

# ***Speed and Power***

## ***Toward an Expeditionary Army***

Eric Peltz ▪ John M. Halliday ▪ Aimee Bower

Prepared for the United States Army  
Approved for public release, distribution unlimited

The research described in this report was sponsored by the United States Army under Contract No. DASW01-01-C-0003.

**Library of Congress Cataloging-in-Publication Data**

Peltz, Eric, 1968-  
Speed and power : toward an expeditionary Army / Eric Peltz, John M. Halliday,  
Aimee Bower.  
p. cm.  
Includes bibliographical references.  
"MR-1755."  
ISBN 0-8330-3478-2 (Paperback)  
1. United States. Army—Foreign service. 2. United States. Army—Field service.  
3. Airlift, Military—United States. I. Halliday, John M. (John Michael), 1945– II.  
Bower, Aimee. III. Title.

U265.P45 2003  
355.3'52'0973—dc22

2003020093

RAND is a nonprofit institution that helps improve policy and decisionmaking through research and analysis. RAND® is a registered trademark. RAND's publications do not necessarily reflect the opinions or policies of its research sponsors.

*Cover photo courtesy of U.S. Air Force at [www.af.mil](http://www.af.mil)  
Photographer: Airman First Class Richard W. Rose, Jr.*

© Copyright 2003 RAND

All rights reserved. No part of this book may be reproduced in any form by any electronic or mechanical means (including photocopying, recording, or information storage and retrieval) without permission in writing from RAND.

Published 2003 by RAND

1700 Main Street, P.O. Box 2138, Santa Monica, CA 90407-2138

1200 South Hayes Street, Arlington, VA 22202-5050

201 North Craig Street, Suite 202, Pittsburgh, PA 15213-1516

RAND URL: <http://www.rand.org/>

To order RAND documents or to obtain additional information,  
contact Distribution Services: Telephone: (310) 451-7002;

Fax: (310) 451-6915; Email: [order@rand.org](mailto:order@rand.org)

---

## PREFACE

---

This report examines how the U.S. Army could improve its ability to enhance strategic responsiveness of U.S. armed forces with respect to prompt power projection. It first analyzes options, given existing technology, for improving the deployment time of Army units. Then it examines how the Army might improve its ability to facilitate the rapid-deployment initiation of joint, mission-tailored packages of capabilities. In essence, there are two problems: initiating deployment of the right force capabilities and then getting these capabilities where they need to be as quickly as possible.

The research has been conducted for a project titled “Combat Service Support (CSS) Transformation,” which is intended to provide analytic support to the Army’s CSS transformation effort. This research should be of interest to logisticians, materiel developers, combat developers, and operations personnel throughout the Army, U.S. Transportation Command personnel, and the Army’s and the Department of Defense’s senior leadership. This project is sponsored by the Army’s Deputy Chief of Staff, G-4, and it was carried out in the Military Logistics Program of RAND Arroyo Center, a federally funded research and development center sponsored by the United States Army.

For more information on the Arroyo Center at RAND, contact the Director of Operations (telephone 310-393-0411, extension 6419; FAX 310-451-6952), or visit the Arroyo Center's Web site at <http://www.rand.org/ard/>.

---

---

## CONTENTS

---

Preface . . . . .	iii
Figures . . . . .	ix
Tables . . . . .	xiii
Summary . . . . .	xv
Acknowledgments . . . . .	xxvii
Glossary . . . . .	xxxii
Chapter One	
INTRODUCTION . . . . .	1
Chapter Two	
THE DEPLOYMENT SYSTEM AND MODELING ASSUMPTIONS . . . . .	3
The Deployment Process . . . . .	3
Determining the Deployment Plan . . . . .	3
Preparing for the Movement of Forces . . . . .	3
Aerial Port of Embarkation Processes . . . . .	5
The Deployment Route . . . . .	5
The Deployment Brigade Combat Team Deployment Goal . . . . .	6
Airfield Throughput . . . . .	6
Modeling Assumptions . . . . .	9
Deployment Node Throughput . . . . .	9
Utilizing Node Throughput Capacity . . . . .	11
Aircraft Loads . . . . .	13
Conditions that Could Slow Deployment . . . . .	13

Airlift Allocation and Working MOG: Baselines for	
Analysis . . . . .	14
Airlift Allocation . . . . .	14
Working MOG . . . . .	17
Chapter Three	
LEVERAGING THE DEPLOYMENT TRADESPACE TO	
IMPROVE STRATEGIC RESPONSIVENESS . . . . .	21
Deployment Footprint . . . . .	21
The Choice of Forces for Early Entry . . . . .	21
Size of the Force: The First Element of Deployment	
Footprint . . . . .	23
Aircraft Loading: The Second Element of Footprint . . . . .	24
The Effect of Deployment Footprint on Closure Time . . . . .	28
Reaching 96 Hours with the SBCT . . . . .	29
Throughput Capacity . . . . .	30
The Effect of Working MOG . . . . .	30
A Future Force Unit of Action Excursion . . . . .	32
The Effect of Distance . . . . .	33
Restricted Throughput Example: Limited Airfield	
Operating Hours . . . . .	34
APOD Ground Times in Recent Operations . . . . .	34
Joint Planning, Practice, and Process Improvement as	
Routes to Increasing Throughput . . . . .	36
The Benefit of APOD Process Improvement for a	
CONUS-Based Deployment . . . . .	39
Expanding the Tradespace: Forward Unit or Equipment	
Positioning . . . . .	40
Forward Unit Positioning: When Does it Make Sense? . . . . .	41
The “Types” of Forward Unit Positioning . . . . .	41
The Deployment Benefits of Forward Unit Positioning . . . . .	42
The Synergy Between Forward Unit Positioning and	
Process Improvement . . . . .	44
A New Alternative: “Selected” Prepositioning . . . . .	44
Sharing Prepositioned Equipment and Supplies Among	
Force Types . . . . .	45
The Forms of Prepositioning . . . . .	47
The Need to Leverage Strategic Warning for Rapid	
Response with Prepositioned Materiel . . . . .	47

The Deployment Benefits of Selected Prepositioning: SBCT Trucks, Nonvehicular Equipment, and Supplies . . . . .	49
Changing the Prepositioning Paradigm . . . . .	50
Additional Selected Prepositioning Issues for Analysis . . . . .	51
Prepositioning Considerations . . . . .	52
Employing a Mixed Strategy of Forward Unit Positioning and Materiel Prepositioning . . . . .	53
Options for Improving Rapid Closure of Early-Entry Forces . . . . .	55
Chapter Four	
RAPIDLY PROVIDING MISSION-TAILORED FORCE PACKAGES . . . . .	59
Filling the Gap with a “Medium” Force . . . . .	59
Changing the Force Design: A New Point on the Tradeoff Curve . . . . .	60
Force Phasing to Minimize Time to Initial Operating Capability . . . . .	62
A Stryker Battalion Task Force “Plus” . . . . .	63
Deployment Time of the SBCT’s First Phase . . . . .	65
Rapid Mission Tailoring . . . . .	66
Tailoring from Capability Building Blocks . . . . .	67
A Menu of Capability Options . . . . .	70
The Next Step: Joint Expeditionary Forces . . . . .	70
Chapter Five	
CONCLUSIONS AND RECOMMENDATIONS . . . . .	73
A Comparison of Cases . . . . .	73
Prompt Power Projection Requires New Thinking in Positioning, Practice, and Preparation . . . . .	73
Recommendations Suggest Changes in Deployment Preparation and Positioning with Process Improvement . . . . .	75
Bibliography . . . . .	81

---

**FIGURES**

---

S.1. Route and Approximate Times for Army Units at Fort Lewis, Washington, Deploying to Skopje, Macedonia by C-17 . . . . .	xvii
S.2. Comparison of Deployment Times . . . . .	xxii
2.1. An Example Air Deployment Structure . . . . .	4
2.2. Throughput Is a Function of Working MOG, Ground Times (Processes), and Airfield Operating Hours . . . .	7
2.3. Assumptions for Deployment Closure Time Modeling . . . . .	10
2.4. OEF Deployments for Fort Campbell Units: Days from First to Last Aircraft Departure . . . . .	17
2.5. Rinas Airport, Albania During the Deployment of TF Hawk . . . . .	18
3.1. The Light-Heavy Mix Forces a Choice Between Response Speed and Power (Notional) . . . . .	22
3.2. A Medium Force Fills the Gap, Reducing Either Maximum Force or Time Risks . . . . .	23
3.3. SBCT Deployment Weight Is Roughly Midway Between Army Light and Heavy Brigade Combat Teams . . . . .	24
3.4. C-17 Load with 3 Stryker ICVs, 36 Personnel, and Combat Loads . . . . .	25
3.5. Actual Deployment “Footprint” Requirement Depends Upon Unit Size and Aircraft Load Planning Effectiveness . . . . .	28
3.6. With Smaller Footprint, the SBCT Deploys Much More Quickly Than a Heavy Mechanized BCT . . . . .	29



3.7.	Working MOG and Distance Constrain Number of Usable Aircraft . . . . .	31
3.8.	Many Airfields in Potential Contingency Locations Have Working MOGs of 3 or Less . . . . .	31
3.9.	Draft Unit of Action Needs Working MOG of 4 to 5 and About 45 Percent of FY09 Airlift Fleet to Achieve 96-hour Goal . . . . .	32
3.10.	At Short Distances, Airlift Is Unlikely to Be the Bottleneck; At Long Distances, Even a MOG of 3 Is Hard to Fully Realize . . . . .	33
3.11.	APOD Restrictions Can Greatly Degrade Performance . . . . .	34
3.12.	Initial Data Suggest the APOD Ground Time Can Be Substantially Better Than the Planning Factor . . . . .	35
3.13.	Reducing Ground Times Can Improve APOD Throughput, But Other Airfields or Lift Can Become Bottlenecks . . . . .	39
3.14.	Forward Unit Positioning Reduces Army Demand on Strategic Lift When Working MOG Is the Bottleneck . . . . .	43
3.15.	Forward Unit Positioning Speeds Deployment When Strategic Lift is the Bottleneck . . . . .	43
3.16.	With Forward Positioning, Improved Ground Times Can Be Leveraged Without Straining Airlift Capacity . . . . .	45
3.17.	Movement of Prepositioned Afloat Must Often Start Before Beginning Air Movement of Deploying Units . . . . .	48
3.18.	TSVs Greatly Expand Port Options . . . . .	50
3.19.	Prepositioning of TWVs and Sustainment Improves Deployment Speed of CONUS-Based Assets . . . . .	51
3.20.	Rapid Response Requires Changes in Prepositioning Paradigm . . . . .	52
3.21.	Prepositioning Considerations . . . . .	54
3.22.	Summary of Options for Improving Deployment Closure Time . . . . .	55
4.1.	Medium Platform Use with Current Heavy and Light Brigade Designs Might Be Viewed as “Moving Along” the Time-Versus-Combat Power Line . . . . .	60
4.2.	SBCT Force Design Concepts Improve the Deployment Time Versus Power Tradeoff . . . . .	61
4.3.	SBCT Deployment Phasing . . . . .	62

4.4. A Preplanned Task Force, 50 Percent of SBCT Size or Smaller, Could Provide the First Level of SBCT-Like Capability . . . . .	63
4.5. A Stryker Battalion Task Force Improves the Responsiveness of SBCT-Like Capability . . . . .	65
4.6. Can Modularity Be Leveraged to “Break” the Tradeoff Between Deployment Initiation Time and Mission Tailoring? . . . . .	68
4.7. Predefined SBCT, SOF, Aviation, Airborne, and Heavy Capabilities Can Be Combined for Rapid Mission Tailoring . . . . .	69
5.1. Comparison of Cases . . . . .	74
5.2. Summary of Recommendations . . . . .	77

---

---

**TABLES**

---

3.1. SBCT Vehicles and Trailers in Afloat Prepositioned Stocks . . . . .	46
3.2. SBCT Vehicles Not in Afloat Prepositioned Stocks . . .	47
4.1. A Menu of Capability Options . . . . .	71

---

## SUMMARY

---

This report explores ways in which the Army might improve its ability to contribute to the prompt, global power-projection capability of the United States. By that we mean the strategic responsiveness of early-entry forces in situations where time is critical. Through a case study based upon the Army's new Stryker Brigade Combat Team (SBCT), we examine two components of early-entry force strategic responsiveness: rapidly tailoring a mission-focused force package and moving the force.

For its future force, the Army has set an aggressive goal of deploying a mounted brigade in 96 hours.<sup>1</sup> The first such unit, leveraging substantial new technology, will not be fully operational until 2012. Thus, to develop lessons and to improve strategic response capabilities in the interim, the Army is fielding SBCTs with the best available sensor and communications technologies to enhance situational awareness and a family of 10 Stryker wheeled armored vehicle variants based upon an off-the-shelf platform. While somewhat heavier and substantially less capable than envisioned future force units, SBCTs are significantly lighter than Army tank and mechanized infantry units and offer more firepower, survivability, and tactical mobility than light infantry units. With this balance between the fire and movement strength of heavy forces and the rapid-deployability strength of light forces, the SBCT offers a new option for prompt power projection.

---

<sup>1</sup>The term "future force" is the replacement for the term "Objective Force."

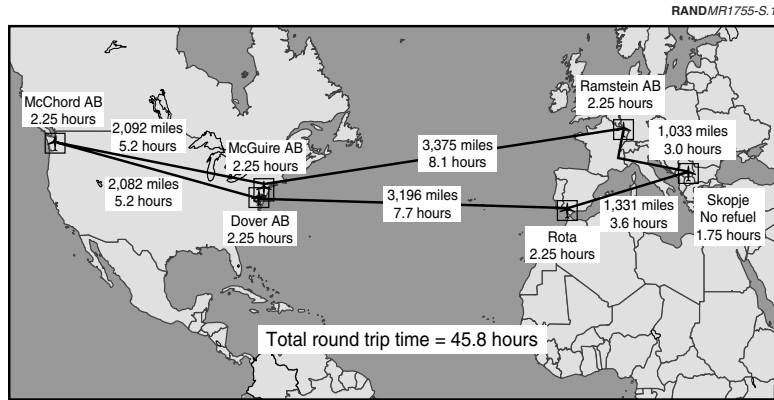
Just how fast SBCTs can deploy has been the subject of much debate and analysis, so this report begins by examining *potential* SBCT deployment time. This is done using one scenario to illustrate how various options would change the deployment time and resource requirements. The intent is not to produce definitive deployment times for the SBCT, but rather to draw insights about means for improving the SBCT's, or any force's, deployment potential.

A design element of the SBCT that has received less attention is its ability to enable more rapid deployment initiation, as the organic brigade is preconfigured as a combined arms unit integrating maneuver support and sustainment capabilities. In the second part of the report, we examine how the Army can build upon this organizational design to increase flexibility while preserving the ability to quickly initiate deployment. The concepts presented are expanded beyond the SBCT to other Army unit types as well as Joint forces.

## **THE DEPLOYMENT PROCESS: AN OVERVIEW**

Once a decision is made to consider or employ military force, the designated geographic combatant commander must work with the National Command Authorities to determine the capabilities required to accomplish the mission. Based upon the requisite capabilities and situation, the commander, working with Joint organizations and the services, selects the appropriate units or parts of units (including the requisite support) and determines the deployment sequence. In conjunction with the development of the deployment plan, the U.S. Transportation Command (USTRANSCOM) must prepare, equip, and man, as necessary, a deployment route.

As an example, Figure S.1 shows a route for the movement of Army units stationed at Fort Lewis, Washington, to Skopje, Macedonia. We use a deployment to Skopje as the basis of a case study to compare the various effects of deployment options. As shown in the figure, bases are of three general types: aerial ports of embarkation (APOE) from which deployment units depart; enroute bases used for refueling and other aircraft operations; and aerial ports of debarkation (APOD) at the destination. The selected route employs two enroute bases in both the outbound and return directions. These bases en-



**Figure S.1—Route and Approximate Times for Army Units at Fort Lewis, Washington, Deploying to Skopje, Macedonia by C-17**

able the route to operate without aerial refueling or the need to refuel at the relatively austere APOD in Skopje. The numbers on the links between bases indicate distances in nautical miles with rough estimates of the C-17 flight times for these distances. The numbers under the base names are the planning factor ground turnaround times for C-17s. Given the times shown, the round trip time for a C-17 would be almost 46 hours. In other words, each C-17 could deliver a load to the APOD every 46 hours.

### IMPROVING DEPLOYMENT CLOSURE TIME

In a deployment time analysis, two critical assumptions are the amount of airlift available and the working maximum on the ground (working MOG) of airfields. Airlift allocation depends upon national and combatant commander priorities and thus the specific mission in conjunction with the global security situation. For example, in Desert Shield, it was critical to get troops on the ground as quickly as possible. As a result, the lead brigade of the 82nd Airborne Division received a high proportion of the airlift, and the Army received 42

percent of the lift missions over the first month.<sup>2</sup> Army deployments to Afghanistan received a much smaller share of lift. Thus, instead of using a “baseline” airlift allocation, our analysis indicates the maximum amount of airlift that could be used given airfield capacities.

In contrast, the working MOG of airfields—how many aircraft can be serviced and unloaded at one time—is much harder for commanders to influence in the short term, particularly for APODs at the deployment location. Deployments since 1990 suggest that an initial deploying force will often be faced with one APOD with a working MOG of 3 or less. While many of the airports in the United States and in other developed regions have relatively large working MOGs, the case can be quite different in other parts of the world or even parts of fairly developed countries away from major cities. Additionally, working MOG is often limited by “allocations.” During Desert Storm, for instance, although the airport at Dhahran, Saudi Arabia is large and modern, the “effective” working MOG for initial deploying Army units was only equivalent to 2 C-17s, since the airport was also used for other purposes. Rinas airport in Albania had a working MOG of 2 C-17s, in part because it was also used for humanitarian operations. All the airfields in the Afghanistan region in support of Operation Enduring Freedom have working MOGs of 3 or less, with the two deployment locations in Afghanistan starting at less than 3.

Thus, to illustrate the effects of options for improving deployment time, we employ a scenario with an APOD working MOG of 3: Fort Lewis, the home station of the first two SBCTs, to Skopje, Macedonia. Deployment time is examined with respect to three dimensions of the deployment tradespace: the deployment “footprint,” the throughput capacity of the system, and force positioning.

There are two primary elements of deployment “footprint”: how much must be moved and aircraft loading effectiveness. With its force size, assuming a reasonable level of loading effectiveness that should be achievable with predeployment load planning, and the APOD working MOG of 3, an SBCT could potentially deploy from Fort Lewis to Skopje in 7.4 days or 45 percent faster than a heavy

---

<sup>2</sup>John Lund, Ruth Berg, and Corinne Replogle, *Project AIR FORCE Analysis of the Air War in the Gulf: An Assessment of Strategic Airlift Operational Efficiency*, Santa Monica, CA: RAND, R-4269/4-AF, 1993.

brigade combat team, plus or minus about a day depending upon load planning effectiveness. This assumes best-case conditions that do not limit throughput as, for instance, bad weather could do. Achieving this time would require at least 38 percent of the FY05 strategic airlift fleet (maximizing C-17s). Given a route and working MOG, the maximum employable number of aircraft can be determined, beyond which additional lift would not improve deployment timelines.

Forward unit or equipment positioning can improve SBCT strategic responsiveness by keeping the route short or effectively reducing the air deployment footprint. Forward unit positioning dramatically improves deployment speed when airlift capacity is the bottleneck. For example, if airlift were limited to 8 percent of the FY05 fleet, the deployment time from Fort Lewis would take about 27 days, as compared to less than 7 days for a forward-stationed SBCT deploying from Ramstein Air Base in Germany. When working MOG is the constraint, the primary benefit of forward positioning is greatly reduced airlift demand, freeing airlift for other purposes. This presents substantial value to the combatant commander by reducing the opportunity cost of calling for an SBCT. Deploying to Skopje from Germany instead of from Fort Lewis reduces the maximum employable lift from 38 percent to just 8 percent of the FY05 fleet.

Given the financial demands of procuring SBCT equipment sets, developing the future force, and recapitalizing current units, it has been assumed that prepositioning SBCT equipment is not financially feasible. However, this is premised upon the traditional approach of prepositioning full sets of unit equipment. Instead, reserving airlift for high-value assets, such as Strykers, and prepositioning less-expensive assets might be an affordable means to mitigate airlift throughput limits. Prepositioning the SBCT's trucks and initial supplies would reduce airlift requirements by about 60 percent, yet these vehicles only account for about 10 percent of SBCT equipment procurement costs. Such "selected" prepositioning would make it possible to move the remaining assets by air in 4 days from the continental United States (CONUS) even with a working MOG of 3. If only the Strykers were moved by air, achieving the 4-day deployment time would require 25 percent of the FY05 strategic airlift fleet. If the 7.4-day deployment time were acceptable, the airlift allocation requirement would drop from 38 percent to 13 percent.



Increasing airfield throughput offers a complementary path to reducing deployment times. To do so, the Army and USTRANSCOM should explore ways to improve offload, airfield clearance, and aircraft turnaround times. Further enhancement can come from frequent practice to maximize process potential. An initial review of data and interviews suggest that ground times for airlift missions in support of unit deployments could be substantially lower than planning factors. For example, average aircraft APOD turnaround time for Task Force Hawk's deployment to Albania in 1999 was about 45 minutes, substantially faster than the 105-minute planning factor. The times continually improved through the operation, with over 50 percent of the flights in the last quarter of the operation turning around in 27 minutes or less. In an air deployment of part of an SBCT in May 2003 employing 45 C-17 lift missions, the operation consistently achieved total APOD turnaround times of between 19 and 34 minutes, facilitated in large part because most of the airlift deployment missions for an SBCT have only vehicles that can be driven straight off a C-17.

#### **DEPLOYMENT PHASING: MINIMIZING TIME TO INITIAL CAPABILITY**

Similar to how division ready brigades are structured for deployment in the XVIII Airborne Corps, the SBCT's deployment might be divided into phases based upon preplanned modules of capability that represent levels of full SBCT capabilities. The first phase might be a combined arms battalion task force plus (a Stryker Battalion Task Force, or SBnTF) with the full breadth (but not depth) of SBCT capabilities. This might be followed by the remainder of the SBCT and then by echelons above brigade support. A notional SBnTF would be half the size of an SBCT, and possibly even smaller with a more detailed examination of "nonmodular" subunits.<sup>3</sup> Given the Fort Lewis-to-Skopje scenario, this force could deploy in about 4 days with 38 percent of the total FY05 lift and with just 8 percent of the lift if forward based. This would enable the SBCT to be leveraged to get

---

<sup>3</sup>In fact, through such an examination, the first operational SBCT—the 3rd Brigade, 2nd Infantry Division (SBCT) (3-2 SBCT) at Fort Lewis—has identified an SBnTF design intended to provide initial operating capability that is about 40 percent the size of the full SBCT.

initial presence on the ground very quickly, with the remainder of the full depth of capability then building, providing more flexibility at a critical time in a crisis. Additionally, it improves the ability to leverage multimodal (air and sea) deployment.

