Introduction

Operation Desert Shield: The Vulnerability of Light Forces in an Early-Entry Role

On August 2, 1990, the nation of Kuwait fell to invading Iraqi units in a matter of hours. In the days following the initial aggression, Iraqi forces made several incursions into Saudi territory. The Saudis' ability to rebuff these violations or stop a renewal of the attacks was limited.[1] Military logic dictated that the Iraqis continue their successful offensive and seize Saudi Arabian airfields, ports, and oil fields (Scales et al., 1993, p. 50). If successful, Iraq would have controlled 40 percent of the world's oil reserves.[2]

At 9:30 p.m. on August 6, the 82nd Airborne Division received an alert notification from its corps headquarters. The division routinely stood organized for short-notice contingencies. At the time of notification, the 2nd Brigade was the Division Ready Brigade-1 (DRB-1): the ground maneuver brigade designated to deploy most rapidly. The brigade had three battalion task forces, each similarly assigned a relative alert status. For example, the 4th Battalion, 325th Airborne Infantry Regiment was the Division Ready Force-1 (DRF-1) at the time of notification, with a two-hour assembly requirement.[3] In less than three days, the lead elements of the battalion were on the ground at Saudi Arabia's Dhahran International Airport,[4] with the remainder of the 2nd Brigade in-country by August 14. Divisional units accompanying this initial force included an Apache attack helicopter battalion, a 105mm artillery battalion, a platoon of multiple-launch rocket systems (MLRS), a Sheridan light tank company, and other supporting elements (Caraccilo, 1993, pp. 4, 16).

Army leaders estimated that an 11-division Iraqi force was in Kuwait or its immediate environs. The senior XVIII Airborne Corps officer in Saudi Arabia expected that an attack from the north would consist of six enemy divisions, some of which would be Saddam Hussein's elite Republican Guard units.[5] Such a force would have included approximately 1,460 tanks, 3,200 other armored or mechanized fighting vehicles, and 76,200 Iraqi soldiers.[6] The soldiers of the 2nd Brigade numbered only 2,300 (Freedman and Karsh, 1993, p. 94). All that stood in defense of the ports and airfields so critical to the defense of Saudi Arabia were this brigade, American support units, and Saudi and Gulf Cooperation Council (GCC) forces that had either been in place or had raced to northeastern Saudi Arabia in the previous few days.[7]

Upon arrival in Southwest Asia, the 2nd Brigade, 82nd Airborne Division mission was to defend Dhahran and Ad Dammam airfields and port facilities. Three days later, on August 12, the mission was changed to defend the port at Al Jubayl, 110 miles to the north, in preparation for the arrival of U.S. Marines.[8] Planners readying guidance

for the protection of Al Jubayl accounted for the limited U.S. ground force strength. The brigade's soldiers focused on the coast road and other nearby avenues of approach; defensive plans included using sabkhas (coastal salt flats) that would slow or stop any Iraqi armor attempting to cross that softer ground.[9] Such obstacles would have been used in conjunction with tube-launched, optically-tracked, wire-guided (TOW) missile and other anti-tank systems to support the engagement of Iraqi armor and mechanized forces at long range before the enemy could bring its fires to bear on the less well-protected and relatively immobile Americans.

In the event of an Iraqi attack, 2nd Brigade, 82nd Airborne Division soldiers' defensive efforts would have been aided by U.S. and coalition air support, Arab forces positioned north and east of the ports, the long distances from the Kuwaiti border to the port of Al Jubayl, the immaturity of the enemy's logistical and command and control (C2) systems, and a high level of training and *esprit de corps*. Nonetheless, a number of factors would have severely challenged the success of the defense, including a force ratio that greatly favored the adversary, the large number of avenues of approach available to the attackers, a lack of other than a skeletal sustainment apparatus, and limited means to deal with an enemy in armored and mechanized vehicles.

But the enemy did not come. Airborne soldiers provided security as the 16,500-man Marine Corps brigade disembarked beginning August 14, 1990 (Flanagan, 1994, p. 23; Scales et al., 1993, p. 84). By August 20, the 1st Brigade of the 82nd Airborne Division had joined its predecessors; four days later, the 3rd Brigade was on the ground in the Gulf.[10] The XVIII Airborne Corps' 101st Air Assault and 24th Infantry (Mechanized) Divisions arrived during the following weeks. Although the probability of a successful coalition defense increased with each unit's arrival, there had undeniably been a period of severe vulnerability; the first ship loaded with tanks and other fighting vehicles of the 24th Infantry (Mechanized) Division did not arrive in Saudi Arabia until August 31, and it was September 25 before the entire division had arrived (Schubert and Kraus, 1995, pp. 80–81).

As the above discussion shows, the 2nd Brigade, 82nd Airborne Division accomplished its mission in Operation Desert Shield, but it did so by default. Taking nothing away from the light forces deployed, the situation in which they found themselves in Southwest Asia in 1990 was clearly nowhere near as "stressing" as it might have been, because Hussein's heavier forces did not behave as one would predict and did not take advantage of the apparent overmatch they had. Had they advanced into Saudi Arabia, as one would have expected, would the light forces in place have been able to delay their advance without suffering massive casualties? Moreover, if Hussein's heavier forces themselves had been more capable, would the 2nd Brigade, 82nd Airborne Division's much smaller and lighter forces have been lethal and survivable enough to have had a decisive impact on the battle?

