacks and feints, fire traps, and rapid shifts of forces from one sector to another, while their deep offensive operations, mostly restricted to the brigade level, could include armored attacks that employ creative turning movements and open the door to exploitation/pursuit operations. They can coordinate deep attacks with operations at the front and use special operations forces to target critical installations like radars, SAM sites, and communications bunkers with cruise and ballistic missiles.

Coordinated deep attack competencies differ from basic combined arms primarily with respect to the capacity to mount deep operations that emphasize rear echelon target kills. In particular, these forces can more accurately target corps-level rear echelon targets, such as assembly areas, truck parks, fuel dumps, and switching stations than can forces competent only in basic combined arms. In addition, these deep attacks can take place simultaneously with either offensive or defensive mobile operations at the front.

Full combined arms competencies represent an ability to conduct sophisticated mobile defensive operations at the corps level, including a mix of maneuver and firepower through the use of full combined-arms task forces. Turning, envelopment, flanking, and breakthrough operations can all be conducted with high skill by forces with such competencies. Defensive operations here can feature counterattacks of varying size as well as basic levels of joint operations, mainly air-ground cooperation in the form of integrated helicopter or fixed-wing close air support (CAS). Offensive operations would include potent division-level mobile capabilities that employ envelopment, turning, flanking, and bypassing operations, as well as full exploitation and pursuit. The ability to closely coordinate the deep and close battle in sequence implies that deep strikes with missiles and tactical aircraft against enemy rear echelons can be mounted just before or just after the critical close combat phase begins, and the acquisition of modest-quality night vision equipment heralds the prospect of round-the-clock operations.