## **A COMPARISON OF DEPLOYMENT STRATEGY OPTIONS**

Figure S.2 summarizes the various deployment closure options and strategies discussed. The left set of columns shows the effect of varying the unit deployment footprint. Given the constant route length, the maximum feasible airlift allocation remains constant while the time improves as the footprint gets smaller. The middle set of columns provides forward unit positioning and selected prepositioning excursions. The third set of columns presents a two-phased deployment flow for the organic SBCT. Given APOD planning factors, a force in the size realm of a light BCT or about half of an SBCT can potentially meet the Army's future force brigade-sized unit deployment goal of 96 hours whether from CONUS or if forward based. Forward basing, however, greatly reduces the airlift allocation needed to reach this goal and makes it more feasible to leverage improved ground times.

## **LEVERAGING MODULARITY FOR RAPID MISSION TAILORING**

A traditional Army strength is the ability to pull elements of many different units together to precisely tailor a force to a mission need. However, this generally begins once a deployment need is identified, and getting to the point where deployment can be initiated can be time-consuming. It is also a process that introduces a great deal of uncertainty about Army lift requirements into the Joint community, complicating the decision process of the combatant commander.

Tailoring, though, reflects an underlying assessment of the capabilities needed and those that each unit or piece of a unit can provide. Additionally, thought must be given to how they are to be tied together by command and control capabilities and how they will be supported. This process could be done more quickly if predefined building blocks of capabilities with detailed time-phased force deployment data were available. These capabilities could include sup-

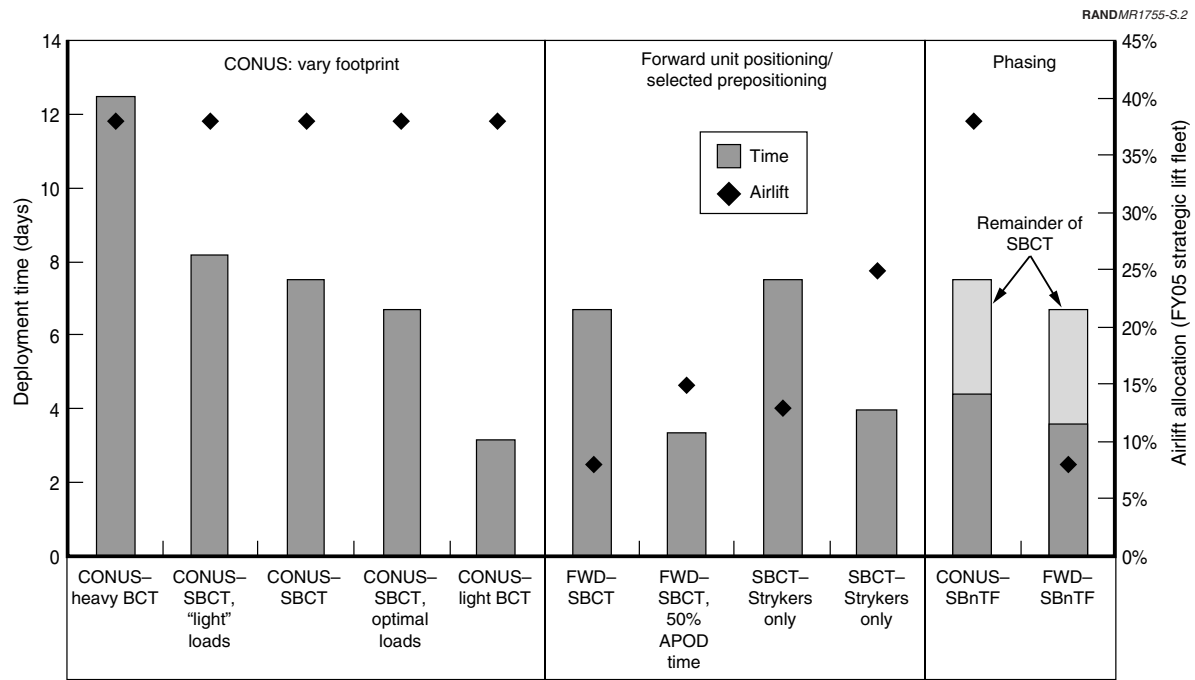


Figure S.2—Comparison of Deployment Times

port augmentation modules based upon potential combinations (e.g., support module of fuel, ammunition, and recovery vehicles for augmentation of an SBCT with a tank unit). Then, for example, some or all of the predefined SBCT capabilities could be combined with other capabilities to meet a wide range of mission needs for early-entry forces. Once capabilities and the associated forces are predefined, a “menu” of modular deployment capabilities can be created for combatant commanders. This would give Joint planners a tool to help them quickly analyze the force package options for a mission. The menu would clearly communicate the deployment resources associated with various options for providing capabilities. The keys to making these concepts work are detailed planning, targeted deployment and operational training, well-designed building blocks, and information systems. Joint habitual relationships could also be created in training to improve joint force effectiveness as well as further enhancing strategic responsiveness.

## RECOMMENDATIONS

First, we recommend that the Army begin evaluating how to transition force deployment to a more capabilities-based approach. A key part of this is to understand the command and control and combat service support implications of creating transparent modularity. In the short term, the Army can apply modularity and new deployment planning concepts to create a phasing strategy for the SBCT and other units that would enable fast response of initial operating capability and flexibility for a range of situations. The longer term will require the development of standards for defining capabilities across the entire force, including “base” and augmentation requirements.

If a deployment speed faster than what is possible from CONUS is desired for SBCTs, other Army units, or future Army forces, the Army and the Department of Defense should develop an integrated global response strategy. A mixed strategy of forward unit positioning and selected repositioning of some SBCT assets is probably ideal, given financial and political constraints. Decisions will most likely have to be made about the extent of global coverage requiring various response speeds.

With regard to throughput capacity and deployment speed, there are several things the Army can do in conjunction with the other services

and Joint organizations to improve. More effective utilization of aircraft through careful preplanning, coordinated with USTRANSCOM, offers an opportunity to improve upon historic aircraft loads, reducing the total number of lift missions for a force. In conjunction with improving load effectiveness, the services should work together to improve tactics, techniques, and procedures (TTP), initially through the designation of a Joint team dedicated to this effort for a short period. Then rigorous practice can ensure that the promise of these TTP can be achieved. Additionally, many of the deployment process capabilities for a unit such as the SBCT could be better than those specified by some of the U.S. Air Force's planning factors. To a large degree, deployment planning factors average many different types of situations. To better understand the responsiveness of a unit such as the SBCT, more detailed planning factors should be developed. Ideally, they should be maintained in a living document as TTP improve. This would enable deployment planners to more effectively communicate deployment capabilities for small-scale contingencies.

Finally, the last recommendation builds upon work the Army has already started with USTRANSCOM and its Air Mobility Command and Military Traffic Management Command Transportation Engineering Agency components. Formal site surveys of SBCT power-projection platforms have been conducted, and projects have been proposed, funded, and initiated to varying degrees to improve outload capabilities. This type of work and monitoring should continue, and it should include enroute bases as well. Beyond facilities and equipment, potential personnel bottlenecks, such as joint inspection or airlift control teams, should be identified.

The deployment problem represents a complex tradespace that, when combined with the need for expert judgment to trade off benefits against costs, is not amenable to optimization. The "best" solution set depends on how fast is fast enough to each region of the world and on assessments of basing and prepositioning site options. Additionally, the recommendations are complementary rather than competing. The force-tailoring recommendations focus on how the Army characterizes its forces and defines the capabilities that they provide. They are intended to improve the effectiveness of force phasing and rapid tailoring so that combatant commanders understand the value of potential Army force options and how they will fit into the overall operational deployment scheme. The intent is that

when commanders ask for a capability, the “right force”—with a known associated demand on lift assets—can quickly be made available for movement. The force-positioning recommendations deal with means for reducing not only deployment time but also airlift requirements once a force package has been selected. While the Army has been thinking primarily in terms of speed, the combatant commander must consider the airlift question as well. It is in this context that forward basing and selected prepositioning are especially useful: for any desired deployment time, they free assets that the commander can use for other purposes. Recommendations to improve throughput ensure that the base structure can be used as effectively as possible. In some cases there is synergy between the two—e.g., forward basing leverages faster ground times. Overall, rather than a specific solution, we have tried to provide a conceptual framework for thinking about how to deploy units within the context of the broader challenge facing combatant commanders.

---

## ACKNOWLEDGMENTS

---

This research was made possible by the sponsorship of LTG Charles Mahan, the Army's Deputy Chief of Staff, G-4. Additionally, his guidance led to the development of many of the messages in the report, and he played a key role in the sharpening of assumptions and baseline capabilities. We also thank him for sponsoring a briefing detailing the research results to GEN John M. Keane, Vice Chief of Staff of the Army, and appreciate his confidence in us to help convey important messages for the Army. At General Keane's request we also briefed Under Secretary of the Army Les Brownlee, as well as the Arroyo Center Policy Committee, the Army's governing board for RAND Arroyo Center. These briefings led to opportunities to further develop the recommendations. We thank MAJ Sean Mulcahey, the G-4 action officer, for coordinating several briefings, for gathering information, for keeping us in the loop on the staff's thinking, and for direct contribution to the research through many discussions. Previously, Ms. Debra Deville of the Logistics Management Institute served a similar role as a member of the G-4's Transformation cell.

General Keane recommended to GEN Kevin P. Byrnes, Commanding General of the U.S. Army Training and Doctrine Command (TRADOC), that he receive a briefing on this research, and he then asked that we work with TRADOC to examine the detailed implications. MG Robert Dail, Chief of Transportation, has pushed this effort forward, and he also provided detailed feedback that helped strengthen the material on theater support vessels, the development of force capability packages, and prepositioning. We continue to work with his Deployment Process Modernization Office (DPMO). The DPMO's Deputy Director, Mr. Hiram Simkins, provided feed-

back on the research as well and is now coordinating broad review of the analysis and recommendations by a cross-section of Army deployment experts. COL Michael Toal, Chief of the Directorate of Combat Developments (DCD) for Transportation, provided key insights with regard to prepositioning and deployment planning. Mr. David Crum, Chief of the Watercraft Branch, DCD for Transportation, and LTC Ron Salyer, Chief of Experimentation and Analysis in the DPMO, provided information on the capabilities and port access potential of theater support vessels. BG(P) Michael Vane, TRADOC Deputy Chief of Staff for Doctrine, Concepts, and Strategy, provided valuable feedback with regard to how TRADOC is thinking about the strategic responsiveness of future forces.

Thanks go to Mr. Michael Williams of the Military Traffic Management Command Transportation Engineering Agency for his feedback through the course of several iterations of a briefing on the report's material and providing several points of contact, and to Mr. Chris Barnhart of the Operational Support Command for helping us understand prepositioning issues. LTC Fred Gellert of the SBCT coordination cell at Fort Lewis coordinated several visits to Fort Lewis for this and other projects, which helped us understand digitization and broader SBCT issues. Mr. Mark Miller, Brigade Mobility Warrant Officer for the 3rd Brigade, 2nd Infantry Division (SBCT), provided insight on developing SBCT deployment issues. We thank Maj. Karl Hackbarth (USMC) for providing comments on rapid deployment from the U.S. Central Command J-8 staff.

At RAND, Lt Col Peter Hirneise (USAF), a former C-17 squadron commander and currently a RAND Air Force fellow, provided valuable insight on C-17 operations and potential paths to improvement from his personal experience moving Task Force Hawk to Albania, delivering cargo to Afghanistan, and working with U.S. Army Special Forces. In addition, he coordinated the gathering of strategic airlift fleet information from the Air Mobility Command, and he helped ensure technical accuracy. LTC Steven Hartman, a RAND Army fellow, developed the information in this report that compares SBCT equipment with currently prepositioned equipment. Bruce Nardulli conceptualized the depiction of deployment time versus combat power tradeoffs employed in this report in the course of his research on the global war on terrorism. Carl Rhodes provided C-17 mission capability data, and his research with Lieutenant Colonel Hirneise on



C-17 operations helped us understand the range of factors that could degrade operations.

It is important to recognize RAND Project AIR FORCE's work on agile combat support structures for supporting Aerospace Expeditionary Forces. Besides laying a broad intellectual foundation for thinking about deployment, this work develops the concepts of initial operating capabilities and full operating capabilities for deploying forces as part of a construct for thinking about how deployment footprint is configured. This research has been led by Bob Tripp with Lionel Galway, Hy Shulman, Tim Ramey, Bob Roll, Mahyar Amouzegar, Jim Leftwich, Pat Mills, Amanda Geller, Kip Miller, Amatzia Feinberg, Tom LaTourrette, Ed Chan, Don Snyder, Dick Hillestad, Chief Master Sergeant John Drew, and one of the authors of this document, Eric Peltz.

John Dumond and Rick Eden helped substantially improve the flow and messages of the report through numerous iterations and brainstorming sessions. LtCol. W. Blake Crowe (USMC) and Jon Grossman reviewed the document and provided many valuable recommendations to improve both the content and the clarity of the discussion. Finally, Nikki Shacklett provided excellent and very rapid response to our editing request.

---

## GLOSSARY

---

AB	Air Base
ABN	Airborne
ACE	Armored Combat Earthmover
A/DACG	Arrival/Departure Airfield Control Group
AEF	Air Expeditionary Force
AF	Air Force
AFB	Air Force Base
AG	Air to Ground
AH	Attack Helicopter
Amb	Ambulance
AMC	Army Materiel Command
Ammo	Ammunition
AO	Area of Operations
APOD	Aerial Port of Debarkation
APOE	Aerial Port of Embarkation
APS	Army Prepositioned Stock
AT	Anti-Tank
BAI	Backup Aircraft Inventory
BCT	Brigade Combat Team

BDE	Brigade
BN	Battalion
BSB	Brigade Support Battalion
C2	Command and Control
CAP	Combat Air Patrol
CBT	Combat
CH	Cargo Helicopter
CO	Company
CONUS	Continental United States
CRAF	Civil Reserve Air Fleet
CRT	Combat Repair Team
CS	Combat Support
CSG	Corps Support Group
CSS	Combat Service Support
CSSC	Combat Service Support Company
DCD	Directorate of Combat Developments
DPMO	Deployment Process Modernization Office
eq.	Equivalent
Evac	Evacuation
FA	Field Artillery
FBCB2	Force XXI Battle Command Brigade and Below System
FORSCOM	Forces Command
FY	Fiscal Year
GRL	Global Reach Laydown
HEMAT	Heavy Expanded Mobility Ammunition Trailer
HEMTT	Heavy Expanded Mobility Tactical Truck
HET	Heavy Equipment Transporter

HHC	Headquarters and Headquarters Company
HHS	Headquarters and Headquarters Support Battery
HMMWV	High Mobility Multi-purpose Wheeled Vehicle
HQ	Headquarters
IAV	Interim Armored Vehicle
ICV	Infantry Carrier Vehicle
IN	Infantry
Inf	Infantry
JEF	Joint Expeditionary Force
LHS	Load Handling System
LIN	Line Item Number
LMSR	Large, Medium-Speed Roll-on/Roll-off
LMTV	Light Medium Tactical Vehicle
MAIRS	Military Airlift Integrated Reporting System
Max	Maximum
MGS	Medium Gun System
MI	Military Intelligence
Mob	Mobility
MOG	Maximum on Ground
msn	Mission
MTOE	Modified Table of Organization and Equipment
MTS	Movement Tracking System
MTV	Medium Tactical Vehicle
NM	Nautical Mile
OEF	Operation Enduring Freedom
OTOE	Objective Table of Organization and Equipment
P	Strategic Parking

PAI	Primary Aircraft Inventory
PAX	Passengers
PLS	Palletized Loading System
PLT	Platoon
PMAI	Primary Mission Aircraft Inventory
Prepo	Prepositioned
Qty	Quantity
R/T	Rough Terrain
RSTA	Reconnaissance, Surveillance, and Target Acquisition
RT	Round Trip
S	Sustainment
SA	Situational Awareness
SBCT	Stryker Brigade Combat Team
SBnTF	Stryker Battalion Task Force
SEAD	Suppression of Enemy Air Defenses
Secs	Sections
SOC	Special Operations Capable
SOF	Special Operations Forces
SPOD	Seaport of Debarkation
SPT	Support
Sq Ft	Square Feet
SSC	Small-Scale Contingency
ST	Short Ton
STON	Short Ton
Strat	Strategic
TAI	Total Aircraft Inventory
TALCE	Tanker Airlift Control Element

TFOM	Theater Force Opening Module
TPFDD	Time-phased Force Deployment Data
TRADOC	Training and Doctrine Command
Trkd	Tracked
TSV	Theater Support Vessel
TTP	Tactics, Techniques, and Procedures
TWV	Tactical Wheeled Vehicle
UA	Unit of Action
UH	Utility Helicopter
USTRANSCOM	U.S. Transportation Command
Veh	Vehicle
Vert.	Vertical

This report explores ways in which the Army might improve its ability to contribute to the prompt, global power-projection capability of the United States. By that we mean the strategic responsiveness of early-entry forces in situations where time is critical, whether for a small-scale contingency (SSC) or as the initial forces in a large buildup. We examine the two parts of the problem—determining the precise force requirements and appropriately sequencing the force’s capabilities (tailoring and phasing), and then moving early-entry forces—through a focus on the Army’s new Stryker Brigade Combat Team (SBCT).<sup>1</sup>

This research grew out of an examination of the deployment time potential of the SBCT, which has been created, among other capabilities it offers, to improve the Army’s strategic response value. However, as we grew to understand the SBCT’s design and examined what it would take to deploy one, we came to better appreciate the broader dynamics of strategic response. As a result, our analysis ex-

---

<sup>1</sup>SBCT fielding schedule:

- 3rd Brigade, 2nd Infantry Division (3-2 SBCT), Fort Lewis, Washington, FY03 (until FY07, when the Army plans to convert a brigade in Germany to the SBCT design)
- 1st Brigade, 25th Infantry Division, Fort Lewis, FY04
- 172nd Infantry Brigade, Fort Wainwright, Alaska, FY05
- 2nd Cavalry Regiment, Fort Polk, Louisiana, FY06
- 2nd Brigade, 25th Infantry Division, Schofield Barracks, Hawaii, FY07
- 56th SBCT, 28th ID, Pennsylvania Army National Guard, FY10

amines the possibility of achieving the Army's future force<sup>2</sup> goal of making a brigade-sized, moderately powerful unit available to a combatant commander within 96 hours of the first "wheels-up" by leveraging the deployment tradespace, the deployment time potential of a smaller force with a similar breadth of capability. Further, we examined how the Army might improve its ability to help enable the rapid-deployment initiation of joint, mission-tailored packages of capabilities.<sup>3</sup> In essence, there are two problems: initiating deployment of the right force capabilities, and then getting these capabilities where they need to be as quickly as possible.

This report addresses the question that has received much attention: "How quickly can the SBCT deploy from the continental United States (CONUS)?" and expands this to how its deployment value can be improved. Since we are only examining those situations for which rapid deployment is critical, we focus on air deployment. It is this situation, which may merit a reasonably large airlift allocation (the proportion of available airlift allocated to deploy a force), that is of interest from an air deployment standpoint, not the "average" or typical deployment. Unless the airlift allocation is relatively high, a force can often deploy more quickly by sea if the deployment location is somewhat near a port.

Chapter Two lays out the assumptions used in the analysis and baseline deployment conditions. Chapter Three treats the deployment closure time question from the three dimensions of the tradespace:

- **Deployment footprint:** how much has to be moved.
- **Throughput capacity of the "deployment system":** how much can be moved per unit of time.
- **Force positioning:** how far and over what route equipment or units need to be moved.

Chapter Four discusses ideas for minimizing the time needed to begin the deployment of minimum essential forces that build on the Army's tradition and skill at creating finely tuned, mission-tailored forces. Chapter Five offers our conclusions and recommendations.

---

<sup>2</sup>The term "future force" is the replacement for the term "Objective Force."

<sup>3</sup>See Headquarters, U.S. Army, *Concepts for the Objective Force*, United States Army White Paper, 2001.



---

## THE DEPLOYMENT SYSTEM AND MODELING ASSUMPTIONS

---

### THE DEPLOYMENT PROCESS

#### Determining the Deployment Plan

Once a decision is made to consider or employ military force, the designated combatant commander must determine the capabilities required to accomplish the mission. Based upon the requisite capabilities and situation, the commander, working with Joint organizations and the services, selects the appropriate units (or parts of units) and determines the deployment sequence. At this point, the U.S. Transportation Command (USTRANSCOM) and the commander's staff build the deployment plan documented by time-phased force deployment data (TPFDD).

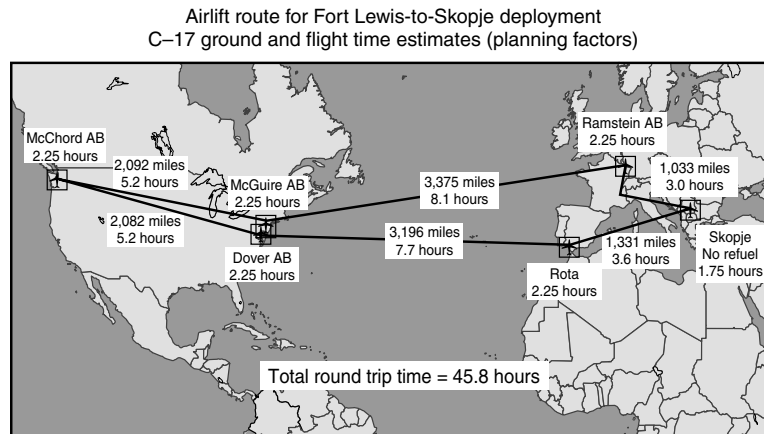
#### Preparing for the Movement of Forces

Before movement of a unit can begin, USTRANSCOM must construct what is called the global reach laydown (GRL). This consists of selecting a deployment route and manning and equipping the air bases on this route as needed. An example of such a structure is shown in Figure 2.1. The deployment route is generally based upon air base selection that limits flight legs to 3,500 nautical miles (NM) or less, the standard operating range of U.S. strategic lift aircraft.<sup>1</sup> Bases are of three general types: aerial ports of embarkation (APOE) from

---

<sup>1</sup>Headquarters, U.S. Transportation Command, "Interim Brigade Combat Team Air Mobility Deployment Analysis," unpublished report, 2002.

RANDMR1755-2.1



**Figure 2.1—An Example Air Deployment Structure**

which deployment units depart; enroute bases used for refueling; and aerial ports of debarkation (APOD) at the destination. While APOEs and enroute bases are generally operational prior to a deployment, they may need an increase in personnel and even equipment to fully utilize their capacities and support the deployment flow at the desired level. At the APOD, however, the U.S. military may be starting from a “bare base” without any personnel and little equipment to run an airfield and to service and unload aircraft. The personnel and equipment that must be deployed to build the GRL are one form of what are called enabling forces.

The GRL includes personnel and equipment to staff the functions (needed to run an airfield) such as Tanker Airlift Control Element (TALCE), maintenance, security forces, aerial port, air traffic control, crash, fire and rescue, medical, intelligence, explosive ordnance disposal unit, and weather.<sup>2</sup>

The enabling force at the APOD is called the Theater Force Opening Module (TFOM).