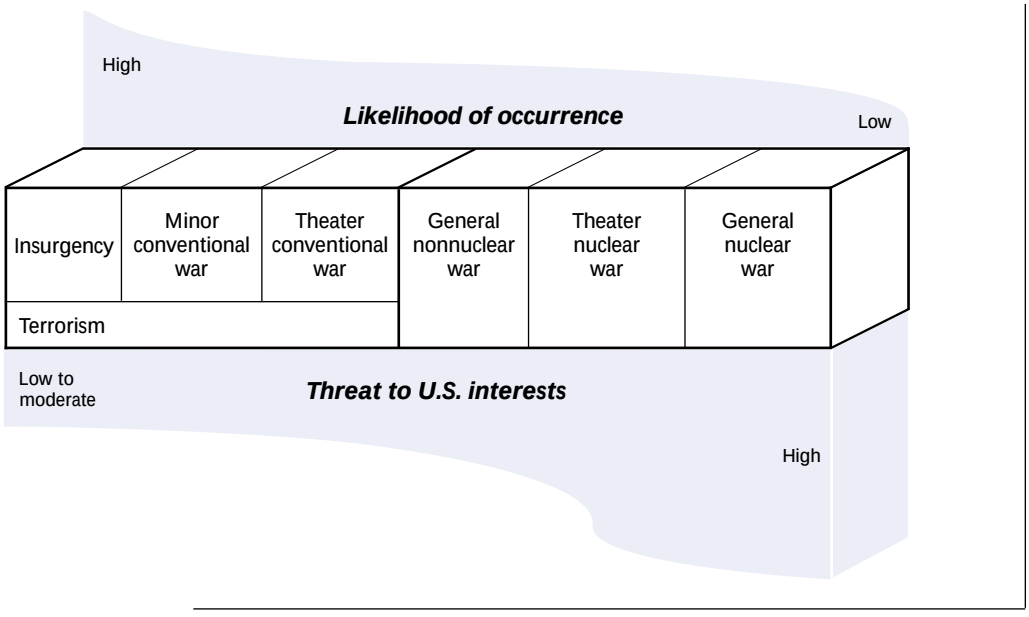
While it is interesting to speculate in hindsight on such questions, the issues are more than just academic. The effectiveness of U.S. light forces[11] in rapid-reaction situations—exemplified by the widely acknowledged vulnerability of the U.S. force during

the Desert Shield buildup—is an increasing national concern. The remainder of this chapter begins by describing the changing role of ground forces before turning to a discussion of concerns about the shortfall of such forces in this role. It then sets out three possible paths for reshaping light forces to meet this shortfall, an unavoidable issue that high-level Department of Defense (DoD) decisionmakers will need to contend with in the near future. It concludes by highlighting the need to *analytically* assess the merits and weaknesses of new concepts and technologies along any of the three paths.

The Changing Role of Ground Forces

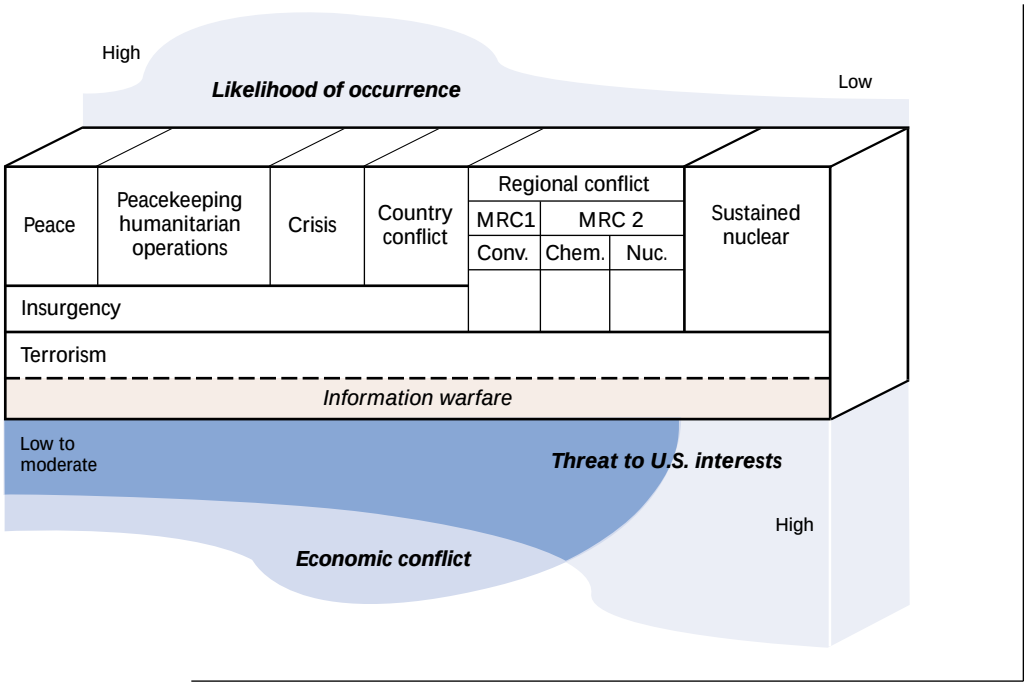
The role of ground forces is being transformed by changes in both the nature and the uncertainties of conflict. In terms of the nature of conflict, the spectrum—or range—of conflict has altered dramatically. Figure 1.1 shows the spectrum of conflict during the Cold War, with its focus on the high likelihood of conventional war and the less likely, but still prominent, possibility of nuclear war. In that world, with the focus on countering one major threat in Europe, prepositioned heavy forces were the hedge against attack, and light forces were focused more on dealing with insurgency and terrorism. (For a more detailed discussion of the history of light forces, see Appendix A.) More specifically, Army light infantry divisions were created in the mid-1980s as a way to provide "global flexible response" and were designed for low- and mid-intensity conflict and as "strategically deployable rapid-responding, flexible light forces." For a detailed account of the development of the light division, see Romjue (1993).