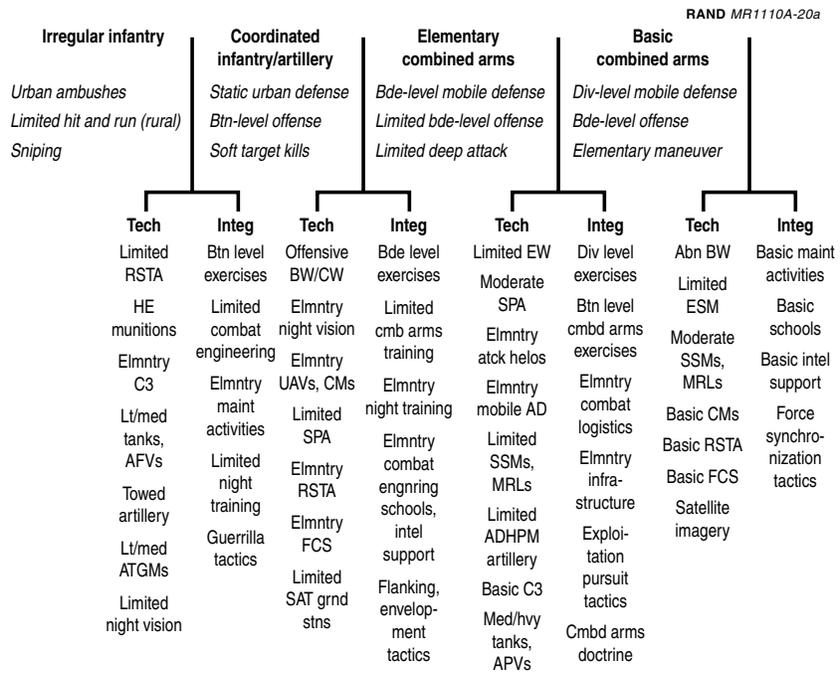


Figure 20—Assessing Ground Warfare Capabilities

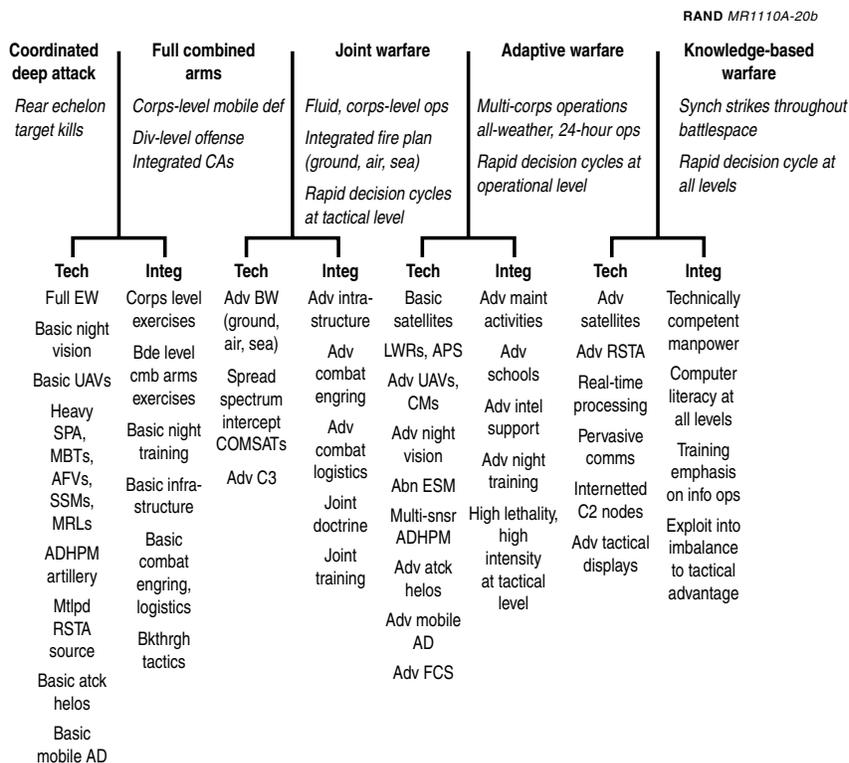


Figure 20—Assessing Ground Warfare Capabilities—extended

Joint warfare competency represents an entry into the realm of nonlinear warfare, wherein force-on-force annihilation no longer depicts the battle accurately. Forces capable of such operations can overwhelm an adversary by quickly paralyzing his command nodes with deep armored thrusts, missile attacks, and massive jamming/intercept operations, and can execute fluid armored operations at the corps level on both offense and defense. Such operations can potentially overload an opponent's command and control structure so heavily that systemic disorientation results in the inability to do anything more than simply react to the moves of the initiator. Joint warfare essentially consists of wresting the initiative from opponents through cognitive dominance at the tactical level.

Adaptive warfare competencies give a force the ability to conduct nonlinear operations at the multicorps level in both offense and defense. Such forces can launch deep attacks based on near-real-time intelligence data, operate at night and in adverse weather, and strike throughout the entire depth of the battlespace simultaneously. Under many circumstances, such forces can defeat more primitive opponents even when facing highly disadvantageous force-on-force ratios, and they can wrest the initiative from opponents through cognitive dominance at the operational level.

Knowledge-based warfare represents a competency that allows a force to achieve cognitive dominance over its opponents at all levels—strategic, operational, and tactical. Because such forces possess a near-perfect, dynamic picture of all unit positions in real time, these armies can get inside the adversary's decision cycle (the so-called "OODA loop") so rapidly that the latter's command structure will always be making decisions based on obsolete information. There is no army that has mastered knowledge-based warfare in existence today, but the U.S. Army's Force XXI vision represents a step toward this ideal.

The spectrum of naval force competencies has been structured in a manner analogous to that of ground forces (see Figure 21). *Coastal defense and mining* represent the most primitive naval warfighting competency in Isaacson's capabilities-based methodology. Such operations are the provenance of navies composed of small craft (under 70 feet), armed with small-caliber weapons, and used primarily to patrol coastal waters or lay mines for defensive operations.

Personnel engaged in such operations acquire ship-operating skills primarily from the fishing industry, and their limited weapons proficiency may require soldiers on board to handle weapons.

Coastal anti-surface warfare (ASuW) represents a marginal improvement in competency deriving from increased offensive capability, with converted Army weapons such as rocket-propelled grenades (RPGs), .50 caliber machine guns, and shoulder-launched rockets as the normal armament. In some cases, land-based missile batteries may be part of the weapons inventory. Forces at this level of competency typically operate ships as independent units, remain relatively close to shore, generally utilize line-of-sight (LOS) targeting of surface vessels, and possess limited VHF communications. For the most part, personnel acquire ship-handling skills from the commercial sector, but limited naval training may provide the skills required for weapons proficiency.