<sup>2</sup>Ibid, p. 30.

USTRANSCOM estimates that the GRL can require up to 2,300 passengers and 3,350 short tons (STONs) and take 4–5 days to construct for more difficult scenarios requiring a large number of enroute bases and a distant location with austere conditions (e.g., Fort Lewis/McChord Air Force Base (AFB) to Central Africa). A less stressing deployment scenario such as Fort Lewis to Colombia would reduce the requirement to about 1,000 passengers and 1,100 STONs and require 1–2 days to put in place.<sup>3</sup> Additionally, the negotiation of basing and overflight rights may increase these preparation times. Thus, the construction of a GRL ideally starts upon strategic warning of a potential contingency.

### **Aerial Port of Embarkation Processes**

While the GRL is being constructed or once a deployment order is given, the deploying Army units will begin moving personnel and equipment to a holding area at the APOE. In some cases, the unit may have to reconfigure or even determine the planned flow sequence and associated aircraft “chalks” or aircraft loads. Ideally they will move from their unit motor pools in a predetermined “chalk” sequence. This can require a convoy from the Army post to the APOE when they are not collocated. At the APOE, the Arrival/Departure Airfield Control Group (A/DACG) personnel and the Air Force Tanker Airlift Control Element (TALCE) work together to prepare aircraft loads for the arrival of aircraft. When ready, they are moved to a “Ready Line” for an inspection to ensure that they meet aircraft loading standards and for staging—in other words, to wait their turn to board an aircraft. Besides loading the unit, aircraft often also refuel at the APOE. In other cases, a separate refuel base might be set up if the APOE lacks sufficient refueling capacity to support the desired frequency of flights. Additionally, maintenance might be performed at the APOE.

### **The Deployment Route**

As an illustration, Figure 2.1 shows a route (with different outbound and aircraft return routings to reduce enroute base congestion) for a

---

<sup>3</sup>Ibid, p. 53.

deployment from Fort Lewis to Skopje, Macedonia. It is a route that was used by USTRANSCOM in a study of the SBCT's deployment potential. For units deploying by air from Fort Lewis, the APOE is McChord AFB, which is nearby but not collocated with Fort Lewis, requiring a convoy operation. The selected deployment route employs two enroute bases in both the outbound and return directions. These bases enable the route to operate without aerial refueling and enable the avoidance of refueling at the relatively austere APOD in Skopje. Additionally, avoiding the need to refuel limits the need for resources at the APOD and reduces APOD ground time, where the threat conditions may be high. Beyond fueling, maintenance would be deferred, to the extent possible, for execution at enroute bases or APOEs. Therefore, the enroute location at Rota Air Base (AB) is known as a recovery base.

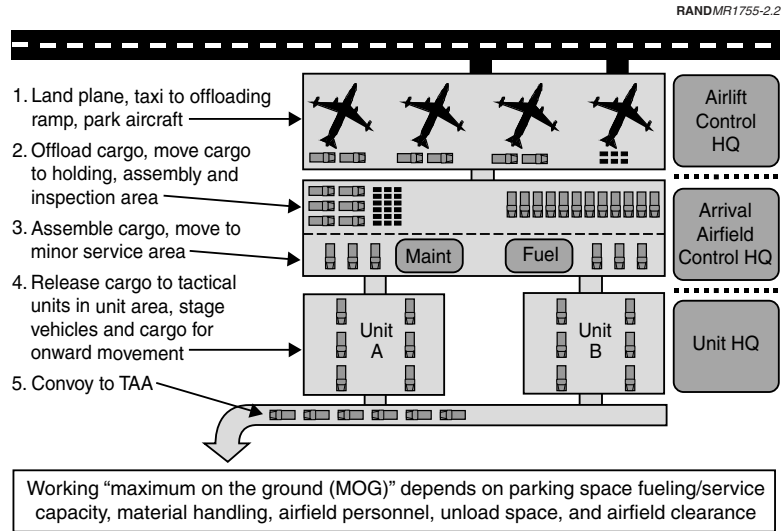
The numbers on the links between air bases indicate the distance in nautical miles and rough estimates of the C-17 flight times for these distances (not accounting for wind). The numbers under the base names are estimated ground times for C-17s. Given the times shown, the round trip time for a C-17 would be almost 46 hours. In other words, each C-17 could be used to deliver a load to the APOD every 46 hours assuming no significant maintenance enroute and that aircrews are available to switch out as necessary.

### **The Deployment Brigade Combat Team Deployment Goal**

For the future force, the Army has set a goal of deploying a brigade-sized unit in 96 hours. This metric for this goal has been defined as the time from wheels-up of the aircraft with the first load of the unit until the last aircraft is unloaded at the APOD. Thus, it does not include the time to negotiate basing and overflight rights, construct the GRL, or determine the force to deploy.

### **AIRFIELD THROUGHPUT**

The previous section laid out the deployment process and the length of time it takes for each aircraft to deliver a load to the APOD. We now turn to the factors that determine the throughput of aerial ports, with a focus on APODs, with a notional APOD illustrated in Figure 2.2. The throughput capacity determines how frequently aircraft can be brought into airfields.



SOURCE: The graphic and process steps are from Keith Solveson and Bill Tarantino, "Enabling Strategic Responsiveness Results (ESR) aka 'The Prepo Study,'" unpublished briefing, Department of the Army, Deputy Chief of Staff, G-3, and Center for Army Analysis, 2002.

**Figure 2.2—Throughput Is a Function of Working MOG, Ground Times (Processes), and Airfield Operating Hours**

The first throughput factor is what is known as the working maximum on the ground (MOG) or working MOG. This is a measure of how many aircraft can be simultaneously handled at the airfield. It is a function of the aircraft parking space, TALCE personnel to guide aircraft to their parking spaces and monitor them during engine running offloads, materiel-handling capacity (both equipment and space for offloaded cargo), fueling capacity as necessary, aircraft service capacity, and ammunition-handling restrictions. In some cases the "allocated" working MOG for a unit deployment is less than the total airfield capacity. For example, humanitarian operations may require the same airfield, or the host nation may wish to continue operations on part of the airfield.

The second factor is how long it takes to turn around an aircraft and process its loads through the airfield—how quickly the various processes are executed from landing through takeoff. Unit processes, cargo areas, vehicle servicing, and unit assembly areas can come into play with respect to airfield clearance.

The third factor is the airfield's operating hours, which can be affected by the threat or environmental conditions. As an example, an APOD with a working MOG of 3, at which it takes two hours to turn around and "clear" the loads for each aircraft from the parking area, operating 24 hours per day, could accept and process 36 aircraft loads per day.

There is one additional point that is not well appreciated. As we will discuss later, the time it takes to process an aircraft load and turn around the aircraft is dependent upon the type of cargo and offload/airfield clearance process procedures. However, beyond just the airfield processing or ground times, the actual cargo types and airfield procedures can change the working MOG of some airfields. In particular this applies to the deployment of a force such as the SBCT, for which it should be possible to configure many aircraft loads with vehicles and personnel only. In many cases, working MOG is constrained by materiel-handling equipment and space to put palletized cargo on the ground. When the cargo consists of only rolling stock, these constraints can be taken out of play. With the right tactics, techniques, and procedures (TTP) in terms of how the airfield is configured and moving vehicles off the airfield (and assuming no refueling or other service operations), the working MOG limit can become simply how many C-17s can be parked and handled by TALCE personnel—whether in official parking spaces, alternate runways, or taxiways. As part of the process improvement and situation-specific planning factor recommendations we will discuss later, this should be explored jointly by the Army and USTRANSCOM to determine the changes in TTP necessary to maximize working MOG in such situations and whether or not to make such an evaluation part of airfield surveys. For example, there could be one projected contingency working MOG for sustainment operations (primarily palletized cargo) or the deployment of units with palletized cargo, and one for the deployment of units with primarily vehicular cargo, since aircraft loaded with pallets and those loaded with vehicles place significantly

different demands on APOD operations. The latter configuration could be used for the first few days of a deployment, as appropriate.

## MODELING ASSUMPTIONS

Since the Army set out to enhance its strategic responsiveness and began to develop a medium-weight brigade for what had been called the interim force, the deployment closure time capability of draft designs, which culminated in the SBCT, has been the subject of a large number of studies both within and outside the Army. One of the reasons for this is that a large number of assumptions must be made to conduct such an analysis, and there is significant uncertainty about what parameters to use for many of the assumptions. Additionally, there is scenario uncertainty. This research is intended to provide insights on opportunities for improving deployment times through a detailed examination of various deployment cases for one scenario. In the process, the intent is to present “best-case” condition deployment times given reasonable assumptions with regard to current deployment capabilities such as aerial port ground times. By best-case conditions, we mean conditions such as 24-hour airfield operations and no major disruptive events due to enemy action, maintenance, weather, and other events. Figure 2.3 summarizes the assumptions, which are discussed in more depth in the subsections below.

### Deployment Node Throughput

Many of the assumptions affect the throughput of deployment nodes to include APOEs, enroute bases, and APODs. As we discussed, combined with the working MOG, several other factors determine node throughput. The first is the length of time an aircraft spends at each node—what we have been calling the ground time. We employ the planning factors specified in Air Force Pamphlet 10-1403, *Air Mobility Planning Factors*, for C-17s and C-5s, the aircraft considered in this study. Additionally, the expedited times for the APOD are assumed. The expedited times are based upon no refueling or aircraft reconfiguration at the APOD. Thus, the routes used in our analysis are based upon routes developed by USTRANSCOM that keep the flight leg from the last enroute base to the APOD and the leg to a recovery base within refuel range given heavy cargo loads (up to the planning allowable cabin load), preventing the need for refueling at

RANDMR1755-2.3

Ground times (hours) (planning factors: all cargo) <ul style="list-style-type: none"> <li>• About 85% of missions have rolling stock and PAX</li> <li>• Expedited assumes recovery bases for fueling</li> </ul> Missions required based upon load plans (vs. planning factors): 50 ST vs. 45 ST	<table border="1"> <thead> <tr> <th></th> <th>C-17</th> <th>C-5</th> </tr> </thead> <tbody> <tr> <td>Load/fuel and service</td> <td>2.25</td> <td>4.25</td> </tr> <tr> <td>Enroute fuel and service</td> <td>2.25</td> <td>3.25</td> </tr> <tr> <td>Unload (APOD expedited)</td> <td>1.75</td> <td>2.00</td> </tr> <tr> <td>Transload</td> <td></td> <td>4.00</td> </tr> </tbody> </table>		C-17	C-5	Load/fuel and service	2.25	4.25	Enroute fuel and service	2.25	3.25	Unload (APOD expedited)	1.75	2.00	Transload		4.00
	C-17	C-5														
Load/fuel and service	2.25	4.25														
Enroute fuel and service	2.25	3.25														
Unload (APOD expedited)	1.75	2.00														
Transload		4.00														
24-hour airfield operations																
Airlift fleet (Primary Mission Assigned Inventory): FY05 used unless indicated																
<ul style="list-style-type: none"> <li>• Near term (end of FY05) / Longer term (end of FY09 )</li> <li>• C-17: 116 / 153</li> <li>• C-5: 92 / 92</li> <li>• Nov 2002 C-17: 84, C-5: 104</li> </ul>																
No flight crew limitations (number of crews and qualifications)																
No "real world" friction / variability																
Operational readiness rates (FY02)																
<ul style="list-style-type: none"> <li>• C-17: 85%</li> <li>• C-5: 68%</li> </ul>																

**Figure 2.3—Assumptions for Deployment Closure Time Modeling**

the APOD. Also, because this study is concerned with initial deployment, there is limited need for retrograde and potential associated aircraft reconfiguration. Thus, the use of the expedited times as opposed to standard factors is assumed.

However, it is possible that even the expedited times are conservative and that a better average APOD ground time for an SBCT will be possible, which would improve throughput. The planning factors cited are based upon averages across an entire deployment for all types of cargo. However, based upon our analysis, more than 90 percent of the SBCT airlift missions will be for rolling stock and passengers, both of which can be offloaded relatively quickly compared to cargo requiring the use of materiel-handling equipment. Interviews suggest that when units have practiced deployment operations, rolling stock can often be unloaded in 20 to 45 minutes. Thus, while some additional ground time beyond unload is needed for airfield operations, the expedited time could probably be improved upon for the portion of an operation devoted to the deployment of rolling stock and passengers. Given the uncertainty about these times, we will examine cases with shorter APOD ground times and data from



recent operations. Additionally, we suggest that during SBCT exercises, offload and aircraft turnaround at APODs should rigorously simulate actual deployments, and the Army should measure total aircraft ground times to establish and maintain an SBCT-specific planning factor. This will enable more precise analysis of expected SBCT deployment closure times for different scenarios. This will be discussed further in the throughput capacity section of Chapter Three and in the recommendations.

The second throughput factor is airfield use limitations that limit hours or landing frequency. In our analysis, we generally assume no restrictions on either aspect, although the effect of limited airfield operating hours will be shown.

### Utilizing Node Throughput Capacity

Three factors affect the ability to use the entire throughput potential of a node: the number of aircraft available, how well aircraft and flight crews can be scheduled and synchronized, and the number of flight crews with the necessary qualifications given any restrictions associated with the employed airfields. Rather than use a point estimate airlift assumption, we show how much of the military organic airlift would be needed to maximize the throughput potential of the route. Later, we will discuss what airlift allocation might be provided to the SBCT in a rapid-deployment situation. At the end of fiscal year 2005 (FY05), the strategic primary aircraft inventory (PAI) will be 116 C-17s and 92 C-5s, and, at the end of the current approved procurement plan in FY09, the C-17 PAI will be 153 with the C-5 PAI remaining unchanged.<sup>4</sup> We assume no flight crew limitations on capacity<sup>5</sup> and perfect synchronization.<sup>6</sup> While this last assumption is clearly

---

<sup>4</sup>The total aircraft inventories (TAI) will be 137 C-17s and 126 C-5s at the end of FY05 and then 180 C-17s and 126 C-5s at the end of FY09. The difference between the PAI and the TAI reflects backup aircraft inventory (BAI) to cover programmed depot maintenance and training fleet aircraft. Current PAIs as of January 2003 are 85 C-17s and 104 C-5s. This information comes from an Air Mobility Command C-17 delivery and basing plan, 30 January 2002, and Air Mobility Command Studies and Analysis.

<sup>5</sup>The active duty C-17 flight crew to aircraft ratio is 3 to 1, and it is 5 to 1 when including reserve flight crews.

<sup>6</sup>The "synchronization" planning factor is 85 percent throughput efficiency. This is likely to vary depending upon the complexity of the route (e.g., no stops versus a more

optimistic, we used this to balance the conservatism of the APOD ground time assumption. Additionally, we do not account for variability (“normal” friction) and assume that no major disruptive events impede airlift.

The final assumption is the operational readiness rate of the airlift fleet, which affects the amount of aircraft necessary to provide a given level of airlift. Air Mobility Command reported C-17s at 85 percent and C-5s at 68 percent during FY02, which we use as the assumed operational readiness rates.<sup>7</sup> For comparison to planning factors, using the assumed operational readiness rates, the flight time for the route from Fort Lewis to Skopje used in this study, and assumed ground times, the resulting aircraft daily flying hour use rates of 14.6 and 10.3, respectively, for C-17s and C-5s are similar to the surge planning factor rates of 15.15 (C-17) and 11.4/10.0 (C-5A/C-5B) flying hours per day. For the forward-based excursion from Ramstein to Skopje, the flying hour use rate becomes 12.2 hours per day for C-17s or just a little more than the contingency planning factor rate of 11.7 flying hours per day.<sup>8</sup> This reveals that utilization is somewhat specific to the scenario. Thus to the extent possible, it is desirable to use a scenario-specific utilization rate. Surge rates assume full reserve mobilization, scheduled maintenance deferrals, and overtime by support personnel, and they are assumed to be sustainable for 45 days. Wartime sustained daily flying hour use-rate planning factors, which assume normal duty days and the accomplishment of scheduled maintenance—to include that deferred during the surge period—are 13.9 and 8.4 hours, respectively, for the C-17 and the C-5. Contingency planning factor rates assume 25 percent reserve mobilization and are 5.8/7.5 flying hours per day for C-5As/C-5Bs.

---

complex route with two enroute bases) and the amount of time that high intensity has to be maintained.

<sup>7</sup>Headquarters, Air Mobility Command, Health of the Force briefing, October 2002.

<sup>8</sup>For a somewhat similar route from Ramstein to Rinas airport in Albania for the deployment of Task Force Hawk in 1999, we estimate a daily flying hour use rate of 8.7 hours per C-17, somewhat below the assumed value. This is based upon flying hour data from Air Mobility Command’s Global Decision Support System (GDSS) for 8–30 April.

## Aircraft Loads

The final factor that determines the rate of material flow is the amount of materiel brought on each aircraft. As with ground times, planning factors for aircraft loading consider an average across an entire deployment for all types of cargo. For a full deployment, a large number of aircraft “cube out” (fill up the available floor or total cabin space in the aircraft before reaching the cargo weight limit). Further, the entire airlift flow may not be carefully planned to maximize airlift utilization, given unit deployment combat loading constraints such as unit integrity. However, *if* the deployment of a small unit’s equipment is well planned and practiced, many of the aircraft should “weight out” (reach the cargo weight limit before using all of the floor space). By well planned, we mean that each aircraft load is preplanned and that the vehicle and aircraft load plans are “precertified” by the Air Mobility Command.<sup>9</sup> In this report, rather than assuming an average aircraft load, we base the required number of airlift missions on an actual analysis of the requirements based upon the SBCT’s equipment. This will be covered in the deployment footprint section of Chapter Three.

## CONDITIONS THAT COULD SLOW DEPLOYMENT

As alluded to or directly indicated in the discussion of assumptions, there are many conditions that could cause deployment closure times to be longer than those reported in this research or, in other words, to be not best case. Airfield, especially APOD, throughput capacity can be reduced by several conditions that limit maximum landing weights. These include hot and wet weather, high altitude airfields, relatively short runways, or effective runway length limited by damage. Additionally, airfields can be restricted to certain operating hours by risk conditions, or poor weather can lead to instrument flight rule conditions. Such conditions can also lead to flight crew limitations, such as nighttime flying into high-risk areas, restricting available flight crews to those who are night vision goggle qualified.

---

<sup>9</sup>A vehicle load plan specifies how material is to be loaded upon a vehicle. This might include sustainment cargo, equipment, and personal gear.

If the aircraft are carrying ammunition (hot cargo), fewer usable parking spaces may be available at APOEs and enroute bases. Representative analysis performed by USTRANSCOM based upon scenarios provided by the Army's Office of the Deputy Chief of Staff, G-3, suggests that when APOD working MOG is restricted to typical historical levels, low levels of hot cargo are unlikely to have major effects for most locations. But when hot cargo reaches 50 percent of missions or when APOD working MOG is relatively high, hot cargo restrictions at enroute bases may become a bottleneck, in particular for deployments to the southern half of Africa.<sup>10</sup>

Transloading delays at enroute bases can limit throughput by increasing ground times, and transloading could increase the number of dedicated aircraft needed to maintain a given air flow level. We have not been able to gather good data for the likely length of such delays, but interviews indicate that shipments to the Afghanistan area of operations for Operation Enduring Freedom (OEF) have encountered significant transloading delays. It should be noted, however, that for many of the deploying Army units, deployment speed was not the top airlift priority of the combatant commander.

Finally, enemy attacks on airfields can restrict or even stop airflow, and major maintenance problems at enroute bases or APODs can consume working MOG.

#### **AIRLIFT ALLOCATION AND WORKING MOG: BASELINES FOR ANALYSIS**

In evaluating the potential deployment closure time of the SBCT, perhaps the greatest variation in modeling and differences of opinion has concerned what working MOG to use and how much airlift the Army will be allocated.

#### **Airlift Allocation**

Airlift is harder to generate agreement on, because the airlift allocation is a command decision based on the priorities of the combatant

---

<sup>10</sup>Headquarters, U.S. Transportation Command, "Interim Brigade Combat Team Air Mobility Deployment Analysis," unpublished report, 2002.

commander as well as national priorities with respect to the allocation of airlift among operations/theaters. The question often asked is: How much airlift can the Army expect to get, given past deployments? The answer is that it depends upon the commander's and national priorities and thus the specific mission and overall security environment. Consequently, there is not a specific "baseline" point assumption that can be reasonably justified. Two historical data points may represent extremes. In Desert Shield, it was critical to get troops on the ground as quickly as possible in order to slow or deter a feared Iraqi advance into Saudi Arabia. This took priority, so the 82nd Airborne Division received a high proportion of the airlift over the first few days of the deployment—more than twice the 1st Tactical Fighter Wing allocation, which was the other early-deploying force by air, and the Army as a whole received the highest airlift allocation among the services during the first month, almost half of the total.<sup>11</sup>

Beyond the pure numbers, though, the key point is that interviews and data indicated that both units received about as much airlift as they could smoothly outload. It was reported that the Military Airlift Command (former name of what is now the Air Mobility Command)

---

<sup>11</sup>Information in our analysis came from *An Assessment of Strategic Airlift Operational Efficiency*, a RAND Project AIR FORCE report (Lund, Berg, and Repogle, 1993), using data from the Military Airlift Integrated Reporting System (MAIRS). This document lists each airlift mission for the initial deploying Army and Air Force units, the 82nd Division Ready Brigade and the 1st Tactical Fighter Wing. Based upon these data, we counted 104 missions for the 82nd and 43 for the 1st TFW from 8 to 12 August. While the 82nd did require more lift overall, there were days on which the 1st TFW was still deploying that the 82nd received a greater allocation. We have been unable to document how many of these missions were provided by organic strategic lift aircraft versus commercial; we note, however, that the Civil Reserve Air Fleet (CRAF) was not activated until 17 August, and the overall use of commercial airlift during August was low, at only 11 percent of the lift missions. During the entire month of August, the Army received 42 percent of the airlift missions, accounting for 46 percent of the cargo and 48 percent of the passengers moved by air, reflecting either more efficient loading by the Army, a relatively greater allocation of large aircraft to the Army, or both. Daily graphs indicate that the Army allocation purely in terms of missions was higher at the beginning of August (about 50 percent) than the end (about 33 percent). The second-highest month with regard to the allocation of cargo airlift to the Army was September, at 33 percent. Channel missions were not allocated to the services in the analysis.

It should also be noted that initial Marine forces used prepositioned afloat equipment, with the personnel flying in via commercial aircraft. This is an example of the value of using multiple nodes and modes of deployment to maximize total force deployment speed.

actually had to reduce airlift to both the APOEs for both of the initial deploying units because excessive delays were occurring. The data (by mission) show that when outflow slowed, user-caused APOE delays went down dramatically. This example shows that if the combatant commander wants an Army ground force somewhere quickly and makes this one of the top priorities, it will receive a relatively high level of airlift allocation (note that the actual level of airlift made available will sometimes be limited by aerial port throughput capacities).