Figure 1.2 shows the current spectrum of conflict, which is clearly much more varied and extensive. The range of conflict possibilities—starting with peace and peacekeeping and humanitarian operations, ranging through country conflicts and regional



SOURCE: Johnson, Pace, and Gabbard (1998).

Figure 1.1—Spectrum of Conflict During the Cold War



SOURCE: Johnson, Pace, and Gabbard (1998).

Figure 1.2—Current Spectrum of Conflict

conflicts (major regional contingencies, or MRCs), and up to sustained nuclear war—presents challenges to military planners. In addition to playing the traditional role in insurgency and terrorism operations—which have grown in scope—light forces are playing a new role in humanitarian operations (like Somalia) and in MRCs (like the Gulf War scenario described above).

And it is not just the nature of conflict that has changed. The uncertainty about where those conflicts—or military operations—can occur has also grown. In the Cold War, the focus was predominantly on major conventional war in Europe, where forces were already present and, as mentioned above, where the military had stores of prepositioned equipment to outfit reinforcing units as they arrived in theater. Even during the Gulf War, the military could rely, to some extent, on prepositioned equipment both in Southwest Asia and afloat nearby.

However, in the world pictured in Figure 1.2, uncertainty about where conflicts and military operations can occur has increased dramatically, in part because of the possible number and kinds of operations. And as the figure shows, the spectrum includes more than one potential MRC, for example, one in Southwest Asia and one in Korea. When the potential for conflict is so global in nature, it becomes more difficult for military planners to rely on traditional prepositioned forces as a hedge against conflict breaking out.

Although the U.S. military is responding to the changing nature and uncertainties of conflict by making air power improvements and by introducing prepositioned

forces afloat for heavy units, these options may be limited in their overall effectiveness, availability, or responsiveness to crises around the globe. And while airlifting heavy forces as they are currently equipped into such situations is technologically possible, it is unlikely that enough airlift will be available to bring significant numbers of heavy forces into theater rapidly, even with optimistic projections on inter- and intra-theater airlift.

Under the circumstances described, the prospect of using the light forces, and airborne forces in particular—which are intended for rapid projection to trouble spots—against larger and heavier forces, including heavy armored forces, in the early phase of conflict has become an accepted reality. Calls for reexamining the role of light forces in these situations have come from many sources. The "Army After Next" initiative conducted by the U.S. Army is one example.[12] That initiative is looking out years into the future to determine likely demands placed on U.S. military forces based on current projections of the political-military environment.

Current RAND research is examining alternative plausible worlds beyond the major competitor world envisioned as the baseline for warfighting exercises. While the study identifies a wide spectrum of plausible worlds that involve the use of light forces in different ways, one in particular—defined as "U.S. polarity"—envisioned an environment in which lethal and survivable forces are fundamental. In this world, where the United States remains dominant militarily, economically, and politically but faces selected hostile regional powers (such as Iran and North Korea), the Army will need to prepare for intimidation by such powers with weapons of mass destruction (WMD), major theater warfare against a regional competitor using asymmetric strategies, and sporadic peace operations in areas challenged by communal violence or natural disaster. Other RAND research has found that the future Army will need a light and lethal component—one that must be easily deployable across intercontinental distances and will have operational mobility, the ability to engage and defeat hostile armored forces, long-range systems for use against logistics and assembly areas, and an intelligence, surveillance, and reconnaissance (ISR) suite capable of detecting massed infantry movement in all-weather conditions (see Matsumura et al., 1997).

Another recent call for examining the role of light forces in the future has come from the congressionally mandated Commission on Roles and Missions (CORM) of the Armed Forces. The CORM was created in 1993 by Congress to review and evaluate "current allocations among the Armed Forces of roles, missions, and functions" and to "make recommendations for changes in the current definition and distribution of those roles, missions, and functions."[13] In one of its many commissioned studies, the CORM asked RAND to examine the need to change the roles and missions of light forces—in this case, both Army light forces and Marine expeditionary forces—and rec-

ommend potential changes. One of the broader conclusions about light forces was that their importance will grow in the post–Cold War world (Kassing, 1994, p. 57):

> Taken together, this analysis indicates greater, not lesser challenges for U.S. expeditionary forces. RAND policy analyses imply that DoD will need more capable expeditionary forces to deal with better prepared opponents. More rapid response capabilities are also called for as forward presence declines. Finally, more manpower could be needed to sustain extended humanitarian, peace enforcement, and peacekeeping deployments. Compared to heavy Army units, the flexibility, deployability, and supportability of light Army and expeditionary Marine forces could give them a comparative advantage in the post-Cold War era.