Anti-surface and anti-air warfare (AAW) with surface ships, including countermining and naval gun fire support (NGFS), represent further improvements in competency but nonetheless remain within the ambit of the simplest form of naval warfare: ship versus ship. Such forces are not capable of operating at large distances from the coast for extended periods, and ships generally sail independently. With increased experience and operating time at sea, several ships can perform as a small surface action group (SAG), with capabilities for limited air/surface search, LOS targeting of low-tech missiles, and naval gun fire support. The technology pertinent here includes corvettes, older frigates, destroyers, and minesweepers, but the larger size of these vessels and the more complicated weapon systems aboard them usually make for greater integrative demands. Ship-handling skills, more advanced than in the commercial sector, usually require formal training for their proper development (usually accomplished at a naval school or training base). In addition, damage control (DC), fire control (FC), and AAW create new training requirements. Finally, keeping large ships under sail—even to a limited degree—requires elementary logistics (e.g., supply) and maintenance activities (e.g., shipyards with skilled laborers).

Anti-surface warfare with submarines represents a higher level of competency relative to operations conducted with surface ships

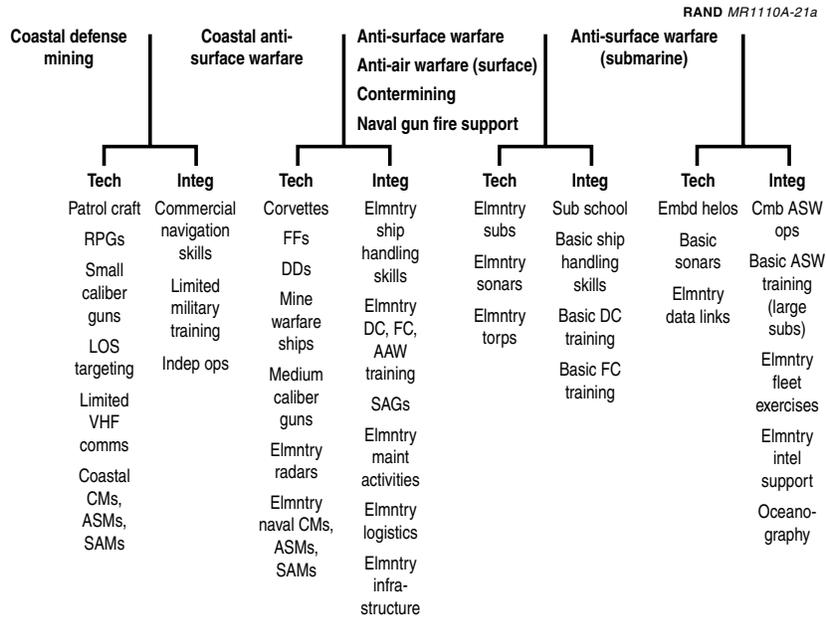


Figure 21—Assessing Naval Warfare Capabilities

alone because of the complexity of submarine operations and the challenges of operating effectively under water. These operations usually take the form of small diesel submarines targeting military and civilian shipping traffic. Such vessels usually operate at moderate distances, and they require resupply and refueling, usually accomplished at a naval base. Typically, diesel submarines act independently and station themselves at geographic choke points. Although they involve high initial investment and operating costs, small diesel boats can provide a relatively potent stealth weapon under the right circumstances even if they are equipped with older-generation sonars and torpedoes. Training for submarine operations usually requires a dedicated submarine school, with a curriculum that includes improved weapons and sensor training to locate and destroy a target.

Anti-submarine warfare (ASW) with surface ships represents another step up in the spectrum of competency because it requires dedicated surface combatants with capable sonars, and usually an organic helicopter capability. Because ships and helicopters must now operate with each other to perform ASW, this competency imposes substantial demands on integration. Ship manning and aviation skills combine with greater maintenance requirements. Moreover, such operations require tactical coordination, including the capability to pass tactical information between units, either by voice or through tactical data links. Target submarines are also required for ASW training, so that elementary fleet exercises become important for realizing such competencies. In addition, sonar training, oceanography, and elementary intelligence support cannot be overlooked.

ASW with submarines represents an even higher level of competency in comparison to surface ASW because of technological requirements, relating to submarine quietness (through hull and propulsion design) and the possession of advanced passive sonar and fire control systems, as well as the high integrative demands owing to the inherent difficulty of subsurface ASW targeting. In this context, passive sonar operations and advanced fire control training are as important as the advanced ship-handling skills necessary to operate submarines effectively in an ASW environment. While nuclear submarines are excellent platforms for ASW, late-model diesels like the German Type 209 and Russian Type 636 Kilo can perform equally well in some missions. In any event, an advanced submarine fleet

requires high levels of skilled maintenance and effective logistics support.