Recent Army deployments to Afghanistan as part of Operation Enduring Freedom present a contrasting situation. While it was desired to get ground forces there quickly, other concerns took priority during the time period of their deployments to OEF. For example, search-and-rescue capabilities had to be deployed before bombing could commence. Humanitarian missions were important. Another priority was to establish a basing structure in the region. Additionally, there was no compelling time deadline for troops on the ground that had to be met, and initial deploying ground combat forces were small special forces units. When larger units from the 101st Airborne (Air Assault) division deployed, they did not represent early-deploying forces, and time criticality for their deployments remained a relatively low command priority.

We use deployments from Fort Campbell as an example. Across several units and task forces, the average number of daily deployment missions was just 3 aircraft per day, and the peak was 6 per day over a two-week span. One should note, though, that node capacity was a tighter constraint for OEF than Desert Shield; early on, no more than 12 missions into Kandahar were possible per 24-hour period. A more detailed examination of Fort Campbell-based unit deployments further reveals how airlift allocation will vary with deployment. In particular, three task forces of the same size—in terms of aircraft mission requirements—deployed in three dramatically different times, as shown in Figure 2.4. The x-axis indicates the number of airlift missions for various task forces or units that deployed from Fort Campbell and the y-axis indicates the elapsed time in days from the first departure flight to the last.

Thus, in the analysis that follows, rather than specifying a baseline airlift allocation and estimating how deployment time would change

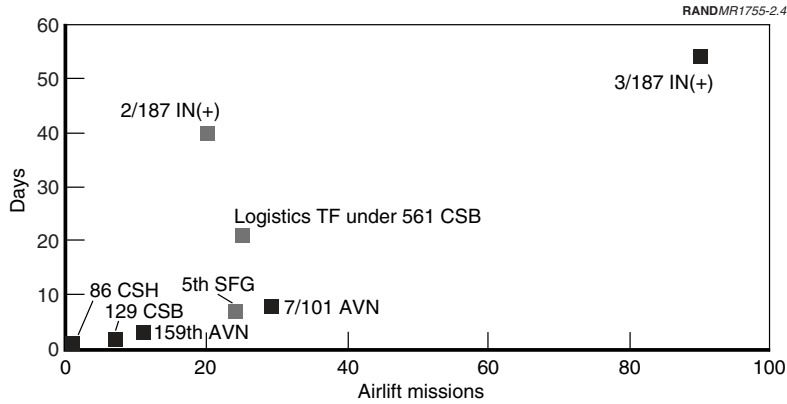


Figure 2.4—OEF Deployments for Fort Campbell Units: Days from First to Last Aircraft Departure

if the allocation changed, we leave this variable as unspecified. Then, we indicate the maximum amount of airlift that could be used given the throughput capability of the node capacities. Depending upon the importance of getting SBCT elements on the ground, the commander could elect to use up to this level of airlift. We do note, however, that we are interested in the deployment potential of the SBCT in situations where ground force deployment time is critical rather than the average or typical deployment time. Thus, higher end, but still reasonable, airlift allocation estimates are most appropriate for consideration in evaluating potential deployment speed.

### Working MOG

In contrast to airlift allocation, the working MOG of the aerial ports and enroute bases, in particular enroute bases and APODs, is much less under the control of the combatant commander. To a great extent, the commander, especially in the initial phase of a deployment, must deal with the existing working MOG of the airfields that can support the operation. In this report we focus on APODs, which have

often been the limiting throughput factor in air-based deployments, even for the initial phase of Desert Shield.

At Dharan, for example, only about 30 landings could occur per day over the first couple of months, which is equivalent to a working MOG of 2 using our ground time assumptions. The deployment of Task Force Hawk in 1999 to Albania was limited by an allocated working MOG of 2 C-17s at the Rinas airport, and these aircraft had to be carefully coordinated on the airfield to enable takeoffs and landings given the tight space. Figure 2.5 shows the Rinas airfield in Albania, through which Task Force Hawk deployed in 1999.<sup>12</sup> Note



SOURCE: U.S. Department of Defense.

**Figure 2.5—Rinas Airport, Albania During the Deployment of TF Hawk**

<sup>12</sup>Task Force Hawk was the name of the U.S. Army force that deployed to Albania during the Air War Over Serbia to drive the Serbian forces from Kosovo.



that the picture shows, as well as the limited parking space, the meager space for handling cargo. Kandahar's working MOG grew from 1 to 3, and operations at Kandahar were limited primarily to night due to the risk of ground fire to a landing transport aircraft; the limit was about 12 missions per night. In addition, runway damage and weather conditions constrained C-17 loads at times. A key airfield in Uzbekistan for the deployment of combat search and rescue (CSAR) capability had an initial working C-17 MOG of just 1.

Additionally for Task Force Hawk and small units deploying for OEF, only one airfield was found to be practical for the deployments. Splitting the forces would have been infeasible either because of the distance between APODs or because of increased risk.

Thus, recent deployment history suggests that an initial deploying force will often be faced with the need to deploy into one APOD with a working MOG of 3 or less. Therefore we use a working MOG of 3 as a baseline in our analysis. However, we do show the effect of varying the working MOG when we examine throughput capacity.

---

**LEVERAGING THE DEPLOYMENT TRADESPACE TO  
IMPROVE STRATEGIC RESPONSIVENESS**

---

Given the assumptions and baseline, we now examine how the three dimensions of the deployment closure time tradespace—how much has to be moved, the rate at which materiel can be moved through the deployment system, and how far materiel has to move—affect deployment closure time and deployment resource requirements. This is done using an SBCT case study of a deployment to Skopje, Macedonia, examining how the SBCT improves deployment speed capability and how the tradespace dimensions might be leveraged to further improve speed.

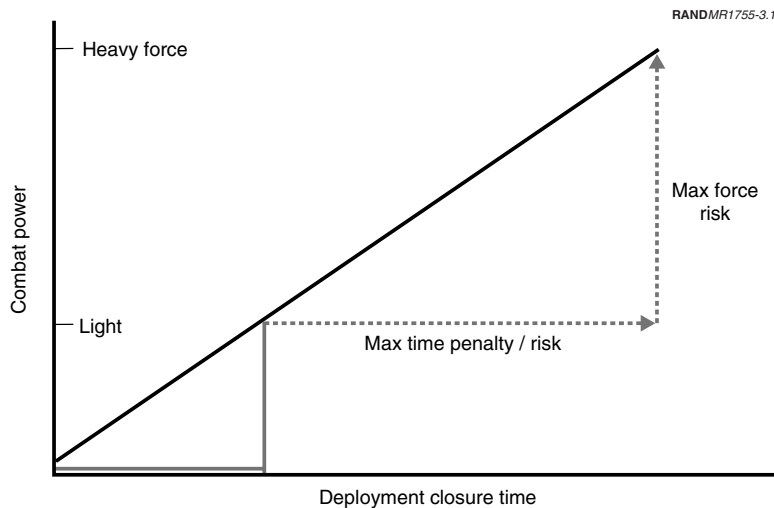
**DEPLOYMENT FOOTPRINT**

**The Choice of Forces for Early Entry**

Currently, the Army's light-heavy conventional force structure forces a choice between response speed and combat power. If we think of combat power along one dimension for simplicity, such as a measure of lethality and survivability, for a given unit size we can posit a relationship between how long it takes to deploy and how much combat power can be deployed. Today there is a big gap between the firepower of an Army heavy brigade and a light brigade and a corresponding big gap between the deployment closure times. When deployment time is critical and the combat power need exceeds that of a light unit at a desired level of operational risk, one of two risks has to be accepted (unless another service can provide the right combat power in the right time). If time is deemed paramount, then a level of force or operational risk will result. Alternatively, if the force risk is

not acceptable, then time risk results. These tradeoffs are depicted notionally in Figure 3.1.

As a medium force and as illustrated notionally in Figure 3.2, the SBCT falls in between these extremes, eliminating risk in situations in which the time and power it offers meet the mission demand, or reducing the time or force risk in other situations. When Iraq invaded Kuwait in 1990, the National Command Authorities elected to deploy a “light” force even though it was recognized that it would face a high level of risk if Iraq continued to attack south through Saudi Arabia. The deployment time difference between this brigade and a heavy brigade was deemed to present unacceptable risk, forcing the acceptance of operational risk. Force tailoring is one response to the heavy-light dilemma, but it tends to add to the decision time needed to deploy a force. The question to pose is whether the smaller footprint of an SBCT in comparison to that of a heavy brigade reduces the deployment time sufficiently to make the SBCT a more valuable option than light and heavy brigades in some situations. In

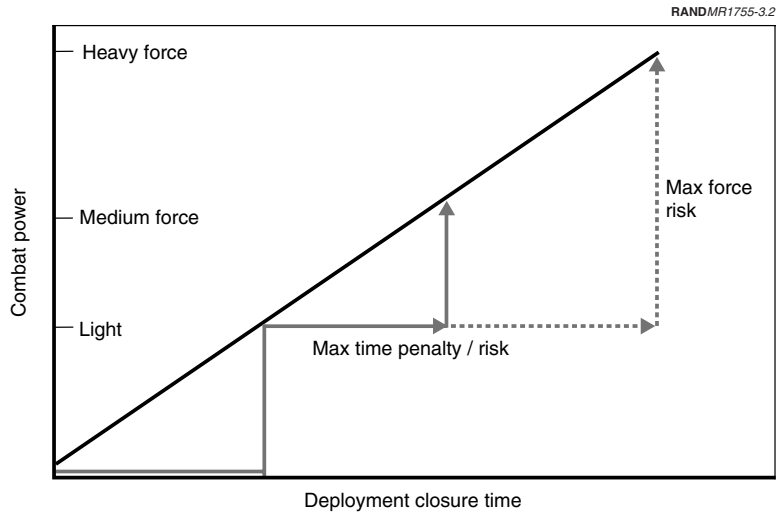


**Figure 3.1—The Light-Heavy Mix Forces a Choice Between Response Speed and Power (Notional)**

this study, we focus on the deployment time change resulting from the footprint difference. We do not address the value, in terms of combat power, provided by this change.

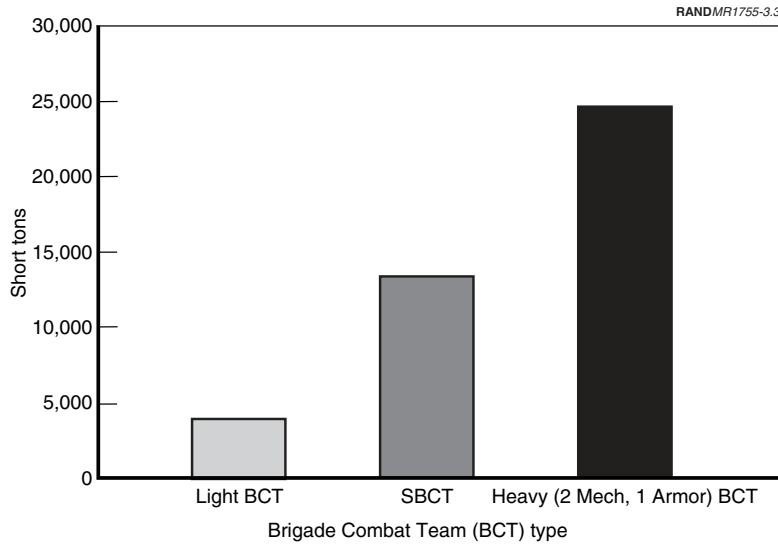
### Size of the Force: The First Element of Deployment Footprint

The first element of deployment footprint is how much has to be moved. Figure 3.3 simply shows that the deployment weight of the SBCT is roughly halfway between that of a typical light brigade combat team (BCT) and a heavy BCT.<sup>1</sup> The light and heavy BCTs have



**Figure 3.2—A Medium Force Fills the Gap, Reducing Either Maximum Force or Time Risks**

<sup>1</sup>As of the writing of this document, a proposal submitted by TRADOC to make the SBCT's combat service support company (CSSC) organic to the SBCT is awaiting Department of the Army approval. Originally designed as a module that would be deployed after the organic SBCT for command and control reasons, the decision has been made to make it part of the brigade support battalion. This would increase the weight of the SBCT by about 1,000 STONs.



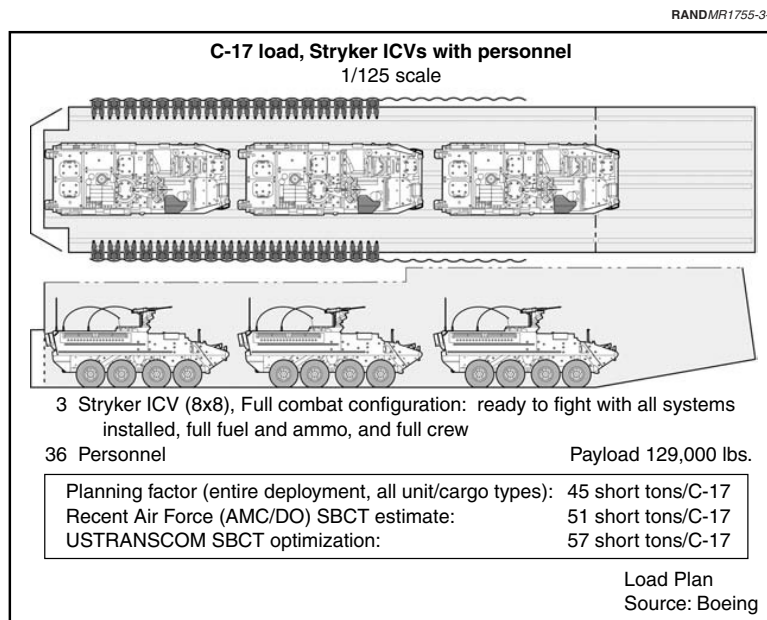
**Figure 3.3—SBCT Deployment Weight Is Roughly Midway Between Army Light and Heavy Brigade Combat Teams**

divisional slices of assets that would most likely have to deploy with a single brigade for better comparison to an SBCT.

### **Aircraft Loading: The Second Element of Footprint**

Combining what has to be moved and aircraft loading effectiveness, the second element of deployment footprint, results in the number of C-17 mission equivalents required to air deploy a unit. Without rigorous planning and practice, outload speed, aircraft utilization, and unit integrity may have to compete. Preplanned loads, however, can often maintain unit integrity, allowing for a desired sequence of delivery (with flexible sequencing of loads depending upon the mission), while achieving relatively high aircraft loads. Additionally, rigorous training that extends through the joint load inspection process and the development of habitual relationships with USTRANSCOM personnel are enablers of effective aircraft utilization.

To illustrate, we provide a C-17 load plan in Figure 3.4, which shows a “weighted out” configuration with three Stryker Infantry Carrier Vehicles (ICV) and 36 personnel. At 64.5 STONs, it is significantly better than the standard planning factor of 45, indicative of historical loads, and within the 65-STON allowable cabin load for a 3,200-NM flight.<sup>2</sup> Two Department of Defense studies of the SBCT both indicate potential to achieve relatively high loads, not uncommon for a unit with many heavy vehicles.<sup>3</sup>



**Figure 3.4—C-17 Load with 3 Stryker ICVs, 36 Personnel, and Combat Loads**

<sup>2</sup>Headquarters, U.S. Air Force, *Air Mobility Planning Factors*, Washington, D.C.: Air Force Pamphlet 10-1403, 1 March 1998.

<sup>3</sup>Headquarters, U.S. Transportation Command, “Interim Brigade Combat Team Air Mobility Deployment Analysis,” unpublished report, 2002, and Roger Brady, Air Mobility Command Director of Operations, “Airlifting the SBCT in the Near and Long Term,” unpublished briefing, January 23, 2003.

Even without any planning, the type of cargo to be moved will affect average aircraft loads. The higher the ratio of equipment weight to floor space, the higher the loads are likely to be in terms of cargo weight. For example, a unit with primarily High Mobility Multi-Purpose Wheeled Vehicles (HMMWVs) and trailers, which are generally light given the floor space requirement, will generate air flow with relatively light loads. Moving a company of tanks instead dictates heavy loads. And as we just examined with the three-Stryker configuration, there are some heavy loads consisting of multiple vehicles that are relatively easy to achieve even without rigorous planning. Thus, since we know the type of unit for examination, we more effectively estimate the airlift requirements through an airload analysis than with the standard planning factor that represents an average across unit and cargo types.<sup>4</sup>

For the SBCT, airlift missions with moderately well-planned loads of Heavy Expanded Mobility Tactical Trucks (HEMTT), 5-ton Medium Tactical Vehicles (MTV), Armored Combat Earthmovers (ACE), and the Stryker family of vehicles (using HMMWVs, M198 towed howitzers, and trailers to round out the loads) are significantly heavier than the planning factor of 45 STONs. Based upon C-17 configuration plans and the SBCT Objective Table of Organization and Equipment (OTOE), 199 such lift missions or chawks come in at about 60-plus STONs (e.g., a load with 3 Strykers, 36 personnel, and their combat loads weighs about 64.5 STONs).<sup>5</sup> On the other hand, the high number of HMMWVs and trailers in the SBCT lead to other aircraft “cubing out” with fairly low weights (as low as 25 STONs in some cases).<sup>6</sup>

---

<sup>4</sup>The cargo planning factors are based upon average loads for Desert Shield and Storm across all services, unit types, and cargo types. The C-17 45-STON planning factor appears to be based upon the C-5 ratio of average loads to the allowable cabin load. Based upon data provided by the 817 EAS/DO, we found that the average load was 43 STONs for C-17 missions into Rinas airport during the deployment of Task Force Hawk. However, the actual cargo on each flight is not known.

<sup>5</sup>The 199 includes 102 with Strykers, 10 with 1 cargo trailer, 3 HMMWVs, 1 M9 ACE, and 2 5-ton MTVs; 4 with 2 M198 towed howitzers, and 3 5-ton MTVs; 44 with a cargo trailer or forklift, 4 HMMWVs, and 3 5-ton MTVs; and 39 with 3 HEMTTs and a HMMWV. In a few cases, items were substituted for other end items of similar size, and in others, one or more empty spaces were left open.

<sup>6</sup>For example, 20 cargo trailers or 10 HMMWVs cube out and are in the 25- to 27-ton range without cargo.

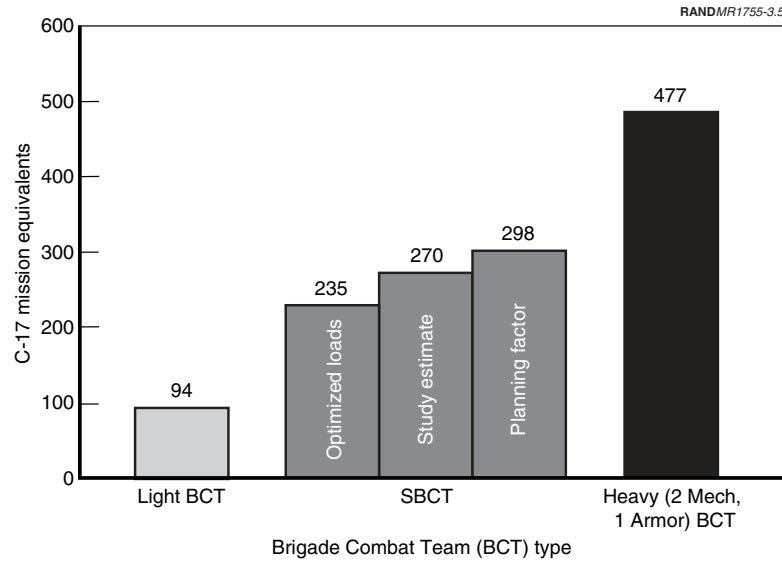
After chalking out all of the vehicles and trailers in the SBCT and estimating the mission requirements for the remaining equipment and sustainment with the 45-STON planning factor, we estimated that the SBCT requires 270 C-17 equivalent missions to deploy based upon the OTOE.<sup>7</sup> We assume no environmental conditions that restrict aircraft landing weights. Based upon the planning factor instead, the SBCT would require almost 300 flights or about 10 percent more lift missions. Conversely, a USTRANSCOM study indicates as few as 235, more than 10 percent lower than our 270 estimate, could be needed with optimal loads of 57 STONs per C-17.<sup>8</sup> These three estimates produce over a 20 percent range in required lift missions, and the real potential variation is probably wider because poor planning could result in lower average loads than the planning factor. Note, also, that some conditions could reduce allowable cabin loads, increasing the number of required lift missions. These include hot weather, high altitude, short runways, wet weather, damaged runways, and “soft” runways.

Figure 3.5 compares the range of three estimates of SBCT required airlift missions discussed in this section with estimates of requirements for light, Stryker, and heavy BCTs. The light and heavy BCT

<sup>7</sup>The vehicles and trailers produced 226 aircraft loads, and we computed them to weigh 11,400 STONs. Based upon various internal Army estimates of SBCT weight in unpublished reports and briefings, the unit basic load, and initial sustainment cargo, we used a total organic SBCT weight of 13,400 STONs consisting of a unit weight of approximately 12,800 STONs (vehicles, trailers, and other equipment) and consumable cargo of 600 STONs (a rough estimate of the maximum of the unit basic load or three days of sustainment for each class of supply). We assumed the 2,000 STONs of cargo beyond the vehicles and trailers would require 44 missions based upon the 45-STON planning factor. This may be somewhat conservative, because some of this cargo would most likely be loaded on the vehicles and trailers within the limits of the allowable cargo loads. As of early March 2003, the final determination of the unit basic load and initial sustainment cargo had not been completed and the weight of the first SBCT was still somewhat in flux, although it has grown beyond the objective design. This is, in part, because some of the objective equipment is not ready for fielding. This is not unusual. The Army often produces OTOEs based upon the equipment expected to be available in the near term. It is modified based upon the actual equipment available (in lieu of the objective systems) and additional equipment deemed necessary to compensate for any consequent limitations in capability. The result is the modified table of organization and equipment, or MTOE.

<sup>8</sup>If the CSSC becomes part of the SBCT, this would increase the number of missions from 270 to 294.





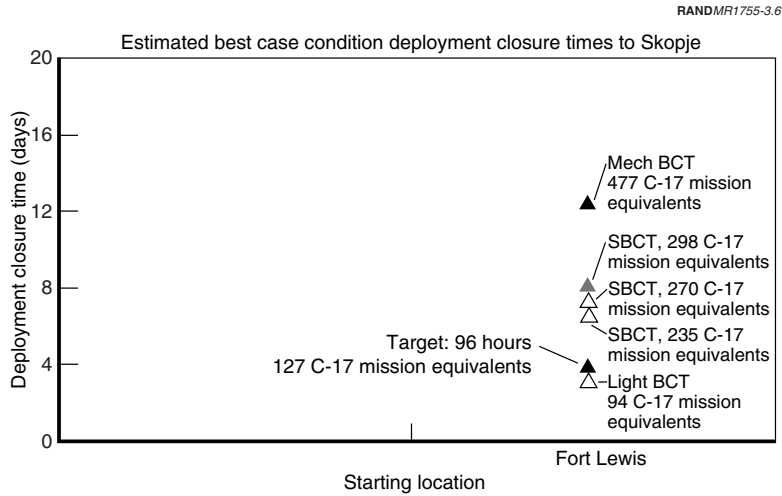
**Figure 3.5—Actual Deployment “Footprint” Requirement Depends Upon Unit Size and Aircraft Load Planning Effectiveness**

requirements are based upon the average SBCT load from our analysis.