The Shortfall in Rapid-Reaction Capability

Beyond establishing the growing importance of light forces in new roles, Kassing (1994) also called attention to the growing concern over whether such forces "have the survivability and killing power for future major regional contingencies" [p. 64]. If light forces are to be used as the rapid-response force in such major regional contingencies, they will need to have much greater survivability and lethality to operate effectively against an increasingly wide range of situations and threats, particularly conflict against heavy forces.

This concern has also been raised by the Defense Science Board (DSB), which has called for greater attention on improving rapid-reaction capability. More specifically, in its 1996 and 1998 summer studies, the DSB, with RAND assisting, examined the limitations of light forces among other force capabilities. The studies explored new technologies and operational concepts for improving these forces from a number of different perspectives. DSB (1996) documents a detailed analysis of the survivability of light forces, such as those deployed in Desert Shield. Not only did this analysis reaffirm the expectation that such forces do not have enough capability to contend with a larger attacking armor force, it also illustrated *why* such forces would probably not succeed. While different solutions posited by the DSB helped to improve survivability, no single solution emerged as a panacea; rather, the analysis showed that a system-of-systems-based approach for improving them would be necessary.

DSB (1998) considered a range of options for improving rapid-reaction capability from a joint warfighting perspective to meet future demands in the 2010 time period.[14] These began from ideas described in *Joint Vision 2010* (Joint Chiefs of Staff, 1995) and evolved from there in the respective DSB sessions.

One key conclusion of these DSB studies was that a wide range of capabilities—including improved reconnaissance, surveillance, and target acquisition (RSTA) capabilities, C2 capabilities, remotely delivered precision-guided munitions (PGMs), and improved logistics—must be introduced into existing light or air-deployable forces to make them a viable contender for future rapid-reaction missions. In this forum, many creative ideas were introduced to assist with the rapid-reaction challenge. For example, the idea of converting the launch tubes of nuclear submarines (once reserved for nuclear

weapons) for tactical ballistic missiles such as ATACMS armed with PGMs was explored. Providing such low-visibility, on-site/on-demand responsive firepower can provide lethality to rapid-reaction forces in a way that currently does not exist.

The Defense Advanced Research Projects Agency (DARPA) has also identified key limitations in rapid-reaction capability and has explored new operational concepts. Specifically, the small unit operations (SUO) program analyzed the idea of extremely small, light units that would rely on advanced precision weaponry for firepower. In theory, these forces could be inserted overnight to help keep a crisis from worsening. Other initiatives sponsored by DARPA, such as the military applications of robotic systems, have application to improving rapid-reaction capability.

Despite the many initiatives that have offered ideas, albeit in the form of analyses and experimentation, the shortfall in rapid-reaction capability still exists nearly a decade after the Gulf War. In retrospect, the Kosovo crisis may have also raised the attention level for more capable rapid-reaction capability—forces that could both deploy rapidly to a crisis *and* provide significant and robust combat power. Although the delay of bringing ground forces into Kosovo could be directly attributed to political indecision, it is probable that such indecision was linked to the risk of bringing current forces into the theater. A particular limitation may have been the lack of protection and sustainability associated with using current airborne forces against Serbian armor.

At the same time, however, the highly survivable and lethal U.S. mechanized forces would have taken considerably more time to both deploy and employ.[15] Thus, to some extent, decisionmakers faced a paradox similar to the one they faced in Desert Shield: Current U.S. airborne forces consisting mostly of light infantry were not likely to be effective against the larger Serbian mechanized armored force; and U.S. mechanized forces, though significantly more capable than Serbian forces, could not be applied with great enough flexibility and speed to put an early end to the atrocities. Further, had a resolution not been reached, the use of U.S. mechanized forces would probably have been in the form of a counteroffensive operation, which may have come with a series of additional challenges.

Options for Resolving the Shortfall in Rapid-Reaction Capability

Although the shortfall in rapid-reaction capability is generally well recognized, the response to it can take on a wide range of forms. RAND analysts, having participated in the aforementioned research activities, helped in both conceptualizing and assessing a major cross-section of ideas for solving the rapid-reaction shortfall. A beginning point for this line of research within RAND's Arroyo Center and National Defense Research Institute goes back roughly ten years, to the aftermath of Desert Storm. During that time, DoD defined a number of research thrusts created within a Science and Technology Master Plan to respond to, among other things, critical weaknesses identified in Desert Storm. One of seven major thrusts identified was that of Advanced Land Combat—a thrust that put the perceived limitations of light airborne forces directly under the spotlight.