Naval strike and limited air control represents an important transition point in naval warfare competency because it signals the ability to project power ashore. Forces capable of such operations typically operate some type of aircraft carrier (perhaps a vertical/short take-off and landing [V/STOL] carrier) with embarked aircraft capable of light attack. To support these operations, either satellite imagery or land-based long-range maritime patrol aircraft, together with intelligence support (for mission planning), are necessary for successful scouting and targeting. Because carrier operations are extremely demanding, an extremely high level of integrative efficiency is required. In addition to the carrier and its aircraft, the force structure required by this competency usually includes guided missile frigates, destroyers, and cruisers to protect the high-value assets against attack and to support the limited air control mission. These battle-groups usually perform basic fleet exercises, are capable of sharing moderate amounts of tactical data, and normally operate under some kind of component warfare commander (CWC) concept, whereby various commanders are assigned responsibility for defined mission areas so that coordinated defensive and offensive operations can be carried out simultaneously.

Multimission air control, limited sea control, and deep strike proficiencies come closest to realizing true “blue water” capability. Forces capable of such operations field advanced aircraft carriers capable of launching a variety of specialized conventional takeoff and landing (CTOL) aircraft, host advanced high-speed data transfer and communications systems, and possess sophisticated multi-dimensional offensive and defensive systems. Advanced cruise missiles with robust intelligence support provide a deep strike capability against both land and sea targets. In addition, under way replenishment makes forward presence possible, although a system of forward supply bases with ports can suffice in many instances. Such capabilities require advanced training and support, large-scale fleet exercises, and substantial joint operations. Moreover, an advanced shore establishment ensures that adequate maintenance and supply capabilities are available.

Comprehensive sea control is the naval equivalent of knowledge-based warfare in the realm of ground operations. In this case, over-the-horizon (OTH) reconnaissance, surveillance, and target acquisition (RSTA) systems, real-time processing, and pervasive communications create true network-centric forms of warfare that enable a force to successfully interdict an adversary's assets in any operating medium. Such capabilities promise an as-yet unseen multiplication of naval force effectiveness and remain an ideal that even the U.S. Navy can only aspire to today.

In a manner similar to the analysis of ground and naval warfare competencies, Isaacson develops an air warfare capabilities spectrum as well (see Figure 22). *Airspace sovereignty defense* remains the most primitive form of air warfare capabilities, and a force whose competencies are exhausted by this mission is usually equipped with lightly-armed air assets operating in tandem with ground-based radars. These forces can detect intrusions into their air space and defend it against unarmed adversaries. Little else is within the grasp of such a rudimentary force.

Elementary defensive counterair (DCA) represents an improved ability to defend one's air space against armed intrusion. While it may not suffice to conduct a sustained DCA campaign against a more advanced air force, it does allow for an ability to inflict some losses against a more advanced aggressor and to prevent a potential foe from conducting unlimited overhead reconnaissance. A force capable of such operations usually fields obsolete air defense fighters, which prosecute air-to-air engagements solely within visual range with cannon and early-generation missiles, and do not operate outside of fixed air defense corridors. Command and control procedures for such air forces are rigid and consist mainly of GCI operations, with pilot training being light and restricted to simple combat maneuvers.

Basic DCA and elementary strategic strike are in many ways similar to the previous level of competency except that such forces often field improved air defense fighters, improved AAMs and GCI radars, and operate out of hardened shelters that provide enhanced passive defense to the force as a whole. Pilot training also improves marginally to enable handling more sophisticated aircraft, but elementary logistics usually make for low operational tempos. In addi-

tion, using simple unmanned aerial vehicles (UAVs) or other forms of elementary aerial reconnaissance bequeath a nascent strategic strike capability, mostly useful for attacks against large, soft targets like cities and industrial plants.

Advanced DCA coupled with maritime defense (coastal) competencies represent a leap in capability over the previous level of proficiency. These forces possess some current-generation air defense aircraft armed with modern air-to-air missiles and possibly supported by airborne early warning (AEW) aircraft. They also exhibit an improved strike capability, utilize long-range, high-altitude aerial reconnaissance in the form of specially configured platforms, and possess the capability to deliver anti-ship missiles effectively within their coastal waters. Realizing such increased capabilities requires integrative investments, including advanced maintenance facilities, dedicated support, relatively high levels of training, and sophisticated command, control, and communications (C³). The importance of integrative factors sharply increases in this domain, and air forces focusing on technological improvements alone are not likely to realize the full capabilities possible in this regime.