### The Effect of Deployment Footprint on Closure Time

Given a working MOG of 3, an SBCT could potentially deploy from Fort Lewis to Skopje in 7.4 days given realistic estimates of current deployment throughput capabilities and best-case conditions (see Figure 3.6).<sup>9</sup> This is significantly faster than a mechanized brigade combat team with a best-case condition time of about 13 days, but still longer than the future force goal of 96 hours. To achieve the 96-hour goal in this scenario, a force would have to be 127 C-17 mission equivalents in size or a little less than half the deployment footprint of an SBCT. For reference, a light BCT, at a little less than 100 C-17

<sup>9</sup>With the CSSC, this would become 8.0 days.



**Figure 3.6—With Smaller Footprint, the SBCT Deploys Much More Quickly Than a Heavy Mechanized BCT**

mission equivalents, could deploy in a little over 3 days in this scenario.

To achieve these times, the forces would require an allocation of 38 percent of the strategic lift fleet as of FY05 or 92 C-17s (33 percent as of the end of FY09) if only C-17s were used. Alternatively, if a mix of 70 C-17s and 30 C-5s were used instead (producing equivalent times), this would be 46 percent of the lift fleet. Using all C-17s is more efficient, because they have higher operational readiness and thus higher flying hour use rates. Additionally, using all C-17s avoids the need for transloading (typically, C-5s will not be flown into contingency APODs). If the airlift allocation were to be lower, the times would obviously increase.

### Reaching 96 Hours with the SBCT

For the SBCT to achieve a 96-hour deployment time in a scenario with similar distance and routings as the Fort Lewis-to-Skopje scenario would require a working MOG of at least 7, 105 percent of the

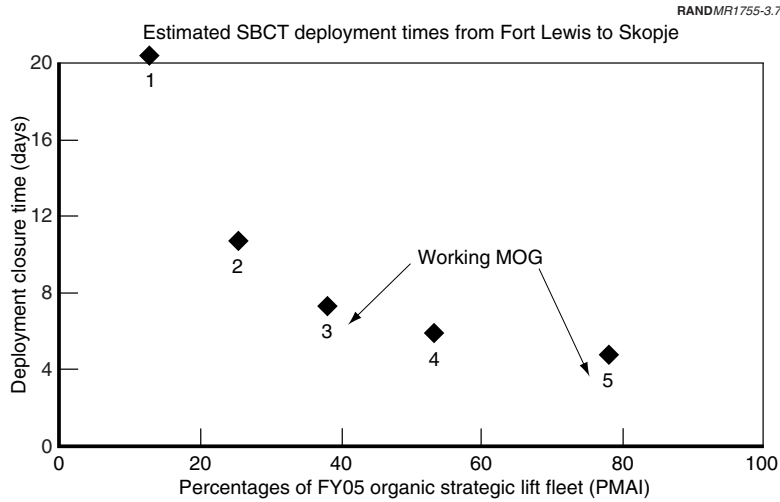
organic strategic lift fleet as of FY05, and still 80 percent of the fleet at the end of the current planned C-17 buy. The working MOG of 7 is substantially beyond the 2 or 3 often available at APODs in rapid-deployment situations, and approaching such airlift allocations for one brigade is unrealistic given the total deployment demands of a Joint force. As we will discuss in the throughput capacity section, process improvement could significantly improve the throughput potential of APODs, removing them as a bottleneck, but the airlift requirement would remain and other bottlenecks could come into play such as enroute base capacity.

## **THROUGHPUT CAPACITY**

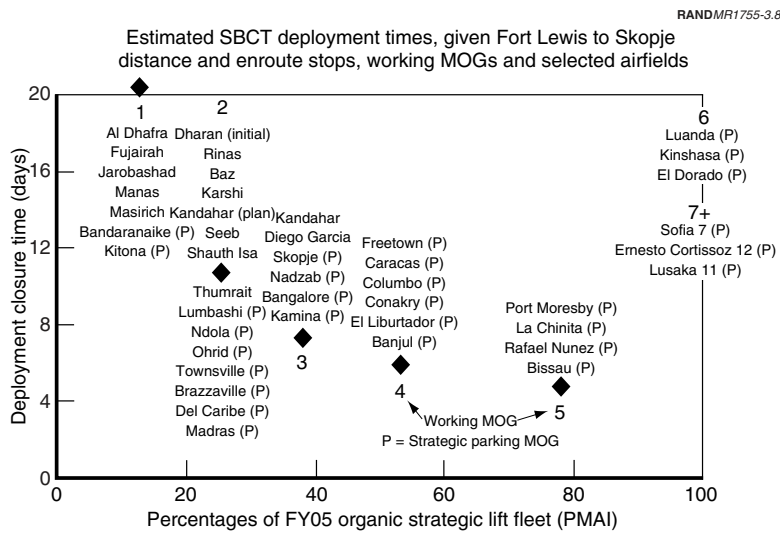
### **The Effect of Working MOG**

Figure 3.7 shows how the deployment time for the SBCT changes with throughput capacity as a function of working MOG, with the x-axis indicating the percentage of the FY05 airlift fleet needed to achieve the time (utilizing C-17s first). For example, with a working MOG of 1 at any node in the system, the best-case condition time is a little over 20 days, and it requires 13 percent of the lift to achieve this time. A lower airlift allocation would result in times slower than those shown. In contrast, a higher airlift allocation would not improve the times shown, as the bottleneck would remain working MOG. As working MOG increases, the deployment closure time decreases but at a decreasing rate. That is, each additional unit of working MOG produces a smaller percentage gain in deployment speed. At the same time, it takes more and more airlift to achieve the best-case potential.

Figure 3.8 lists airfields at potential contingency location sites by working MOG. All of those without the (P) are locations that have actually been used in recent operations. None of these locations has a working MOG greater than 3. The other locations would support potential scenarios identified by the Office of the Deputy Chief of Staff, G-3. They are indicated by a (P), which signifies strategic parking MOG. The working MOGs are all less than or equal to the parking MOGs. Even if a contingency occurs in an area with one of the higher potential working MOGs, it is unlikely that sufficient airlift would be allocated to the SBCT to enable the achievement of the



**Figure 3.7—Working MOG and Distance Constrain Number of Usable Aircraft**

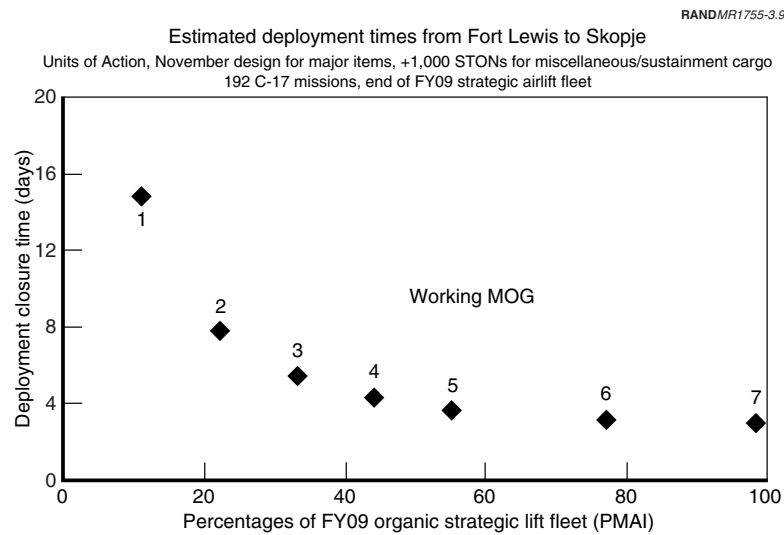


**Figure 3.8—Many Airfields in Potential Contingency Locations Have Working MOGs of 3 or Less**

illustrated times once a working MOG of 5 (~80 percent of airlift) or greater is reached, and even at 4 (~55 percent of airlift), receiving sufficient airlift would probably be a stretch.

### A Future Force Unit of Action Excursion

Given the Army’s draft Unit of Action (the basic brigade-sized maneuver element of the future force) design, achieving the 96-hour goal will remain challenging, as shown in Figure 3.9. It would require a relatively high working MOG of 4 or 5 and close to half of the FY09 strategic lift fleet.<sup>10</sup> However, the time potential does represent a



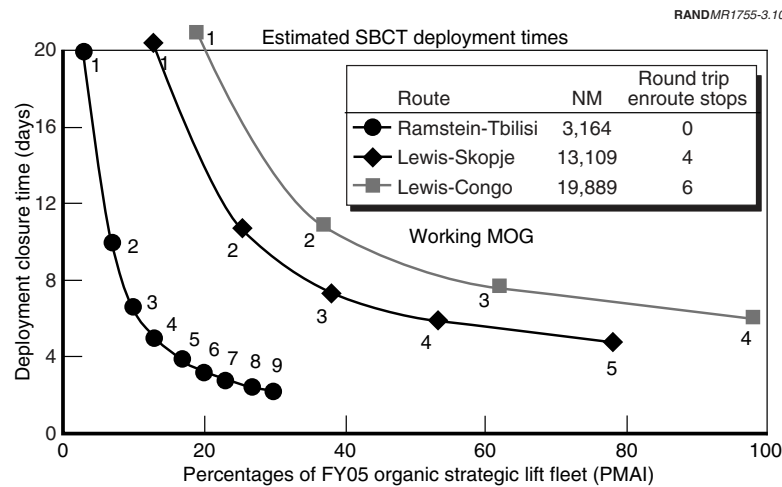
**Figure 3.9—Draft Unit of Action Needs Working MOG of 4 to 5 and About 45 Percent of FY09 Airlift Fleet to Achieve 96-hour Goal**

<sup>10</sup>This is based upon an estimate of 192 C-17 missions based upon a draft Unit of Action design from November 2002. Major end items were chalked out, and we assumed a requirement of 1,000 additional short tons at 45 STONs per C-17. The total resulting unit weight estimate is 9,800 STONs.

substantial improvement over the SBCT, and at a working MOG of 3, the best-case condition time is only a little over 2 days longer than that for a light BCT.

### The Effect of Distance

Figure 3.10 shows how the aircraft allocation needed to maximize the throughput potential of a deployment route increases with distance. As distance increases, the best potential time increases only slightly, but the likelihood of achieving the best time becomes more and more remote as the needed aircraft allocation increases. The three routes shown run the gamut from a relatively unstraining route from Ramstein to Tbilisi, Georgia, to a moderately long route from Fort Lewis to Skopje, to a very demanding deployment route from Fort Lewis to the Congo. The legend includes the round trip distance and the number of round trip enroute stops for each route.



**Figure 3.10—At Short Distances, Airlift Is Unlikely to Be the Bottleneck; At Long Distances, Even a MOG of 3 Is Hard to Fully Utilize**

### Restricted Throughput Example: Limited Airfield Operating Hours

If airfield operating hours are constrained, then deployment closure time will be significantly slower. Figure 3.11 shows the degradation in time that occurs when an APOD with a working MOG of 3 is limited to 12-hour-per-day operations. Note that with a working MOG of 3, with a day or night limit on airfield operating time, a force would have to be one-fourth the size of an SBCT or even smaller to deploy in 96 hours.

### APOD Ground Times in Recent Operations

To this point, our deployment time estimates and airlift requirements have been based upon the ground time planning factors—again, they do not account for the type of cargo, unit, urgency, or even degree of practice. Figure 3.12 shows APOD C-17 turnaround time data for recent operations and the May 2003 SBCT certification

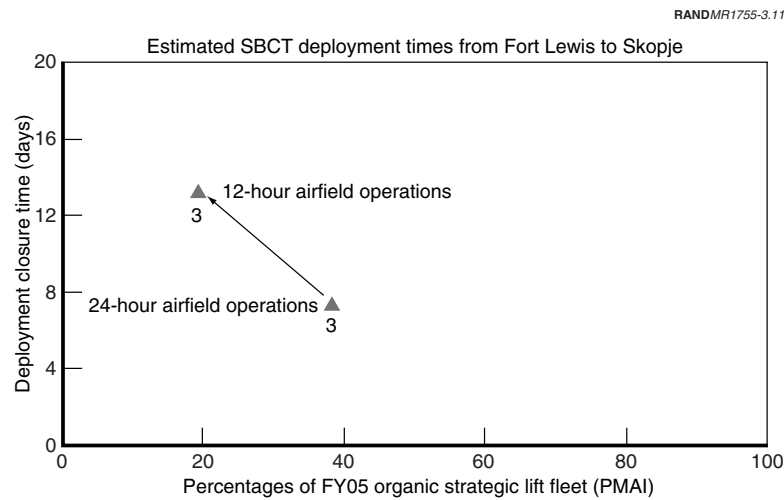
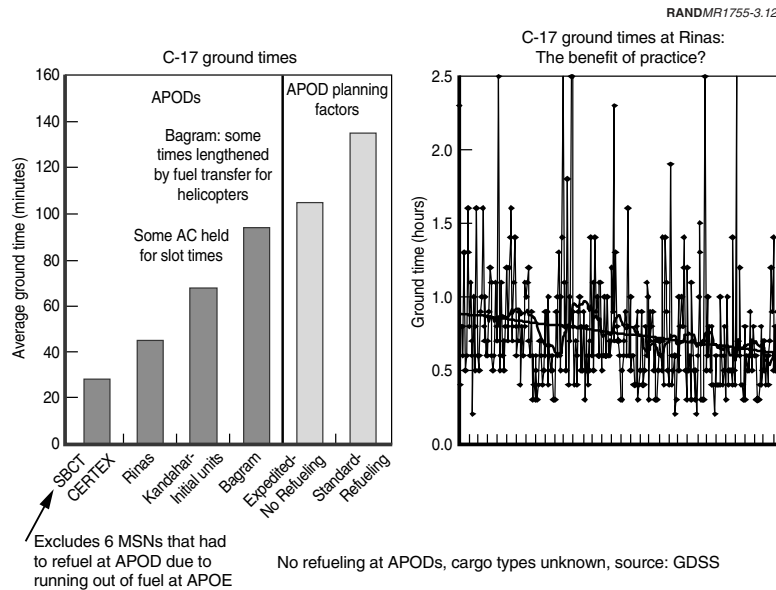


Figure 3.11—APOD Restrictions Can Greatly Degrade Performance



**Figure 3.12—Initial Data Suggest the APOD Ground Time Can Be Substantially Better Than the Planning Factor**

exercise (CERTEx).<sup>11</sup> We have not yet been able to stratify the data by cargo type for the actual operations, but we tried to select periods that should have been primarily unit cargo.<sup>12</sup>

The data shown, with average ground times on the y-axis, reflect the average times for SBCT CERTEx flights without APOD refueling, all flights into Rinas airport, and initial flights into Kandahar and

<sup>11</sup>As part of the CERTEx, a portion of the 3-2 SBCT deployed by C-17 to Alexandria International Airport, Louisiana, which is near the JRTC.

<sup>12</sup>SBCT (CERTEx): 34 flights from May 2, 2003 to May 4, 2003. This reflects all records in the Air Mobility Command's Global Decision Support System (GDSS), 39, less 5 flights that had to refuel at the APOD due to insufficient fuel at the APOE. Rinas: all 335 flights from April 4, 1999 to April 30, 1999 recorded in GDSS. Kandahar: all 52 flights from January 10, 2002 to February 27, 2002 recorded in GDSS. Bagram: sample of 41 flights from January 31, 2002 to April 10, 2002.



Bagram. Refueling did not occur at Rinas, Kandahar, or Bagram, and thus the expedited planning factor is the appropriate comparison.

The SBCT CERTEX air deployment, with 42 of 45 missions having only “rolling stock” or vehicles that could be driven straight off the C-17 and the other 3 having only one pallet, consistently achieved total turnaround times of between 19 and 34 minutes. Rinas was substantially faster than the planning factor, with an average of about 45 minutes without stratifying by cargo type. Of note, the times continually improved through the operation, as shown in the right half of the figure, with over 50 percent of the flights in the last quarter of the operation turning around in 27 minutes or less. Bagram times, while still faster than the planning factor, were longer than at the other APODs, in part because some of the C-17s offloaded fuel at Bagram for use by helicopters operating from there (“wet wing” operations).

Finally, the times are also somewhat affected by planning. USTRANSCOM schedules slot times in an attempt to effectively utilize throughput capacity but avoid getting backed up—particularly at the APOD. In some instances, aircraft must be held until the scheduled departure time. Thus it is critical for the Army and USTRANSCOM to determine appropriate times for a given operation. Similar data should be collected and analyzed for APOEs and enroute bases.

### **Joint Planning, Practice, and Process Improvement as Routes to Increasing Throughput**

Despite these relatively fast times, as a process that has not been subject to a rigorous define-measure-improve type of continuous improvement methodology, there is probably room for improvement in addition to the determination of expected times for different situations. Additionally, historical loads have been approximately at or below the planning factor. For example, for the deployment of TF Hawk to Albania, C-17 loads averaged about 43 STONs.<sup>13</sup> Of note, though, with limited opportunity to plan the air flow based upon significant flux in what would deploy by air, 3-2 SBCT achieved an

---

<sup>13</sup>Spreadsheet data from Lieutenant Colonel Sam Szvetez, 817 EAS/DO.

average of 46.2 STONs per C-17 during its CERTEX.<sup>14</sup> This may be somewhat better than it appears, because they did not conduct this movement with a full unit basic load of sustainment cargo, which could have added up to 2 STONs per C-17 if loaded in Strykers, trucks, and trailers. This would have been feasible with a standard allowable cabin load of 65 STONs, because many were relatively or completely empty and aircraft loads were limited to 60 STONs as the result of Fort Sill's short runway.

Increased emphasis on deployment planning, including preplanned loads and sequencing, can improve airfield flow and outload times as well as the utilization of aircraft through more effective loading. For this to work well, the Army unit must receive the aircraft types promised and may even need one aircraft type dedicated to its move. The unit might have a C-17 plan and C-5 plan on the books, but it would be tough for it to be prepared to accept a mix of these aircraft types and maintain an airflow with well-utilized aircraft.

Further improvement can probably come from refining TTP and local standard operating procedures. Once this is done, "living" standards should be set for all deployment processes—not just static planning factors.

A substantial training program should then ensure that the standards can be met and should drive further ideas for improvement, thus driving continuous improvement. Training should periodically span the entire deployment process from planning to movement from the unit motor pool all the way through arrival at the APOD and final preparation for the commencement of operations. This demands that deployment training be Joint, which will require additional coordination. Tasks that require relatively little in terms of resources can be practiced more often. These generally include all the processes that span planning and APOE outload. Such training can take the form of command post-type exercises, unit alerts, vehicle load preparation, movement to the airfield, and the use of aircraft mock-ups.

---

<sup>14</sup>Cargo data were provided by the air load planner for the movement.

To emphasize the criticality of deployment skills, deployment capabilities should be part of unit mission essential task lists (METL).<sup>15</sup> For the SBCT, this would include not only air but sea deployment. Army regulations should be reviewed to determine whether deployment training requirements are addressed with rigor appropriate to the newly recognized need for rapid deployment, specifically the relatively large-scale air deployment of vehicle-based forces.

Rigorous measurement in exercises could be used in such a manner to drive the type of improvement the Army has experienced in the delivery of spare parts, which are now delivered about 67 percent faster than before the application of a rigorous process mapping, measurement, and improvement process. Additionally, recording times on practice would enable the Army and USTRANSCOM to establish planning factors for different commodity types and situations for more refined planning capability. For instance, there might be one APOD ground time planning factor for a situation in which most of the flights have only vehicles, which would apply to the initial deployments of SBCTs and other vehicle-based units, and another for periods when substantial sustainment or other palletized cargo is being delivered. Similarly, two contingency working MOGs could be established: one for initial deployment operations when most or all lift missions contain only vehicle cargo and one for other periods when cargo is primarily palletized or a mix of cargo types.

Finally, to effectively plan and train, units will need the appropriate resources—whether people, training aids, or Joint exercises and mobility assets. The Army has increased the emphasis on deployment in the SBCT, but additional assessment of unit capabilities would be valuable during and beyond the operational evaluation process. For instance, the SBCT has the Army's first Mobility Warrant Officers (one per SBCT). Other SBCT deployment personnel, however, still serve in their roles as additional duties.<sup>16</sup> This training challenge adds further to the wide breadth of training requirements for the SBCT. This is in contrast to a Marine unit with two dedicated embarkation personnel in each infantry battalion, three more at the

---

<sup>15</sup>3-2 SBCT has designated deployment by air as part of its METL.

<sup>16</sup>An Army additional duty is akin to a part-time job given to an individual beyond his or her formal duty position.

regimental level, and thirteen in a division embarkation section for a total of 40 personnel in the division, only counting the infantry sub-units. This is not to say the Marine numbers are more appropriate or the right solution for the Army. Rather, it simply raises the question as to what is the right number for each type of Army unit, depending upon their strategic response roles.

To assist with the development of improved TTP, assess needed training regimes, and refine resource requirements, benchmarking across the services should be conducted, with a particular focus on frequently deploying organizations or those known for deployment expertise.

### The Benefit of APOD Process Improvement for a CONUS-Based Deployment

Figure 3.13 shows the potential deployment time benefit of cutting the APOD ground time to half that of the planning factor (from 105 minutes to 52.5 minutes). However, this potential benefit is limited

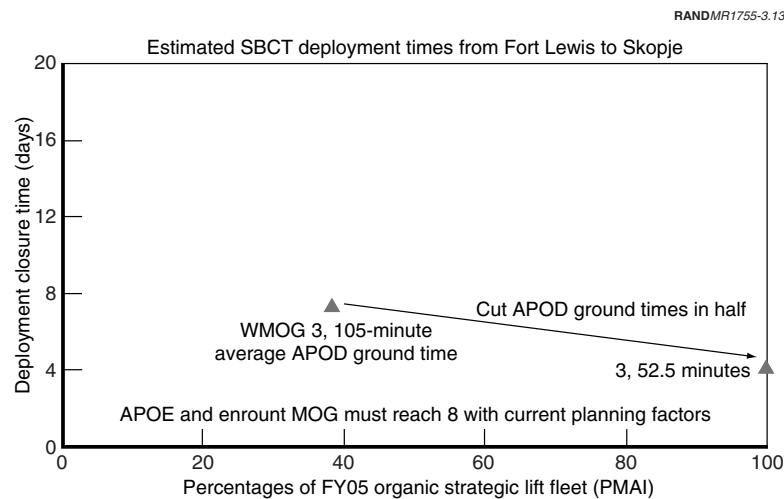


Figure 3.13—Reducing Ground Times Can Improve APOD Throughput, But Other Airfields or Lift Can Become Bottlenecks

by other constraints such as the available airlift and the throughput capacity at APOEs and enroute bases. Even a working MOG of 3 requires relatively high airlift allocation to fully utilize the APOD capacity when deploying from CONUS. Higher levels of airlift become more and more unlikely, and other nodes will often become bottlenecks. But when airlift is less of a factor, it becomes possible to take advantage of reduced ground times. This is revisited during the discussion of forward positioning of units.