A direct outcome of the Advanced Land Combat thrust was the creation of the first Advanced Concept Technology Demonstration (ACTD). The name for this ACTD eventually evolved to the Rapid Force Projection Initiative (RFPI). The RFPI ACTD provided a hands-on means for soldiers to experiment with new concepts and technologies. Although the focus was on providing near-term capabilities and on leveraging commercial technologies, as new ideas were raised in this forum, many additional initiatives emerged outside the ACTD—some of them concentrating on farther-term capabilities that would permit more formidable changes in force effectiveness.

These changes could take on one or more combinations of forms, including not only changes in operational concept and equipment (new technologies), but also changes in force organization and design. There are also varying degrees to which each of these changes might occur. How these changes are envisioned to reshape light forces for greater rapid-reaction capability can be broken up into three broad paths. Providing a framework and exploring these paths to help resolve the rapid-reaction shortfall represents the primary impetus for this book.

Figure 1.3 conceptually arrays the three different paths for improving rapid-reaction capability considered within this book. Each path represents a very different means to get to a similar end: a force that offers more overall capability than the current light airborne forces but is still very quickly deployable. While not intended to be mutually exclusive in application, the three paths are analytically treated separately so that their respective strengths and weaknesses can be distinctly examined. It is recognized that a *combination* of the different paths or some of the distinct elements and technologies within each one might be the optimum route for the Army to ultimately pursue. As such, high-payoff systems and technologies are highlighted in the quantitative analysis of each path, presented in subsequent chapters.

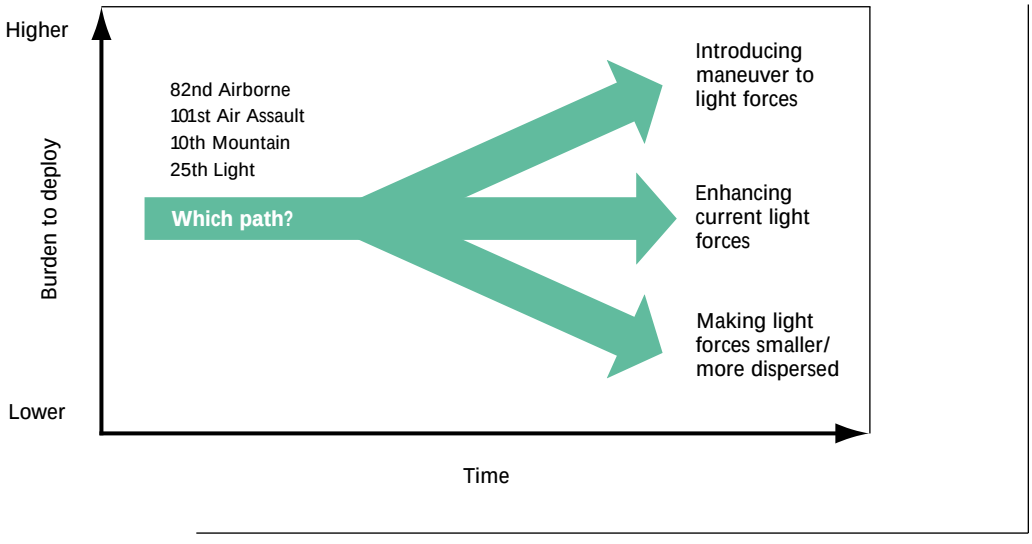


Figure 13—Three Different Methods for Developing a More Effective Rapid-Reaction Capability

The First (Middle) Path: Enhancing Current Light Forces

This path examines what might be considered an evolutionary change from current rapidly deployable forces, such as the Division Ready Brigade of the 82nd Airborne. Here, the force remains as a small, mostly self-contained unit with a force structure similar to the DRB, but it is given the capability to fight and survive in a mission that might otherwise require a larger, heavier force. This could be accomplished by introducing a modified operational concept(s) and by incorporating many underlying, enabling technologies, which include advanced RSTA, C2, and weapon systems. These modified operational concepts involve substantially greater indirect-fire capability than a current light force would have. More specifically, by linking precision munitions to a range of advanced indirect-fire weapons to an integrated sensor and C2 network, substantially more firepower can be brought to bear on an attacking enemy, essentially providing much greater indirect firepower and, thus, lethality at substantially longer ranges. More descriptive detail and discussion of the impact of this operational concept and equipment will be provided in Chapter Three.

The Second (Lower) Path: Making Light Forces Smaller and More Dispersed

Another method for improving light forces involves removing the notion of area control by massed ground forces almost entirely. Here, a very small, highly dispersed force would be deployed in a threatened region. These virtually independent dismounted teams would be equipped with advanced sensor systems for establishing on-site intelligence, and advanced C2 giving them the capability to call in remotely located long-range fires. If the deploying force is very small and dispersed, it has been argued that the enemy would have great difficulty engaging it (e.g., it presents a target with no obvious center of mass); thus, that force would be much more survivable than a typical rapid-reaction force. It was noted early on that such a force may not be capable of holding terrain, but might be sufficient for denying the enemy full use of it.