Battlefield air interdiction (BAI), basic strategic strike, and maritime strike competencies enable a force to influence ground combat in a manner impossible for forces with lower levels of capability. Utilizing basic attack aircraft, ground surveillance radars, cluster munitions, and basic anti-armor PGMs, such forces can influence the tactical battlefield while also reaching out to targets in the strategic realm. Here, such forces usually rely on their own air-breathing reconnaissance platforms or on foreign-supplied satellite data for targeting; they may also possess aerial refueling technology and air-launched cruise missiles (ALCMs) to strike an array of deep (i.e., greater than 300 km) targets like large surface-to-air missile (SAM) sites or surface vessels operating outside of their coastal waters. Pilot training in such forces is usually extensive, and a well-organized logistics system is usually available for combat support.

Fixed-wing close air support, basic suppression of enemy air defenses (SEAD), and basic deep interdiction remain competencies associated with highly advanced and capable regional air forces. Such forces utilize real-time communications with mobile ground units and can provide direct air support to ground elements engaged in close com-

RAND MR1110A-22a

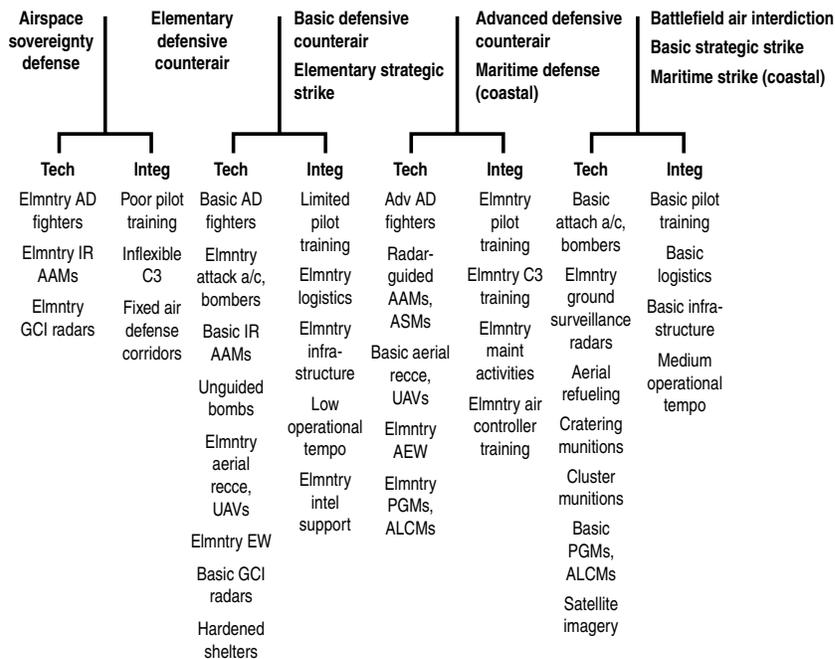


Figure 22—Assessing Air Warfare Capabilities

RAND MR1110A-22b

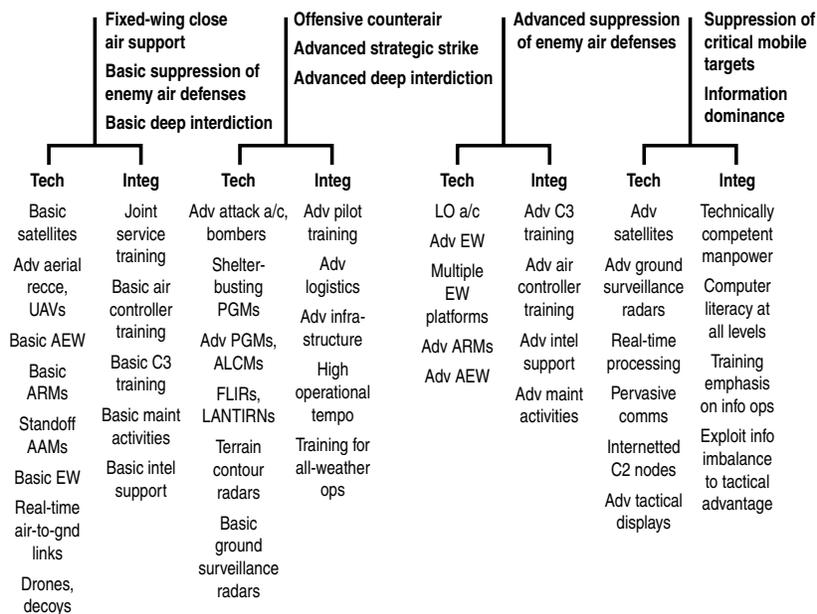


Figure 22—Assessing Air Warfare Capabilities—extended

bat. They also possess an established SEAD capability that includes moderate jamming, the use of decoy and reconnaissance drones, and basic anti-radiation missiles (ARMs). In the air-to-air realm, they often possess active radar missiles, improved AEW systems, and highly integrated air defense ground environments (ADGES), potentially making them formidable air-to-air adversaries for most air forces of the world. Finally, using small, independent satellites and advanced aerial reconnaissance they can execute deep interdiction missions against mobile and hard stationary targets. Creating such a force involves significant integration requirements, including joint service training with an emphasis on C³, well-trained forward air controllers (FACs), effective intelligence support, and basic facilities and manpower for maintaining advanced systems.

Offensive counterair (OCA), advanced strategic strike, and advanced deep interdiction capabilities allow an air force to conduct a decisive offensive counterair campaign that includes airbase suppression through a day/night/all-weather deep interdiction campaign. Such a force possesses advanced attack aircraft, sophisticated navigation and targeting sensors, and highly capable ground surveillance radars. Its weapons include shelter-busting munitions, advanced air-launched cruise missiles utilizing GPS guidance, and advanced precision-guided munitions that can be used in high-intensity operations conducted at high tempos. Thanks to intensive and sophisticated training regimes, advanced logistics, and sizable ordnance stockpile, this type of air force can seal off the ground battlefield from enemy reinforcements for substantial portions of time.