### **EXPANDING THE TRADESPACE: FORWARD UNIT OR EQUIPMENT POSITIONING**

The preceding discussion shows that even under best-case conditions (with relatively realistic deployment system assumptions), there are few likely contingency situations in which an SBCT could deploy from CONUS in 96 hours. Even so, it is on the order of 45 percent faster than a heavy BCT, providing a distinct new option for early deployment of Army forces.

We now turn to the other dimension of the tradespace—positioning—to examine how further value might be gained from the SBCT by improving its deployment time potential in some situations. First, we will discuss forward unit positioning or basing. This improves responsiveness in cases where airlift capacity is the bottleneck. However, we have asserted that working MOG will limit speed in many situations. While forward positioning reduces time somewhat in such situations, the primary benefit becomes a greatly reduced demand on airlift, freeing up capacity for other purposes.

Second, we will discuss what we term “selected prepositioning,” or prepositioning part of a unit’s equipment forward. When deployment speed is of concern, one of the first strategies often considered is the prepositioning of equipment. However, given procurement funding constraints and the need for research and development investment for the future force, it was initially assumed by the Army that prepositioning of SBCT equipment would not be feasible. But this is in the traditional context of prepositioning full sets of unit equipment. Instead, airlift throughput limits might be mitigated by using the airlift to move high-value assets, such as the Strykers and other specialized equipment, and prepositioning less expensive

assets. Prepositioning the SBCT's trucks, trailers, HMMWVs, and sustainment assets would reduce airlift mission requirements by 60 percent, yet these vehicles account for only about 10 percent of the SBCT's vehicle costs. While prepositioning can improve speed, it cannot do so everywhere—it is of most value for dedicated land locations or for littoral areas via afloat prepositioning.

### **Forward Unit Positioning: When Does it Make Sense?**

Forward unit positioning can provide significant value, but it imposes costs, which must be balanced against the benefit. Beyond cost, the issue of feasibility can arise as well. The decision process should start with a review of regions where fast-response capability is desired. Then, potential sites that could support deployments to these locations should be determined. The benefit can then be assessed in terms of response speed improvement and resource requirement reduction as compared to CONUS positioning and the criticality of fast response to the region. Criticality is a function of three factors: the severity of potential crises, the probability of these crises, and the likely warning time.

Feasibility is foremost an issue of political conditions. Agreement must be worked out with the host state. Given that access and base use is politically feasible, political conditions then become a “cost” issue in the form of risk. How likely are political conditions to change so that the U.S. forces would no longer be welcome? Other feasibility and “cost” considerations include access to training areas, existing support infrastructure, quality-of-life issues, and the financial cost of maintaining the forward presence.

### **The “Types” of Forward Unit Positioning**

Potential forward unit positioning locations can be evaluated on two levels. Permanent stationing imposes high feasibility hurdles as well as significant costs—financial and otherwise. Thus a region probably needs to be very critical with an expectation of little change in the near to medium term, or the conditions must be such that the site presents relatively low costs. If these two conditions are not met, the site might be a candidate for rotational basing. Or if a region temporarily becomes critical, temporary positioning can be considered.

Moving a unit upon strategic warning might even be viewed as a form of temporary forward positioning. Another interesting application of what might be called temporary or even rotational forward positioning is an afloat Marine Expeditionary Unit (Special Operations Capable). With its full complement of personnel and equipment, this is more than prepositioned equipment—this is a forward positioned unit.

### **The Deployment Benefits of Forward Unit Positioning**

Returning to the Skopje scenario, we present the bounds of unit forward positioning advantage. First, let us assume that the Army is deploying from Fort Lewis and receives sufficient airlift to fully utilize the working MOG (see Figure 3.14). Deploying instead from central Germany would dramatically reduce the airlift requirement and save close to a day (the first aircraft arrive at Skopje much more quickly because of the shorter flying time and the elimination of enroute stops), reducing the airlift need from 38 percent to 8 percent of the fleet with a working MOG of 3. In a scenario with similar distance but a working MOG of 5, the lift requirement would drop from 67 percent of the strategic lift fleet to only 14 percent. So while the time savings are limited in this case, the positioning still presents substantial value to the combatant commander by freeing up significant airlift capacity for other uses, such as moving Air Force units to regional bases. In effect, forward positioning greatly reduces the opportunity cost of calling for an SBCT. Additionally, knowing that the time can be achieved with a relatively small amount of airlift might increase the relative value of the SBCT to a combatant commander, increasing its probability of use early in a deployment.

The more airlift is constrained below the maximum amount needed to fully utilize an APOD's working MOG's throughput potential, the greater the time advantage of forward positioning becomes. For example, suppose the airlift allocation for the SBCT were limited to 14 percent of the fleet as in Figure 3.15. Deploying from Fort Lewis would take about 18 days. Given a working MOG of 5, the same airlift used from Ramstein would allow a 4-day deployment closure time.

RANDMR1755-3.14

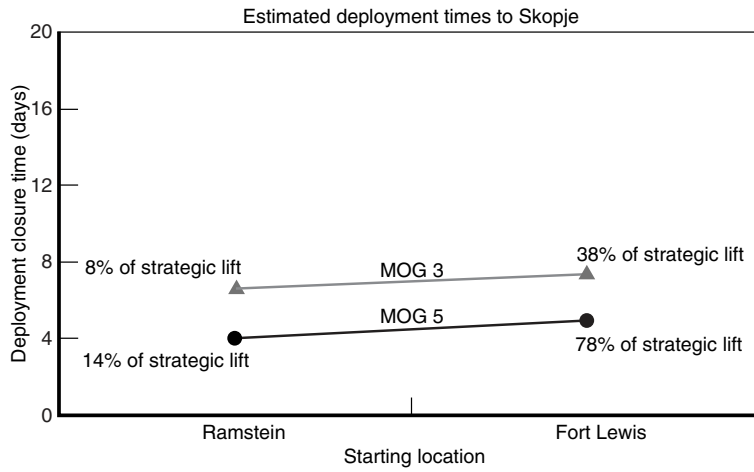


Figure 3.14—Forward Unit Positioning Reduces Army Demand on Strategic Lift When Working MOG Is the Bottleneck

RANDMR1755-3.15

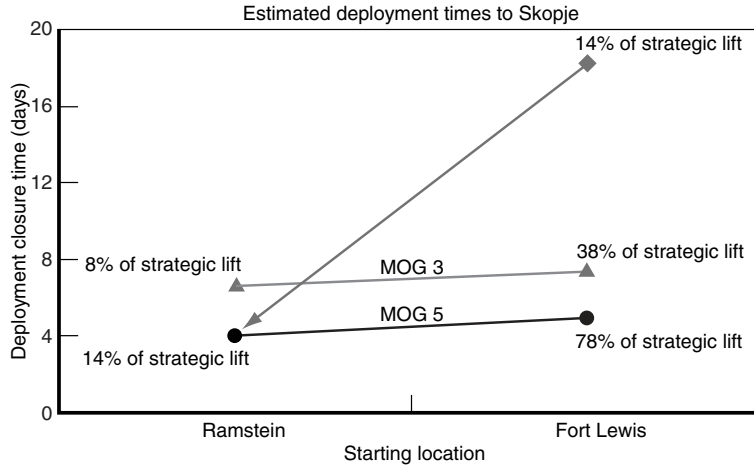


Figure 3.15—Forward Unit Positioning Speeds Deployment When Strategic Lift is the Bottleneck



Deploying from a forward position presents another advantage. With no enroute stops, managing the airflow becomes much less complex, enabling improved synchronization. Additionally, potential transloading problems disappear. The result is a greater probability of achieving the best-case condition times presented.

### **The Synergy Between Forward Unit Positioning and Process Improvement**

There is another potential advantage of forward basing: the ability to leverage any improvement in APOD ground times that can be achieved by TTP improvement and practice. If, for example, average ground times at an APOD for an SBCT deployment could be cut in half from the expedited planning factor to 52.5 minutes—still higher than that achieved during the SBCT CERTEX and at Rinas in 1999 during the deployment of TF Hawk—a forward-based unit could deploy in less than 4 days with a working MOG of 3 (see Figure 3.16). For the Ramstein-to-Skopje scenario, this still only requires 15 percent of the strategic lift to fully leverage.

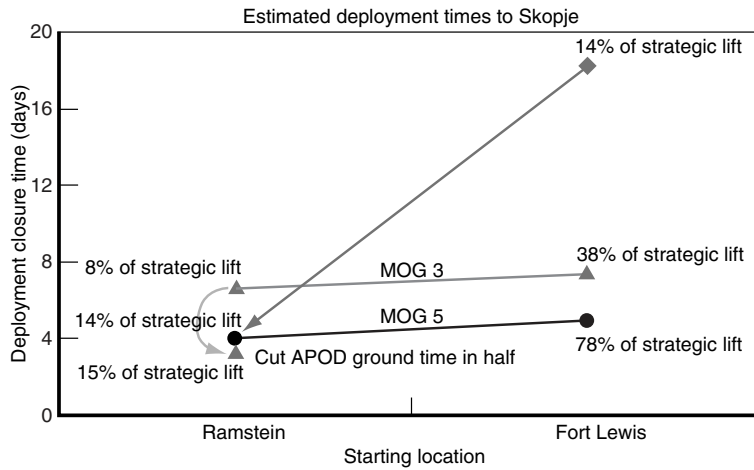
### **A New Alternative: “Selected” Prepositioning**

Rather than “prepositioning” a unit, the equipment can be prepositioned. At about \$780 million dollars in equipment cost per set, it is not financially feasible for the Army to buy additional sets of SBCT equipment, recapitalize current forces, procure 6 brigades’ worth of equipment, and fund investments in the future force. However, all of the soft-skin tactical wheeled vehicles in an SBCT cost just \$80 million or about 10 percent of the procurement cost for an SBCT equipment set. And there is some possibility that existing assets could be leveraged.<sup>17</sup> Prepositioning these assets and generally low sustainment cargo such as conventional ammunition reduces the airlift requirements for an SBCT by approximately 60 percent. The

---

<sup>17</sup>Expensive items can be used in a low-cost asset strategy when there are excess assets, as sometimes occurs when forces are reduced in size.

RANDMR1755-3.16



**Figure 3.16—With Forward Positioning, Improved Ground Times Can Be Leveraged Without Straining Airlift Capacity**

higher-value, constrained strategic air mobility assets would then be saved to move the higher-value combat assets.<sup>18</sup>

### Sharing Prepositioned Equipment and Supplies Among Force Types

Additionally, this concept could be expanded to produce common combat service support and combat support prepositioned asset

<sup>18</sup>Selective prepositioning of a brigade’s trucks and other selected assets can be applied to a heavy BCT as well as to an SBCT, but the benefits are not as pronounced. If the Army prepositions everything but the tracked vehicles of a heavy BCT, it will still take as much airlift to get these heavy assets to the fight as to deploy the whole SBCT by air. The tracked vehicles in a heavy BCT, which roughly cover the roles of Strykers in an SBCT, account for about two-thirds of a heavy BCT’s airlift requirement as opposed to the Stryker’s 40 percent of the smaller SBCT airlift requirement. Existing tracked vehicles, depending upon the desired level of modernization, could also reduce the cost benefit of selected prepositioning for a heavy BCT as compared to an SBCT.

**Table 3.1**  
**SBCT Vehicles and Trailers in Afloat Prepositioned Stocks**

Vehicle	Quantity	STONs	Square Feet	Watkins
HMMWV	367	1,001	45,049	219
HEMTT	31	634	12,107	23
HEMAT	5	20	890	5
PLS trailer	53	438	11,448	19
3/4-ton trailer	7	5	532	7
400-gallon water trailer	26	29	2,444	25
Variable reach R/T forklift	6	99	1,470	
Carrier ammo tracked vehicle	18	406	4,320	6
M88A1	17	917	5,491	13
Trailer cargo: LMTV	1	1	140	1
TOTAL	531	3,552	83,891	318

pools. Half of the items, based upon a LIN-by-LIN<sup>19</sup> match, are already aboard afloat prepositioned ships today, as shown in Table 3.1. The rightmost column shows that many of the vehicles are on just one ship: the S.S. *Watkins*.<sup>20</sup>

The remaining LINs not aboard ships today, shown by vehicle type in Table 3.2, primarily reflect newer variants of end items that are common with “modernized” forces such as Force XXI units and would be aboard the ships if the prepositioned materiel were modernized. These LINs include the HEMTT with an integrated load handling system (LHS), up-armored HMMWVs, and MTVs (in place of older 5-ton trucks).

The other difference is that in most current force units, these vehicles are not equipped with new command and control technology such as the movement tracking system (MTS) and the Force XXI Battle Command Brigade and Below System (FBCB2), although this is

<sup>19</sup>A LIN (line item number) corresponds to each equipment model.

<sup>20</sup>These comparisons of SBCT equipment with afloat prepositioned stocks were produced prior to Operation Iraqi Freedom. Much of the equipment was downloaded for the operation, and the precise reconstitution of the ships is uncertain as of the writing of this report.

**Table 3.2**  
**SBCT Vehicles Not in Afloat Prepositioned Stocks**

Vehicle	Quantity	STON	Square Feet
HMMWV (heavy)	34	119	4,546
MTV	208	1,927	37,207
HEMTT-LHS	56	988	15,008
Other	11	77	1,758

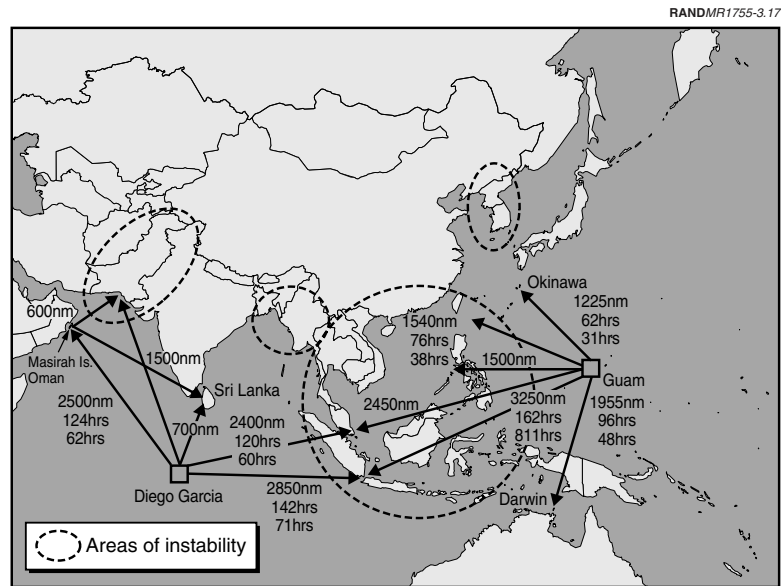
changing. To accommodate this difference, these items might be installed only upon strategic warning. Installation time could be minimized if the vehicles were prepared beforehand by predrilling holes and installing the wire harnesses, which would only be used if “digital” forces deployed and employed the vehicles. This might even be the technique employed if the assets were not shared across force types in order to better protect the electronic components. This concern is apt to be transient, as eventually we anticipate the entire force structure to be appropriately digitized.

### **The Forms of Prepositioning**

There are three forms of prepositioning. If a specific location is deemed critical and there are regional base access possibilities, equipment can be stored on land close to the potential contingency location. Examples include heavy brigade sets in Kuwait that were prepositioned in response to the Iraqi threat, sets positioned in Germany during the Cold War, and equipment sets in South Korea. A second option is the use of theater-oriented prepositioning on ships. A third is theater positioning, but on land to be moved by ship in the event of a contingency.

### **The Need to Leverage Strategic Warning for Rapid Response with Prepositioned Materiel**

The second and third forms of prepositioning, both of which require movement by ship to a contingency location, are more flexible but also require strategic warning to close on the desired location quickly. A large, medium-speed roll-on/roll-off (LMSR) ship with selected prepositioning should be within 500 NM to meet equipment



Times based on 20 knots sailing speed (LMSR)/40 knots sailing speed (TSV)

**Figure 3.17—Movement of Prepositioned Afloat Must Often Start Before Beginning Air Movement of Deploying Units**

closing by air in 4 days at up to 400 miles from the port (depending upon road and threat conditions), and can be an additional 500 NM distant for every day of warning acted upon.

The use of theater support vessels (TSV) can increase the number of ports that can be accessed to deliver prepositioned materiel due to their shallow draft and shorter length.<sup>21</sup> However, they must be positioned relatively close to a potential area of operation or be used in conjunction with LMSRs due to their 1,000-NM range with cargo.

<sup>21</sup>A study done by the Deployment Process Modernization Office found that the use of shallow draft ships can increase port access options by three to six times, depending upon the theater, over current strategic sealift.

Longer-distance moves with refueling could be considered with at-sea or enroute bases. This would take advantage of their greater speed.

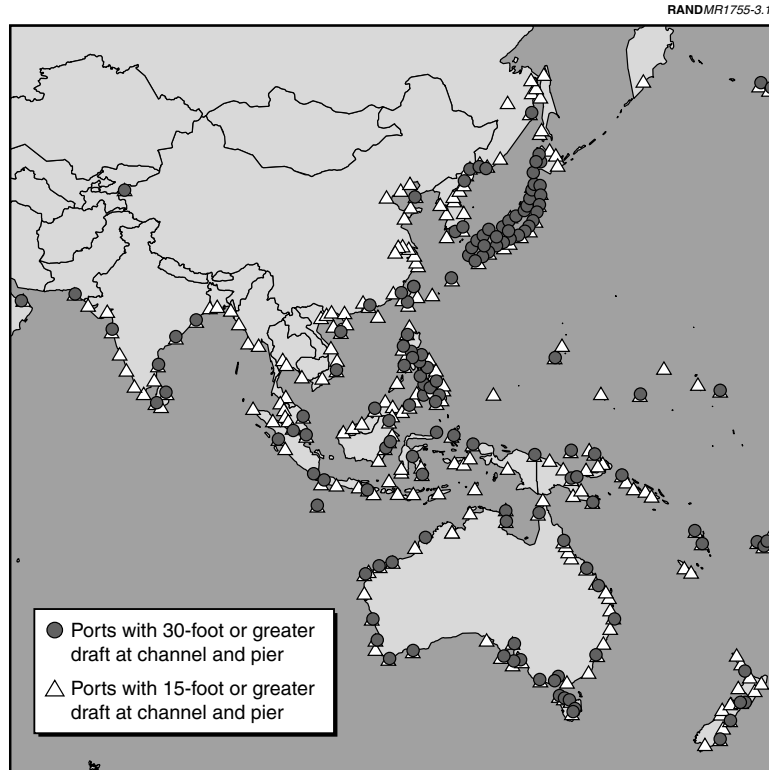
Strategic warning does seem implied in the deployment closure time goal the Army has set for a brigade-sized unit, since it does not start until wheels-up on the first aircraft, and unless stationed forward, establishing the GRL to create an airlift route provides additional steaming time. In fact, it would seem to be appropriate to consider the advance of prepositioning ships as akin to establishing the GRL. Given the ability to move the ships before the remaining CONUS-based assets begin moving, prepositioned afloat could probably move as much as 400 miles from a port to link up with the Strykers, depending upon road conditions and other factors.

Figure 3.17 illustrates the need for strategic warning to move prepositioned afloat ships and provides warning requirements. Suppose equipment were prepositioned on ships stationed at Diego Garcia and Guam. It would take LMSRs five to six days to reach ports in the vicinity of most Asian littoral hot spots. With TSVs, the time would potentially be cut about in half, given that they can be refueled at sea (which would lengthen the times shown somewhat).

When strategic warning is considered, the speed advantage of TSVs is not always significant. However, they can decrease time by potentially enabling prepositioned equipment to be brought ashore closer to the desired deployment location. As Figure 3.18 indicates, there are many more ports that can accommodate such vessels (15- to 30-foot draft at channel and pier) than can accommodate the current fleet of strategic sealift ships, which require 30-foot drafts.

### **The Deployment Benefits of Selected Prepositioning: SBCT Trucks, Nonvehicular Equipment, and Supplies**

Selected prepositioning would make it possible to move the remaining assets by air in 4 days from CONUS, even with a working MOG of 3, which is illustrated in Figure 3.19. If only the Strykers were moved by air, this would require 25 percent of the organic military strategic airlift. Keeping time constant would instead drop the airlift allocation requirement from 38 percent to 13 percent.



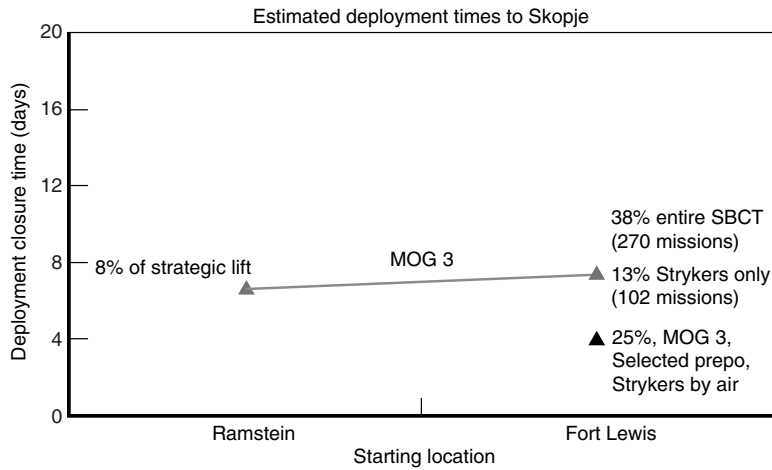
SOURCE: DPMO.

Figure 3.18—TSVs Greatly Expand Port Options

### Changing the Prepositioning Paradigm

Leveraging selected prepositioning for SBCT rapid response requires changes in the Army's prepositioning paradigm along several dimensions, with contrasts shown in Figure 3.20. First, movement of afloat prepositioned upon strategic warning is necessary. While this is not under Army control, the Army can influence this decision by making the benefits clear to the National Command Authorities. Second, prepositioned items must be mission loaded to reduce marshaling

RANDMR1755-3.19



**Figure 3.19—Prepositioning of TWVs and Sustainment Improves Deployment Speed of CONUS-Based Assets**

and organization time after download. Third, download must be practiced to improve TTP and enable the maximum effective potential of these TTP. Fourth, prepositioning might become more affordable if it is used in a selective manner. Fifth, prepositioning packages can be used to support multiple unit types, given that ships are loaded to support such flexibility. Sixth, since it will be tied to critical rapid-response situations and modernized units, it should receive relatively high modernization priority.

### Additional Selected Prepositioning Issues for Analysis

Prepositioning does require personnel to unload the ships, to conduct any final vehicle preparation tasks, such as installation of digital command and control electronics, and to provide port security.<sup>22</sup> In addition, the personnel to operate the vehicles must be flown to the

<sup>22</sup>Based upon U.S. Marine Corps experience, this typically requires about one company of light infantry.