This general path has taken on several distinct forms, including a DSB-generated concept that is similar to one espoused in the U.S. Marine Corps (USMC) Sea Dragon proposal, the U.S. Army's Training and Doctrine Command (TRADOC) light battle force concept, and DARPA's small unit operations (SUO) concept.[16] All of these are examined in detail in Chapter Four. This path extensively builds on the previous concept, not only by drastically changing the organization of the force, but also by changing the philosophy of ground warfare with its greatly increased dependence on external RSTA and remote firepower (Matsumura et al., 1997).

The Third (Upper) Path: Introducing Maneuver to Light Forces

Another method for responding to the limitations of current rapid-reaction capability is to make a major adjustment to the nature of the force itself. More specifically, new ideas and technologies are emerging that can enable some level of operational and tactical maneuver combined with rapid deployment. Vertical envelopment concepts being explored out of the TRADOC are one example of such a major shift. Most of the rapid-

reaction capability envisioned in these concepts more closely resemble heavy forces than current-day light forces. That is, rather than emphasizing dismounted infantry, these concepts involve infantry mounted in lightweight but highly capable vehicles that could be airlifted close to battle positions by large inter/intra-theater lifters or, possibly, by large rotary-wing, tilt-rotor, or tilt-wing aircraft.

Speed and knowledge are key tenets of the viability of such concepts. By using agile air and ground platforms for strategic through tactical maneuver and by achieving information supremacy, a quick response from the continental United States (CONUS) to the battlefield could theoretically be attained. Critical technologies that bring about information dominance, agile dissemination of the information, and ultra-efficient, lightweight, but lethal platforms would be necessary, where some combination of advanced lightweight composite armor and active protection systems (APS) mounted on a lightweight chassis would be used to supplant more conventional, heavy armor plates.

The fundamental notion for a relatively lightweight, perhaps middleweight force, has recently gained attention. In addition to TRADOC, other organizations such as the Office of the Secretary of the Army for Research, Development, and Acquisition have come up with similar, albeit somewhat heavier, force designs. These forces would be airlifted into theater by C-130J class aircraft, and ground platforms would consist of variants of the Future Scout and Cavalry System (FSCS) currently in development, among other vehicle designs. Research as part of the 1998 DSB Summer Study examined the SARDA concept among others as part of a Joint Service concept for enhancing rapid-reaction capability (Matsumura et al., 1999). More descriptive detail and discussion of the impact of redesigning the force with maneuver capability are provided in Chapter Five.

Although the three different paths involve improving light forces to give them greater rapid-reaction capability, they do so in significantly different ways—by improving one or more of five critical parameters of rapid-reaction missions:

- *Kind of mission* (e.g., peace operations, forced entry, area defense, local attack).
- *Type of environment* (e.g., open, close, urban, contaminated).
- *Level of threat* (e.g., size, sophistication).
- *Kind of threat* (e.g., militia, light infantry, mechanized, combined arms).
- *Responsiveness into theater* (e.g., few days, week, few weeks).

Path 1 enhances a current DRB through new concepts of operation and enabling technologies. These should help to improve both the levels and kinds of threat that can be addressed. Path 2 substantially reduces the size and footprint of the force, transitioning much of the firepower to remotely located systems. These changes should dramatically improve force responsiveness, but they may reduce the kinds of mission, levels of threat, and kinds of threat that can be successfully addressed. Path 3 introduces maneuver to the force by equipping it with a lightweight family of vehicles. This change may reduce force responsiveness into theater, but it can potentially improve the kinds of mission, types of environment, levels of threat, and kinds of threat that can be addressed by the force.

Which Path or Paths to Follow? The Need For Sound Analysis

Ultimately, efforts to improve light forces to give them greater rapid-reaction capability, making them more lethal and survivable and more germane to future conflicts, require policymakers to make decisions now that will affect military capabilities down the road. These decisions—whether about organizational structure, force designs, new operational concepts, and enabling technologies—can lead to irrevocable consequences. Unfortunately, ideas that look good on paper do not always meet expectations when they are implemented. This means that the selection of one path or a combination of paths should be based on a sound analytic foundation that gives policymakers confidence in the choices they make.

The analyses presented in this book are all driven by an extensive and broad-based simulation environment, one that has evolved over many years of development at RAND. In an evolutionary manner, new concepts and technologies have been added into the simulation environment as needed to meet the objectives of the research. The process of developing the simulation environment has been an interactive one. In essence, building the environment (which included developing the scenarios used with it) has involved importing and applying a wide range of analytic and simulation tools, refining those tools to represent new systems and technologies, and determining the appropriate level of model resolution. This resulted in the development of specialty models, such as acoustic models and smart-munition representations.

This effort, in turn, has relied heavily on a wide-ranging knowledge base that exists at RAND. Personnel who have contributed to this research include a mix of technologists, operations research (OR) analysts, logisticians, and scenario specialists. In addition, in developing the scenarios, RAND personnel worked extensively with a range of DoD organizations. And in developing the concepts, a number of senior defense officials, military users, and system developers and testers were consulted. Finally, in many instances, field tests and early-user experiments were observed, resulting in lessons learned that were employed to further refine the modeling and simulation environment and the scenarios where applicable.

Appendix B discusses in more detail the locally distributed simulation environment RAND has assembled over the years to model the many different aspects of ground combat. Here, we merely summarize the current scope of the modeling effort, shown in Figure 1.4.