Advanced SEAD competencies allow a force to rapidly paralyze even the most advanced air defense systems. Using low observable (LO) aircraft and munitions, sophisticated jamming from multiple platforms, spoofing, intelligent anti-radiation missiles, and advanced AEW, this force can achieve theater-level air supremacy more rapidly and at less cost than a force at the previous level of competency. This force invests heavily in C³ training, air controller training, intelligence support, and maintenance activities to allow for high levels of sortie generation and effectiveness that are “second to none.” The U.S. Air Force is the sole exemplar of this level of air power competency.

Suppression of critical mobile targets (CMTs) and information dominance represents a capability whereby a force relies on information imbalances to paralyze its adversaries and dominate its battlespace. Using real-time data processing and pervasive communications, it can destroy critical mobile targets (e.g., mobile missile launchers, mobile command posts) with a high level of confidence. This force can typically sustain a fleet of advanced ground surveillance aircraft in theater, a robust theater missile defense (TMD) capability, and a fully rounded out indigenous satellite capability that produces photo, infrared, and radar imagery in real time. Its tracking radars and air-based targeting sensors are more advanced than any fielded currently, and its well-trained, technically competent manpower can fully exploit them to perform CMT spotting and attacking adversaries effectively even in forested or mountainous terrain. This type of force remains an ideal for now.

The purpose of such a methodology is to locate the military competencies of a country on a schematic map that allows the analyst to depict its relative capabilities. The advantage of Isaacson's framework is that it allows military capabilities to be perceived not simply in terms of what countries possess but rather in terms of what can be achieved—with respect to operational competency—as a consequence of their possessions. It allows for the integration of both their strategic resources and their conversion capabilities, but ultimately it assesses their military power in terms of operational proficiencies that can be attained as a result of these interacting variables. The methodology can thus be used both in a static and in a comparative-static sense. It can locate the military capabilities of a country at a given point in time and in fact compare those capabilities to a select group over peers. If the relevant data are collected continuously, however—as the U.S. government invariably does—they can be used to measure progress diachronically both with respect to how a given country has improved (if it has) relative to its own past performance and with respect to other competitors or rivals that may be arrayed against it. In that sense, Isaacson's methodology allows for both absolute and relative comparisons of military competency across time. Clearly, the methodology itself is by no means sacrosanct. It is possible to devise other, or perhaps even better, methodologies. What is most important, however, is that it provides a structured way of combining data that are openly available—for example, about

inventories—with data that are classified—for example, about logistics and training practices—to arrive at a more sophisticated, evaluative assessment of a country's military capability, which, as argued earlier, remains the final manifestation of national power.