Old	New
• <b>Administrative loading</b>	• <b>Mission loaded</b>
• <b>Don't always move early</b>	• <b>Strategic warning</b>
• <b>Downloads for maintenance</b>	• <b>Practice download and operational use</b>
• <b>Full units (prepo)</b>	• <b>Selected equipment</b>
• <b>Fixed application: one force type</b>	• <b>Flexible application: multiple force types</b>
• <b>Dated equipment</b>	• <b>Modernization priority</b>

**Figure 3.20—Rapid Response Requires Changes in  
Prepositioning Paradigm**

port. Moving only the personnel, though, will require a small number of aircraft, and if the airfield permits, commercial aircraft would be an effective and efficient choice of transportation. This would reduce the burden on the military airlift fleet and, by flowing to another node, would also reduce the throughput consumption on the APOD where the nonprepositioned materiel is flowing. None of this is easy, however; it must be well thought out and practiced before the need ever occurs.

### **Prepositioning Considerations**

The strategic response value of prepositioning has become well accepted in the U.S. military. Afloat prepositioning has long been used by the Marine Corps, ashore prepositioning has been used extensively by the Army with increasing use of afloat prepositioned items, and the Air Force has been prepositioning ammunition and other consumable stocks. Just as with forward unit positioning, the benefit of prepositioning equipment and sustainment stocks must be balanced against the costs it imposes.

The prepositioning decision process might start with an evaluation of the global locations for which the response speed of appropriate ground forces is insufficient. Very critical areas might merit land prepositioning, as feasible, such as the Army's heavy brigade set in Kuwait. Otherwise, afloat prepositioning or central land locations at

ports should be considered. The benefit of each site then depends upon the response time and airlift reductions it provides for deployments to critical regions—functions of both distance and what materiel is to be prepositioned.

The marginal cost that must be balanced against the benefit depends upon the cost of equipment and other materiel to be prepositioned, the amount of this equipment already available (i.e., excess inventory such as from downsizing the military), the annual maintenance cost of the prepositioned items, and the perishability of prepositioned materiel. Perishability can be thought of with respect to sustainment stocks such as food and ammunition as well as equipment that is subject to modernization. With respect to modernization, the pace may be different for different types of equipment, or, in other cases, the effects of modernization may be different. That is, when modernization affects how operations are conducted, training issues can develop when the prepositioned equipment is different from home station equipment. Modernization that instead is transparent to operation (e.g., reliability or fuel efficiency improvement) is less of an operator training issue, but it still potentially affects maintenance capabilities.

Once the costs and benefits of prepositioning options are determined, they should be compared to the costs and benefits of other options, if any, for the region, which can include forward unit positioning and increased strategic lift. In some cases, however, there may not be another option. These include cases where unit positioning is not politically feasible or where throughput capacity of potential APODs is the likely bottleneck as opposed to airlift.

Because the issues are not purely financial and because the benefits may take nonmonetary form, the prepositioning decision is difficult to convert to a rote formula. The considerations are summarized in Figure 3.21.

### **Employing a Mixed Strategy of Forward Unit Positioning and Materiel Prepositioning**

Assuming that the Army and the Department of Defense opt to explore a forward-positioning strategy for the SBCT to improve response speed—either for the SBCT itself or for a larger deployment

- **Criticality of each global location**
- **Prepositioning options for the location**
- **Other options for rapid response to a location**
- **Available equipment to preposition**
- **Procurement cost of equipment to preposition**
- **Maintenance cost of prepositioning**
- **Modernization and training implications**

Figure 3.21—Prepositioning Considerations

by reducing the airlift assets that must be dedicated to the SBCT—a mixed strategy would probably be ideal. Limited permanent forward unit stationing, situation-specific rotational or temporary basing, and selected prepositioning of equipment and supplies are probably the best options for different potential contingency locations and situations.

A cursory examination of likely contingency locations and potential permanent basing sites suggests a limited set of good candidates. The best and only clear region of value is Europe. Basing in Central, Eastern, or Southern Europe provides fairly good response to Central Asia, the Middle East, and Northern Africa. Clearly, Germany imposes the least cost due to the already robust U.S. military infrastructure. The only potentially politically feasible locations in or near Asia pose significant costs and are still quite far from many hot spots. For example, Darwin lacks a U.S. military infrastructure and is still several thousand miles from many South Asia hot spots. Politically it could be difficult to add forces to South Korea, and it is still far from many hot spots. Guam lacks maneuver area. But such locations or even others might be viable sites for “temporary” stationing if a specific crisis arises. As a crisis develops, it may also temporarily change the political conditions, opening up a greater set of possible “staging” sites.

With the large distances in Asia and the tendency of hot spots to be in littoral areas, prepositioning on ships or at ports offers the opportunity for regional presence and response. Either a central site or two sites, such as Diego Garcia and Guam, would be necessary to cover most of the Asian, East African, and Middle Eastern littoral with strategic warning of up to a week.

### **OPTIONS FOR IMPROVING RAPID CLOSURE OF EARLY-ENTRY FORCES**

Figure 3.22 summarizes general options for improving the ability to rapidly move an SBCT to the desired location once the final deployment order is given. As we have discussed, there are two general possibilities for moving the SBCT closer to a potential crisis spot: forward position the unit or its equipment. Either can be employed permanently or temporarily and for a full unit or a partial unit.

<p><b>Forward unit positioning</b></p> <ul style="list-style-type: none"> <li>• Overseas stationing</li> <li>• Brigade or battalion rotation (full units or with prepo)</li> </ul> <p><b>Selected prepositioning (afloat and fixed sites)</b></p> <ul style="list-style-type: none"> <li>• Sustainment (I, IIIB/P, IV, V)</li> <li>• Soft-skin tactical wheeled vehicles</li> <li>• Changes in prepositioned afloat loading</li> </ul> <p><b>Theater lift (TSVs or other sealift) with forward positioning</b></p> <p><b>Continue APOE construction to improve throughput as necessary</b></p> <p><b>Preplan loads to optimize airlift utilization given tactical constraints</b></p> <p><b>Improve and practice deployment procedures to maximize throughput</b></p> <p><b>Advocate for</b></p> <ul style="list-style-type: none"> <li>• Improving working MOG potential of APODs (i.e., non-“space” factors)</li> <li>• Strategically located joint basing network with construction projects, where feasible, to improve throughput</li> </ul>
---

Figure 3.22—Summary of Options for Improving Deployment Closure Time

Enhanced theater lift capabilities could broaden the range of candidate sites for “close proximity” unit stationing and the prepositioning of equipment and supplies. Rather than being right at the desired site, a force or equipment could be somewhere within, say, a 1,000-NM range. Theater lift platforms also expand entry point possibilities.

From a throughput standpoint, the U.S. military has the greatest ability to affect APOE throughput, less ability to affect enroute base throughput, and the least ability to affect APOD throughput. Still, all three can be influenced. First, the military should ensure that departure points are not the bottlenecks of an operation, since they are fully under U.S. control or, generally, that of close allies. As the result of mobility studies, significant improvements have been made at candidate APOEs, and several construction projects have recently been approved for SBCT APOEs. From an enroute standpoint, the Army should work with USTRANSCOM to identify needed basing structures for deployments to various regions of the world and assess gaps in base throughput capacity. Then the Army can advocate for programs to improve the structures. Improvement can range from new base access agreements, incentives for host nations to improve their infrastructure, or direct U.S. funding to improve the infrastructure. APODs remain the greatest challenge. Generally, the United States will not be able to change the parking MOG of likely APODs in advance of an operation. However, to the extent that airfield control, materiel-handling capabilities, and fueling and service capabilities limit working MOG, such assets could be enhanced—in terms of both resources and route construction.

Perhaps a better way to improve APOD throughput is to continually improve offload, airfield clearance, and aircraft turnaround TTP to minimize ground times. Further enhancement can come from frequent practice to maximize the potential of the TTP. This requires coordination with USTRANSCOM as well as funding for rigorous deployment practice.

In conjunction with practice, preplanning is critical. To efficiently use airlift given tactical needs and loading “rules,” it is imperative to chalk out the entire unit prior to a deployment order. Further confidence can be achieved by gaining Air Mobility Command “precertification” of the loads. Actual use of these loads on practice

deployments then adds the final layer of robustness. By precertification, we mean bringing in Joint Inspection teams and gaining agreement that each proposed chalk meets guidelines.

---

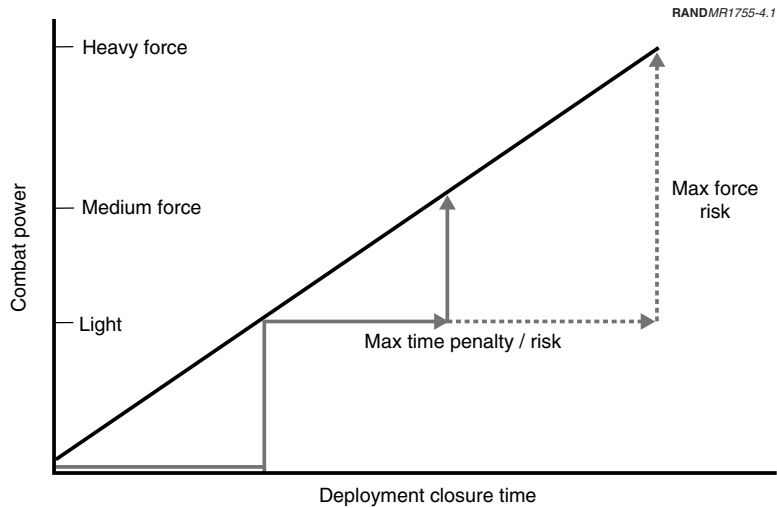
**RAPIDLY PROVIDING MISSION-TAILORED  
FORCE PACKAGES**

---

To this point, we have focused on understanding the SBCT's deployment closure time potential and strategies for improving movement times once a unit actually begins the final movement to the deployment location. We now shift to the problem of how to rapidly configure the right force for a mission to get a force on the ground more quickly once a deployment is initiated and, just as importantly, reduce the amount of strategic warning needed to initiate movement.

**FILLING THE GAP WITH A "MEDIUM" FORCE**

A notional medium-weight force fills the gap between the Army's light and heavy forces, providing another option on the deployment closure time versus combat power tradeoff curve. Simply substituting medium-weight vehicles into the force might be thought of as just filling in another point on a fixed relationship curve between the two measures. For those situations in which time is critical and combat power needs are greater than what light forces can provide, the maximum force risk and the maximum time penalty are reduced. The change in these risks shown on Figure 4.1 is simply a function of the introduction of medium-weight combat platforms and weapons instead of either light weapons and soft-skin vehicles (or no vehicles), or heavy weapons and heavy armored vehicles.



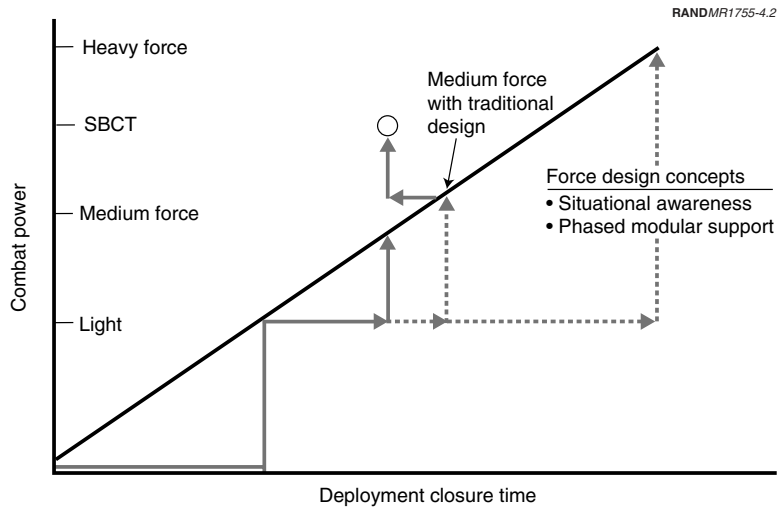
**Figure 4.1—Medium Platform Use with Current Heavy and Light Brigade Designs Might Be Viewed as “Moving Along” the Time-Versus-Combat Power Line**

### Changing the Force Design: A New Point on the Tradeoff Curve

The SBCT, though, does not simply put medium-weight weapons and vehicles into a traditional force design. Rather, new organizational design concepts and supplementary technologies change the relationship between deployment closure time and combat power. That is, for the size of the force required to provide operational capability, it offers greater combat power than might be expected.

The new design concepts both increase the numerator (combat power) above what might be expected given the traditional combat assets and decrease the denominator (total weight of the force) that might be expected given traditional support concepts. From a combat power standpoint, situational awareness capabilities that provide greater information dominance multiply the power of the maneuver





**Figure 4.2—SBCT Force Design Concepts Improve the Deployment Time Versus Power Tradeoff**

formations. From a support standpoint, greater modularity allows support to be phased in. Only what support is needed for initial operations is included organically and is placed in the initial deployment flow. Longer-term sustainment capabilities can then be phased in. In tooth-to-tail parlance, the value of the teeth has been strengthened and the initial tail has been reduced, potentially moving the SBCT off the tradeoff curve in Figure 4.2.<sup>1</sup>

The result is a force that produces a reduction in maximum force risk or maximum time risk beyond what could be expected simply given the existence of a medium-weight force. Some of this risk reduction comes from the difference in maneuver platforms, and some comes from the changes in organizational design and the inclusion of combat power providers or multipliers other than maneuver platforms.

<sup>1</sup>Eric Peltz, John M. Halliday, and Steven L. Hartman, *Combat Service Support Transformation: Emerging Strategies for Making the Power Projection Army a Reality*, Santa Monica, CA: RAND, DB-425-A, 2003.

### **FORCE PHASING TO MINIMIZE TIME TO INITIAL OPERATING CAPABILITY**

Expanding on the support phasing concepts in the force design expands the strategic response tradespace and capability. As shown in Figure 4.3, the SBCT's deployment can be divided into phases based upon preplanned modules of capability that represent levels of full SBCT capabilities. We divide the organic SBCT, which provides initial operating capability, into two levels of power: a brigade minus (or combined arms battalion task force plus) and the full SBCT. This is followed by the SBCT-dedicated combat service support company, designed to provide the SBCT with extended operations sustainment capability, in conjunction with corps support group elements that link national providers to the brigade's support capabilities. The final phase would be for long-term presence, that is, when and only when operations require the development of infrastructure for improved quality of life. This final stage would reflect a transition from an expeditionary mode to a rotational status when long-term presence becomes necessary.

To provide well-phased deployment phases requires detailed planning of what will be in each phase. The "capability packages" should be ready to deploy with preplanned loads based upon an assessment of what resources are needed in each phase. This has the advantage of enhancing deployment discipline so that only those items needed during that phase, based upon an understanding of the benefits and costs on the entire force, are moved in each phase, producing a known airlift requirement. Finally, such preplanning of aircraft loads

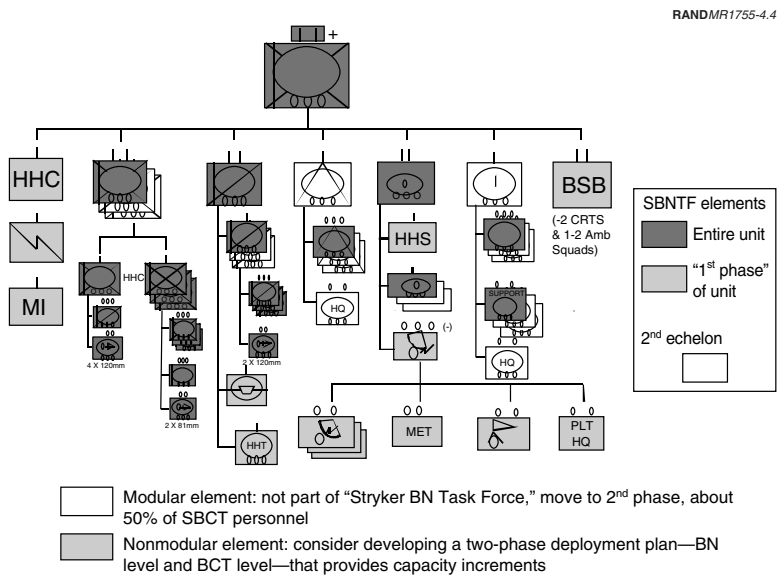
- |   |
|---|
| <ol style="list-style-type: none"> <li>1. <b>Initial phase/SSC</b> <ol style="list-style-type: none"> <li>a. <b>Combat power level 1: "BNTF plus"/SBCT (-)</b></li> <li>b. <b>Combat power level 2: SBCT</b></li> </ol> </li> <li>2. <b>Post 72-hour SSC follow-on/Sustained operations—CSSC and CSG</b></li> <li>3. <b>Long-term presence/operations—Base camp/infrastructure development</b></li> </ol> |
|---|

Figure 4.3—SBCT Deployment Phasing

allows the Army to more effectively communicate deployment requirements to combatant commanders. This increases value to the commander by reducing his uncertainty and enabling him to make a better evaluation of the benefits and costs of requesting a capability.

### A Stryker Battalion Task Force “Plus”

Figure 4.4 lays out how a derivative fully functional combined arms Stryker battalion task force (SBnTF) might be created from the SBCT. It is half the size of an SBCT (and potentially even smaller) and takes advantage of modular unit designs by deferring deployment of duplicate modules until the full spectrum of SBCT capability (not the full depth of capability) is on the ground. Where there are like units of any size, only one or more must be kept to retain the basic capability. Modular units are indicated by dark shading (1st module) and



**Figure 4.4—A Preplanned Task Force, 50 Percent of SBCT Size or Smaller, Could Provide the First Level of SBCT-Like Capability**

white (2nd plus modules). The three infantry battalions, the anti-tank (AT) company, and the engineer company are fully (or at least close to fully in the AT case) modular. The reconnaissance, surveillance, and target acquisition (RSTA) squadron and the field artillery (FA) battalion are somewhat modular. The surveillance troop of the RSTA squadron, the RSTA headquarters and headquarters troop, the FA headquarters and headquarters battery, the FA target acquisition platoon, the BCT headquarters and headquarters company, the signal company, the military intelligence (MI) company, and the brigade support battalion (except for the combat repair teams and ambulance squads) are not transparently modular, indicated by light shading. That is, they only have one “unit” of each subcapability within them. Taking one module of each of the modular elements and all of the nonmodular elements creates a combined arms task force of about half the size of the entire BCT. This produces a force with almost exactly half the soldiers of a full SBCT and requires just over half the number of C-17 missions.

Further detailed subunit analysis might cut the force size closer to a third of the full BCT. Some of the nonmodular elements will have excess capacity when only supporting half of the BCT, specifically those whose size is based upon the workload requirements imposed by the remainder of the BCT (e.g., distribution capacity) as opposed to those that provide a capability with size independent of the BCT (e.g., many MI functions). Detailed analysis of each BCT workload-sized subunit could potentially identify two phases of capacity for deployment. For example, stage one could require four of seven personnel from a section, with the remainder considered stage two (either for operations that expand or full SBCT deployments). This is precisely what 3-2 SBCT has developed as a potential “Stryker Ready Force.” They have decomposed all the nonmodular units to determine essential first-phase slices. The result is a task force about 40 percent of the size of the SBCT. Further, they have analyzed how it might be sequenced in varying orders depending upon the mission.<sup>2</sup>

Applying both full unit modularity and staging capacity of nonmodular subunits would produce a first deployment phase consisting of

---

<sup>2</sup>Interview with MAJ Barry Huggins, S-3, 3-2 SBCT, on March 3, 2003, and Barry Huggins, Headquarters, 3-2 Stryker Brigade Combat Team, “Early-Entry Operations in the SBCT,” unpublished briefing, September 2002.

the complete (dark-shaded) units and the “stage one” portions of the light-shaded units, where applicable. This notional design is meant to provoke ideas on how a smaller but full-spectrum SBCT-type combined arms force might be formed.

### Deployment Time of the SBCT’s First Phase

Even the larger form of the SBnTF (based solely on full unit modularity and not decomposing nonmodular units into stages), at a little more than half the size of the full SBCT in terms of C-17 missions, potentially provides closure in about 4 days (see Figure 4.5). With a working MOG of 3, the time for the case considered in this document would be potentially just over 4 days from CONUS and a little under that time if forward based. This type of thinking enables the SBCT to be leveraged to get initial presence with the full range of capabilities on the ground very quickly, with the remainder of the full depth of combat power and support then building. In some cases the SBnTF might be deployed by air, with the remainder of the brigade deploy-

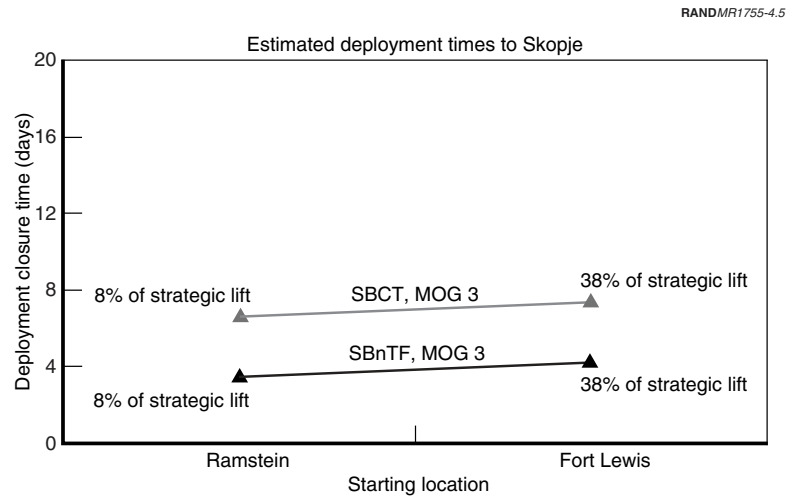


Figure 4.5—A Stryker Battalion Task Force Improves the Responsiveness of SBCT-Like Capability

ing by sea to leverage multimodal and multinodal deployment capabilities. This provides the combatant commander with more flexibility at a critical time in a crisis.

The 3-2 SBCT has already taken this one step further. Beyond decomposing the SBCT into two phases similar to the SBnTF and the remainder of the SBCT, they have identified 83 root elements of capabilities across the SBCT. Each element is defined by its contribution to the fight, its unit, the number of passengers, the vehicles and other equipment, and the number of C-17 sorties required to deploy the element. Using these elements, they have developed proposed unit flow for a range of potential scenarios from which they can quickly reconfigure as the actual mission demands. Additionally, the proposed flows cleanly indicate which elements would need to deploy in the initial air flow and which could be candidates for a complementary sea move.<sup>3</sup>

## RAPID MISSION TAILORING

To this point, we have addressed how modularity can be used “vertically” to phase in levels of power and sustainability. We now turn to a discussion of how modularity might help address another problem. Today, the Army rightly prides itself on the valuable ability to pull elements of many different forces together to precisely tailor a force for the mission need. However, this generally begins once a deployed mission need is identified. Determining the requisite forces and getting to the point where deployment can be initiated is often a time-consuming process. Significant work has to go into exactly how and what units will be “broken” and what they will deploy with. How will command and control requirements change? How will support requirements change? Iterations may be necessary until the right balance of size and capabilities is determined. Various constituencies insist on presence in a deployment. The result is a highly tailored force but one that delivers a slow deployment initiation time—the time until the first wheels-up. For example, with respect to one early-deploying unit in October 2001, it took 17 days in Operation Enduring Freedom from the time U.S. Central Command

---

<sup>3</sup>Barry Huggins, Headquarters 3-2 SBCT, “SBCT Airflow,” Excel spreadsheet, November 12, 2002.

submitted a request for forces (RFF) until the first aircraft departed with the deploying unit.<sup>4</sup> This was preceded by the identification of requirements and the development of the RFF. Furthermore, it is a process that introduces a great deal of uncertainty as to Army lift requirements into the Joint community, complicating the decision process of the combatant commander. Finally, it can produce force packages not normally used in peacetime training exercises, violating the tenet “train as you fight” and potentially impeding effectiveness, especially if the force must begin operations immediately.