Starting in the center of the figure, the RAND version of JANUS serves as the primary high-fidelity, force-on-force combat effectiveness simulation and provides the overall battlefield context; JANUS is capable of modeling as many as 1,500 individual systems on a side. To the right of JANUS in the figure, the combination of the RAND Target Acquisition Model (RTAM) and the Cartographic Analysis and Geographic Information System (CAGIS) enable us to represent detailed target detection/acquisition phenomenology as needed, including those associated with low-observable vehicles. The C2 model, which is linked to JANUS, relies on an architecture that is generally based on components of the highly notional RFPI C2 concept and components of the Ad-

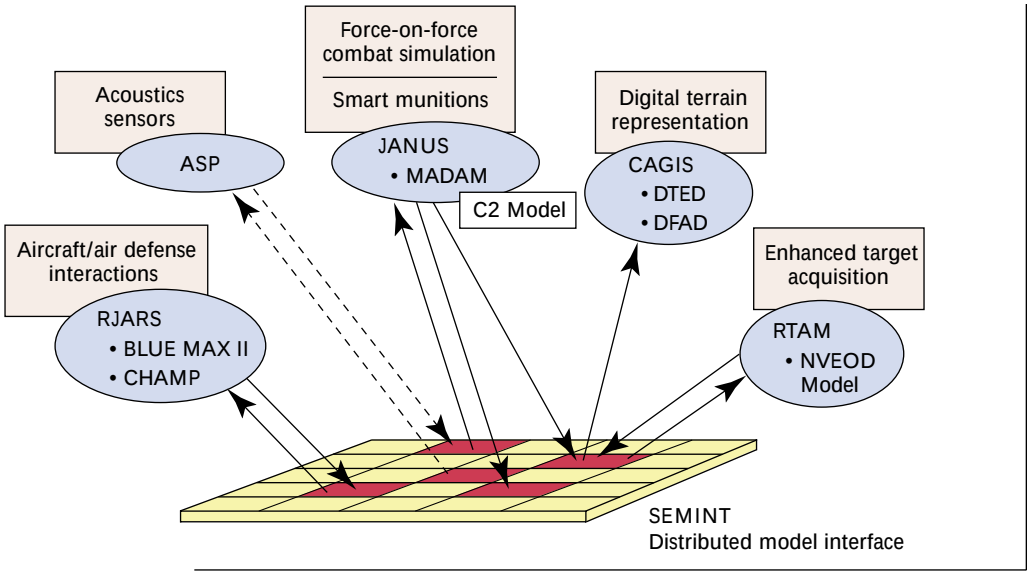


Figure 14—Current Scope of RAND Modeling Effort

vanced Field Artillery Tactical Data System (AFATDS). It models delays associated with message transmission, options planning, and assignment of weapons to targets. It also represents delays and degradations caused by the loss of C2 nodes and the subsequent reconfiguration.

Represented on the far left of the figure, RAND's Jamming Aircraft and Radar Simulation (RJARS) provides a means to simulate the detection, tracking, flyout, and fusing of air defense missiles fired against helicopters and unmanned aerial vehicles (UAVs). The Model to Assess Damage to Armor with Munitions (MADAM), in conjunction with CAGIS, simulates the dispensing, search and target-acquisition process, and attack sequence of smart munitions, including chaining logic, multiple hits, shots at hulks, unreliable submunitions, and so forth.

The Acoustic Sensor Performance (ASP) model, a recent addition to the suite of models, allows us to simulate in detail acoustic phenomenology for a number of different systems, such as the acoustic overwatch sensor, wide area munitions (WAM), the intelligent minefield (IMF), and the air-deliverable acoustic sensor (ADAS). As shown in the figure, the ASP is linked to JANUS, which enables us to expand our analysis of individual sensors' performance in the few-on-few environment to a "system-on-system" analysis in a large-scale, many-on-many situation.

Finally, we use the Seamless Model Integration (SEMINT)—a distributed model interface—as a way to enable all these simulations to communicate during an exercise.

Organization of This Book

This book explores new ideas and the underlying concepts, technologies, and organizations that can help address the current shortfall in rapid-reaction capability. The book refrains from recommending a single solution to the shortfall, instead focusing on increasing awareness of the problem and providing a collection of possible solutions, highlighting their many advantages and disadvantages through analysis. Perhaps, through subsequent dialogue and corresponding analysis, a more definitive solution to the rapid-reaction shortfall will emerge. This research draws extensively on recent RAND work that was conducted for the DSB, DARPA (in conjunction with USMC), the Joint Staff, and the U.S. Army—research in which the authors of this book were directly involved.

To help define the problem, Chapter Two provides a base case showing why existing light airborne forces may not succeed in a relatively recent context—the Desert Storm era. This base case is used as the foundation for the analyses in Chapters Three, Four, and Five, which correspond to the three paths shown in Figure 1.3. Chapter Three focuses on path 1, in which rapid-reaction capabilities are enhanced through near-term changes in concept and technologies and in which force structure and organization remain as they currently are. Chapter Four continues the discussion by exploring path 2 for improving rapid-reaction capability, which proposes making light forces smaller and more dispersed. Chapter Five extends the discussion further by looking at path 3, which introduces maneuver to such forces (inherently making them heavier). In each chapter we follow a similar structure, setting up the context for analyzing a scenario(s), showing how a "lieutenant" serving in the notional rapid-reaction unit might experience that scenario, and then presenting the analysis results for that scenario and others in the form of an "after-action review."

Chapter Six highlights some of the special challenges that go along with reshaping rapid-reaction forces for the future, looking in particular at the potential role of light forces in military operations on urbanized terrain (MOUT). Finally, Chapter Seven concludes this work by summarizing opportunities and implications for responding to the rapid-reaction shortfall.[17]

Appendix A provides a brief historical perspective on the evolving role of light forces. Appendix B presents a more detailed description of the analytic simulations, models, and tools used for the RAND analysis. To help readers visualize the numerous systems mentioned throughout the book, Appendix C presents renditions of these systems, as well as a brief discussion of capabilities. Appendix D provides a short think piece on the increasing role that robotics might play on the future battlefield.

CHAPTER ONE ENDNOTES

1 Cordesman and Wagner (1996), p. 54. These authors write that the Saudi units in the vicinity of the Kuwaiti border consisted only of a small armor brigade in King Khalid Military City and a national guard unit without tanks.
2 Cordesman and Wagner (1996), pp. 55–56. Twenty percent of these oil reserves were in Iraq and Kuwait; an additional 20 percent were in Saudi Arabia.
3 "Oral history interview (DSIT AE 017): LTC John R. Vines," p. 1 (footnote). The lower the DRB or DRF number, the shorter the time given between notification and deployment.
4 The battalion's first elements disembarked in Saudi Arabia at 5:00 P.M. on August 9, 1990. See "Command Report Narrative: Desert Shield & Desert Storm," prepared by Headquarters, 82nd Airborne Division, Fort Bragg, NC, January 20, 1992, pp. 1–2. The time at Fort Bragg was 10:00 A.M., August 9, 1990, or seven hours earlier than Saudi time.
5 Scales et al. (1993), p. 82. The XVIII Airborne Corps was the 82nd Airborne Division's immediate senior headquarters. The corps also included the 101st Air Assault Division, the 24th Infantry Division (Mechanized), and other units.
6 These values assume that four of the six attacking divisions would have been regular force organizations (mechanized or armored) and that the remaining two divisions would have been Republican Guard armored or mechanized divisions. For assets assigned to these division types, see Cordesman and Wagner (1996), p. 124.
7 Schubert and Kraus (1995), p. 55. Roughly 2,000 Egyptian commandos who had arrived on August 6, 1990, were farther to the west (in the vicinity of Hafr al-Batin). See Pimlott and Badsey (c1992), p. 91. McCausland (1993, p. 10) states that "leading elements of the Egyptian Army landed on 11 August." Khaled bin Sultan (1995, pp. 8–11) notes that Moroccan and Egyptian forces were "the first friendly Arab forces to fly to our aid." He explains the early paucity of Saudi troops along the northern border and the nation's efforts to reinforce this area.
8 "Oral History Interview (DSIT AE 017): LTC John R. Vines," p. 2. Movement to Al Jubayl was made with the help of Saudi Arabian transportation assets. See "Command Report Narrative: Desert Shield & Desert Storm," p. 2.
9 Scales et al. (1993), p. 85, and "Oral History Interview (DSIT AE 017): LTC John R. Vines," p. 11.
10 Schubert and Kraus (1995), p. 53. Cohen et al. (1993, Table 23) gives August 13, 1990, as the closing date for the 2nd Brigade, 82nd Airborne Division, and August 17 as that for the 1st Brigade. Swain (1994, p. 356) agrees with August 14 as the 2nd Brigade's closing date but does not provide information on the closings of the division's other two ground maneuver brigades.
11 For the purposes of this study, "light forces" are ground forces with all of the following characteristics: force structure is significantly influenced by the need for rapid deployment by air, the organization's infantry forces have no organic motorized, mechanized, or armored vehicles for movement on the battlefield, and organic maneuver and fire support systems are lighter and have less armor protection than the contemporary mechanized infantry, armored infantry, or armor unit standard.
12 The terminology "Army After Next" has since been replaced with an initiative referred to as "Army 2010 and Beyond."
13 See the National Defense Authorization Act for FY 1994, Conference Report, p. 198.
14 This was only one of several important issues studied by the DSB; others included methods of contending with a weapons of mass destruction (WMD) threat.
15 In addition to the time needed to bring such forces into theater, the heavy weights of combat vehicles themselves would have required modification to bridges affording access to the area.
16 The USMC Sea Dragon effort is a five-year experimental process of innovation and experimentation that embodies several key experiments—Hunter Warrior, Urban Warrior, and Capable Warrior. Each of these, under the supervision of the Marine Corps Warfighting Lab, envisions a smaller but more lethal force.
17 Although this book focuses on the future Army, the authors clearly recognize that the Army operates with, and relies on, the forces of the other services. As various options are examined in this work, the likely contribution of the other rapid-reaction elements of the Joint force will be highlighted and their relationship to Army operations considered.