An organic brigade might be deployed quickly, but it would be poorly tailored for many missions. Ready brigades have some pretailoring and can initiate deployment quickly but still fall short of finely tuned mission tailoring. The goal in this section is to generate ideas for breaking the relationship between mission tailoring and deployment initiation time shown in Figure 4.6 with a target of being able to deploy a force with “full” mission tailoring as quickly as a ready brigade.

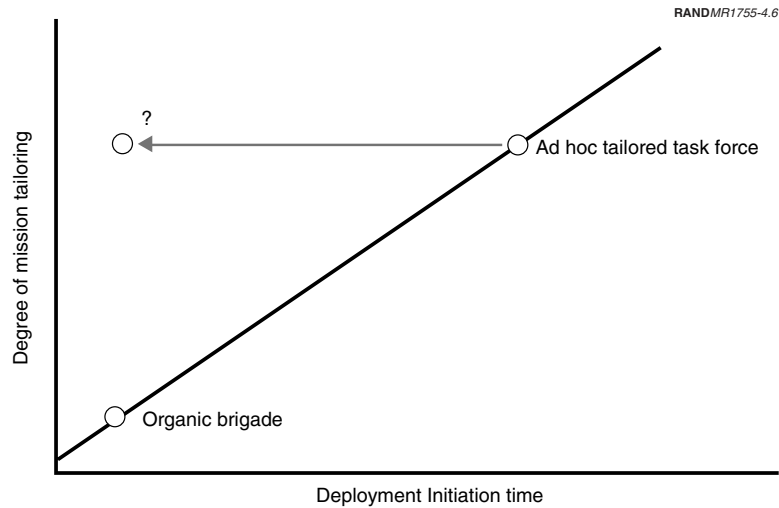
### **Tailoring from Capability Building Blocks**

Tailoring is really putting together the right sets of capabilities by combining full or partial units. This process reflects an underlying assessment of the capabilities needed and those that each unit or piece of a unit can provide. Additionally, thought must be given to how the parts are to be tied together by command and control (C2) capabilities and how they will be supported.

To create horizontal modularity, building blocks of capabilities can be predefined, with detailed time-phased force deployment data (TPFDD) created for each. These capabilities could include supplemental support augmentation modules based upon potential combinations. For example, if one were to deploy an armor battalion with an SBCT, the Brigade Support Battalion (BSB) would probably require augmentation of assets such as fuel trucks, cargo trucks, and spare parts. This requirement could be predefined to include de-

---

<sup>4</sup>Stan Hoskin and Steve Joachim, “Joint Deployment Process Improvement (JDPI) Update to the JCS,” unpublished briefing, May 23, 2003.



**Figure 4.6—Can Modularity Be Leveraged to “Break” the Tradeoff Between Deployment Initiation Time and Mission Tailoring?**

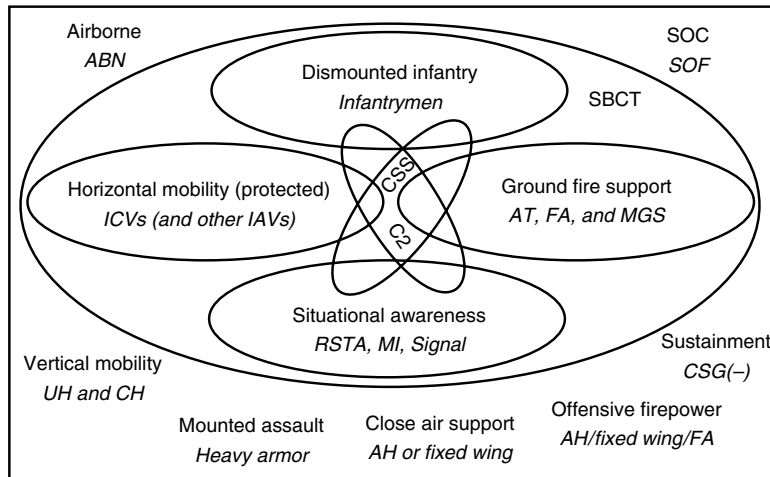
tailed TPFDD data. Two capabilities are now defined: mounted assault and CSS support of mounted assault augmentation to an SBCT.

We examine this construct in Figure 4.7 using the SBCT as the basis of the joint mission-tailored force package. First, what basic sets of capabilities does the SBCT provide? The SBCT is built around dismounted infantry. Given the right training, these infantry personnel can be capable of any light infantry–like missions. Further, the battalions reflect Force XXI CSS design, making them organically lean, which is ideal for quick-hitting operations (for more conventional missions, they must have more support). For situations that call for a mobile force or long-range, protected patrolling, Stryker infantry carrier vehicles provide protected horizontal mobility (as other Strykers provide to other SBCT elements). These become separable assets—light infantry and mobility—if this potential is reflected in training, deployment planning, and force design. The infantry would still need their C2 vehicles or would have to have more robust dismounted C2 capability. The medium gun system (MGS) platoons, the anti-tank company, and the FA batteries provide both offensive



RANDMR1755-4.7

Design TPFDD building blocks that represent capabilities (each includes identified CSS)



KEY: Capability  
Unit/equipment type

**Figure 4.7—Predefined SBCT, SOF, Aviation, Airborne, and Heavy Capabilities Can Be Combined for Rapid Mission Tailoring**

and defensive ground fire support and firepower capabilities for heavier target takedown, overwatch, quick response to intelligence, and increased force protection. Finally, the “situational awareness” module provides a new level of self-contained capability through the RSTA, MI, and signal assets. These four capabilities are tied together with a C2 capability—one that has the ability to integrate other assets—and the BSB, augmented by a combat service support company as necessary, provides “internal” sustainment capability (maintenance, field services, and internal distribution).

Some or all of these SBCT capabilities could be combined with other capabilities to meet a wide range of mission needs for early-entry forces. These might include mounted assault or heavy protected patrolling capability (which is provided by heavy armor) for urban warfare, operational risk reduction, or when the threat and mission

so dictate. In many situations, there will be a need to combine the SBCT with additional fire support, which could be provided by attack helicopters, fighter/bombers, or heavy artillery. A vertical mobility capability could be needed to act quickly on intelligence. The SBCT could also be employed in tandem with airborne, offensive fire-power, air assault, and special operations forces. Combined with such capabilities, the elemental SBCT capabilities can be used to create a full menu of options for potential missions.

### A Menu of Capability Options

Once capabilities and the associated forces are predefined, a “menu” of modular deployment capabilities can be created for combatant commanders. This would give Joint planners a tool to help *quickly* think through the force package options for a mission. It would clearly communicate the deployment resources associated with various capabilities and the options for providing such capabilities.

Table 4.1 gives a partial example of this approach. It lists unit or unit components—building blocks—on the right and the C-17 mission equivalent deployment requirements on the left. For example, the entire SBCT requires 270 C-17 missions, the first phase of SBCT combat capability requires 143 missions, and the “cost” of providing an infantry battalion with protected mobility is 39 missions. The deployment requirements for the non-SBCT elements are for the unit only and do not include the requisite support augmentation that would be needed if they were integrated with another unit, such as the SBCT. The notional Air Expeditionary Force (AEF) “task force” provides a mix of counter-air, suppression of enemy air defense, and air-to-ground capabilities, each of which could represent independent capabilities in this menu as well. A full realization of this menu would have three sets of columns: capabilities, unit options for those capabilities, and deployment requirements for each unit option.

### The Next Step: Joint Expeditionary Forces

Preplanned force packages would provide commanders with a spectrum of rapid response options from which to flex. From an analysis of likely missions and courses of action, potential Joint force packages could be developed. From these, the commonly required

**Table 4.1**  
**A Menu of Capability Options**

Number	C-17 Mission Equivalent	Capability
1	270	SBCT
1.1	143	SBCT Combined Arms Battalion Task Force, phase 1 elements
1.2	127	Remainder of SBCT
1.21	16	RSTA squadron phase 2 (2 recce troops)
1.22	14	Field artillery BN phase 2 (2 firing batteries)
1.23	39 (× 2)	SBCT Infantry Battalion
1.24	25	SBCT Infantry Battalion without ICVs
1.25	9	Engineer CO phase 2 (2 CBT Eng PLTs, 2 Mob Secs, HQ)
1.26	4	Anti-armor CO phase 2 (2 PLTs and HQ)
1.27	6	BSB phase 2 (2 combat repair teams and 2 evacuation squads)
1.S1	24	SBCT Combat Service Support company
1.S2	21	SBCT area of operations Corps Support Group requirements
2	168	AEF:6 F-15C, 12 F-15E, 12 F-16CG, 6 F-16CJ to bare base
3	33/48	Combat search and rescue (CSAR):6 HH-60, same base as AEF/different base
4	87/93	AEF:6 F-15C, 12 F-15E, 12 F-16CG, 6 F-16CJ to established base/ + CSAR
5	12	Light Infantry BN
6	87	Mechanized Infantry BN
7	124	Tank BN
7.S1	8	Additional combat service support for tank BN attached to SBCT
8	6	Ranger BN
9	29	Special Forces Group with vehicles (estimate based upon OEF)
10	14	Vertical lift package:6 CH-47

capability building blocks can be identified. Joint expeditionary forces (JEFs) could be created, with named units representing the spectrum of requisite capabilities. Then habitual relationships can be created and exercised among SBCT, airborne, Army aviation, mechanized infantry, tank, special operations, artillery, and air expeditionary force units. The keys to making these concepts work are detailed planning, targeted deployment and operational training, force package discipline, and information systems.

The capability menus offered by these JEFs would be available to combatant commanders and kept updated. For very quick response, some capabilities packages could be defined for the most likely types of missions, enabling almost instant tailored response. What is critical is that when a mission develops, every involved unit knows precisely which people and what equipment must move and how they are to be configured on aircraft. Within the JEF, ready forces could be kept on call, with rotations among those units capable of providing the requisite assets. It is equally critical that the commanders understand and are comfortable with the configurations of preconfigured capabilities. This enables the constructions of building blocks during deliberate planning, preventing the need for such work during crisis action planning. Now, rather than building from units and pieces of units, a force is built from capabilities that already appropriately combine units and elements of units.

A standing JEF C2 package could improve the integration of capabilities. The C2 packages and combinations of capabilities offered by different force types, both within and across services, should conduct periodic exercises.

---

**CONCLUSIONS AND RECOMMENDATIONS**

---

The final chapter of the report presents a summary of the various cases and then provides conclusions and recommendations.

**A COMPARISON OF CASES**

Figure 5.1 shows the various cases used to illustrate the effects of various options displayed. The left set of columns shows the effect of varying unit deployment footprint. Given the constant route length, the maximum feasible airlift allocation remains constant while the time improves as the footprint gets smaller. The middle set of columns provides forward unit positioning and selected prepositioning excursions. The third set of columns presents a two-phased deployment flow for the organic SBCT. Given APOD planning factors, a force in the size realm of a light BCT or about half of an SBCT can meet the Army's future force goal of 96 hours whether from CONUS or forward based. Forward basing, however, greatly reduces the airlift allocation needed to reach this goal and makes it more feasible to leverage improved ground times.

**PROMPT POWER PROJECTION REQUIRES NEW THINKING  
IN POSITIONING, PRACTICE, AND PREPARATION**

While there are situations in which airfields will have a working MOG of greater than 3 and others in which multiple APODs can be exploited, recent history suggests that to have confidence that a deployment time goal can be met for an early-entry brigade-sized element or below, the goal should be achievable with a total working

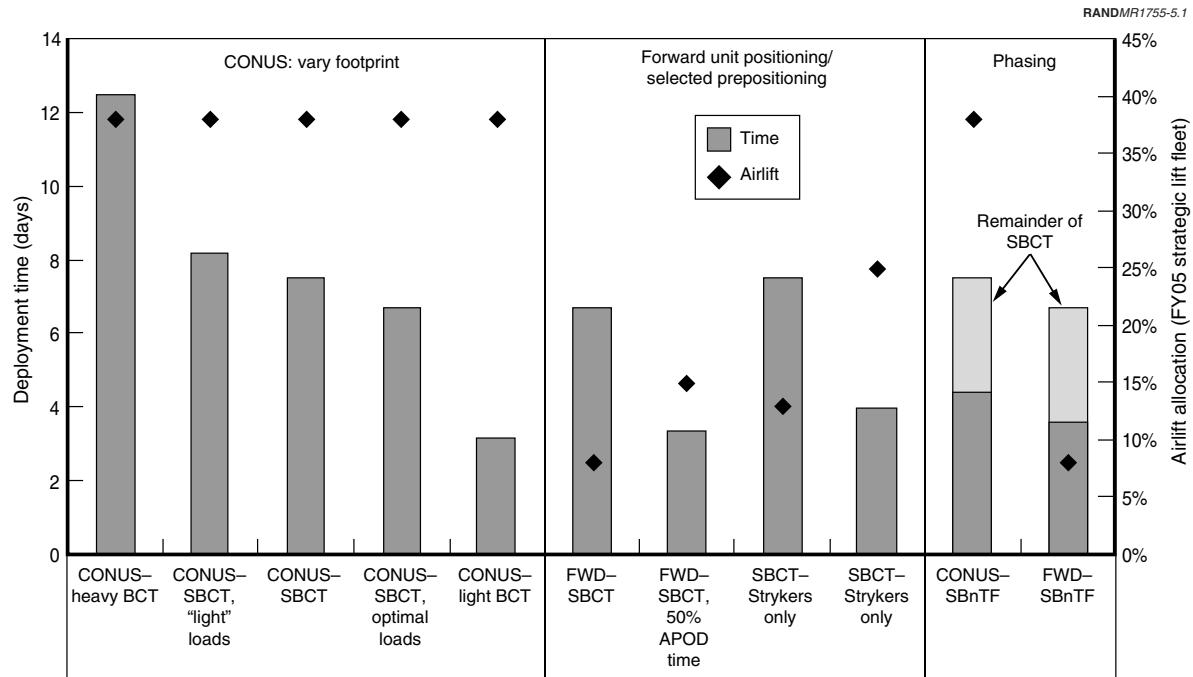


Figure 5.1—Comparison of Cases

MOG of 3. Even then, many other factors, such as airfield operating hour limitations, could come into play and lengthen the time from the potential “best case.” Given this, the SBCT cannot robustly meet the 96-hour stretch goal from CONUS, and it appears to be a challenge for the emerging future force Unit of Action.

However, the SBCT does offer a significantly faster response option than heavy forces. Additionally, there appear to be options for further improving potential deployment times to selected locations. These include forward positioning of units, whether permanent, temporary, or rotational, and selected prepositioning of equipment and supplies. In some cases, forward positioning will primarily reduce the unit’s demand on lift resources, which provides value to the combatant commander in a different way by lowering the “opportunity cost” associated with deploying an SBCT. Where airlift is the bottleneck, forward positioning will speed deployment. Beyond presenting an affordable prepositioning option, the selected prepositioning of support assets will provide a “multi-use” capability, potentially serving the full array of Army maneuver units. In conjunction with one or both of these strategies, rigorous review and practice of TTP and flexible deployment planning are critical to achieving the full potential of the SBCT’s deployment capability, or later, that of the Unit of Action.

Further, SBCT force modularity can be employed to enable SBCT full-spectrum presence on the ground very responsively, even from CONUS, in the form of a combined arms battalion task force plus. Further value can be provided by thinking about horizontal modularity of the SBCT and other forces in order to define building blocks of capability for rapid mission-tailored force package construction.

### **RECOMMENDATIONS SUGGEST CHANGES IN DEPLOYMENT PREPARATION AND POSITIONING WITH PROCESS IMPROVEMENT**

From these conclusions and the detailed analyses, we offer recommendations for consideration by the Army that fall under the purview of a wide range of organizations. With regard to deployment speed, in the short term the Army has the most control over what has to be moved and the effectiveness of APOE and APOD TTP. More

effective utilization of aircraft while satisfying tactical requirements through careful preplanning offers an opportunity to improve upon historic aircraft loads, reducing the total number of lift missions for a force. This should be done in conjunction with gaining “precertification” of loads, which has the added benefit of enhancing deployment process discipline, since the joint inspection team will still have to confirm the validity of loads upon actual deployment.

In conjunction with improving load effectiveness, the Army and USTRANSCOM should work together to improve TTP, perhaps initially through the designation of a joint team dedicated to this effort for a short period. This team should also examine the potential to change airfield processes and layout during initial deployment periods to expand the working MOG during periods when all or most of the cargo consists of vehicles. Such a team should include personnel with experience in rapid deployment. Then rigorous practice can ensure that the potential turnaround times at aerial ports and the times for other key process segments such as moving equipment to the airfield can be achieved.

In the course of this research, we came to believe that the process times for a unit such as the SBCT could be better than those indicated by the Air Force’s planning factors. However, we lacked solid data to use alternative times. We found that to a large degree, deployment planning factors are based upon major theater wars and average many different types of situations. To better understand the responsiveness of a unit such as the SBCT, more detailed planning factors should be developed through measurement during SBCT exercises. Then, ideally, they can be maintained in a living document as TTP improve. Similarly, when airfield surveys are conducted, they should analyze the potential contingency working MOG for the initial deployment of vehicle-based units in addition to the standard working MOG that must be able to accommodate a mix of cargo types. This would enable deployment planners to more effectively communicate deployment capabilities for small-scale contingencies.

The second and third main bullets in Figure 5.2 build upon work the Army has already started with USTRANSCOM and its Air Mobility Command and Military Traffic Management Command Transportation Engineering Agency components. Formal site surveys of SBCT power-projection platforms have been conducted, and projects have



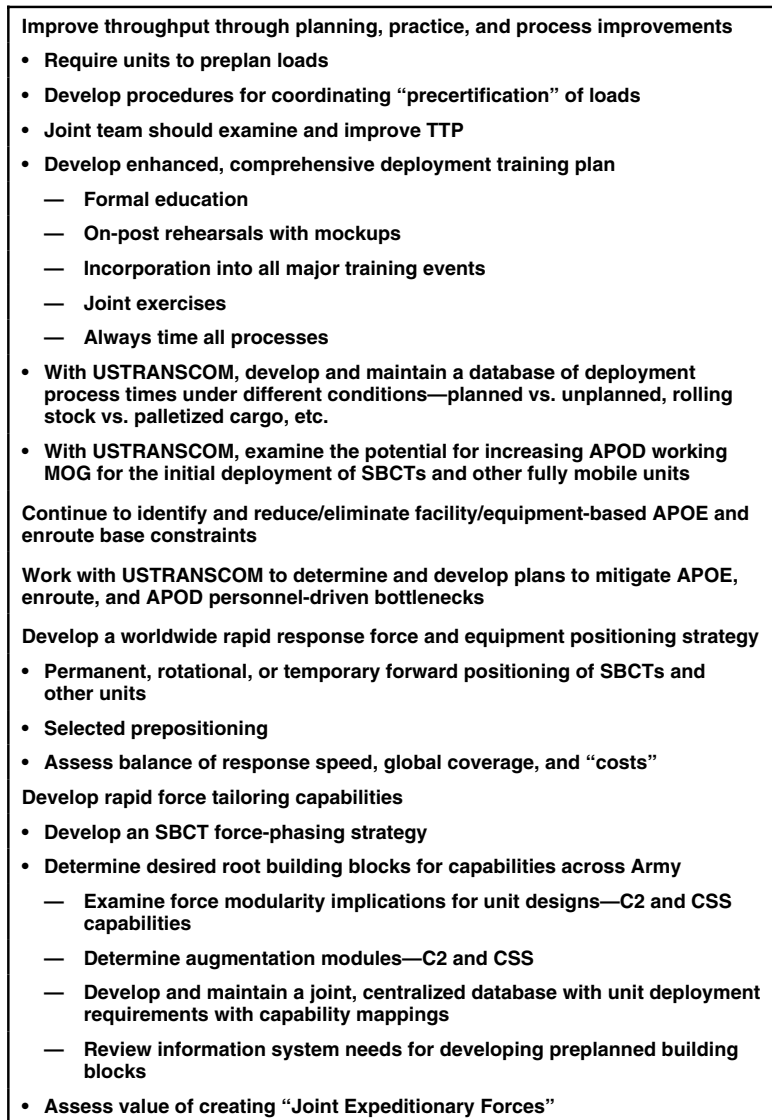


Figure 5.2—Summary of Recommendations

been proposed, funded, and initiated to varying degrees to improve outload capabilities. The Army's G-4 is incorporating the measurement of such capabilities in the Army's Strategic Readiness System. This type of work and monitoring should continue, and it should include enroute bases as well. Beyond facilities and equipment, potential personnel bottlenecks, such as joint inspection or tanker airlift control teams, should be identified.

To the extent that faster deployment speed than that possible from the CONUS is desired for SBCTs, the Army and the Department of Defense should develop an integrated global response strategy. As previously discussed, a mixed strategy of forward unit positioning and selected prepositioning of some of the SBCT's equipment and supplies is probably ideal, given financial and political constraints. Decisions will probably have to be made about the extent of global coverage requiring various response speeds.

Finally, we recommend that the Army begin evaluating how to transition force deployment to a capabilities-based approach. The Air Force has made significant strides in modularizing units, and its approach might represent one construct; others may emerge from detailed examination.<sup>1</sup> A key part of this is to understand the C2 and CSS implications of creating transparent modularity. In the short term, the Army can apply modularity and new deployment planning concepts to create a phasing strategy for the SBCT that would enable fast response of initial operating capability and flexibility for a range of situations.

In summary, the deployment problem represents a complex tradespace that, when combined with the need for expert judgment, is not amenable to optimization. The "best" solution set depends on how fast is fast enough to each region of the world and assessments of basing and prepositioning site options. Additionally, the recommendations are complementary rather than competing. The force-tailoring recommendations focus on how the Army characterizes its

---

<sup>1</sup>We recommend two documents that describe this approach: Headquarters, U.S. Air Force, *Deployment Planning and Execution*, Washington, D.C.: Air Force Instruction 10-403, 9 March 2001; and Lionel Galway, Mahyar A. Amouzegar, R.J. Hillestad, and Don Snyder, *Reconfiguring Footprint to Speed Expeditionary Aerospace Forces Deployment*, Santa Monica, CA: RAND, MR-1625-AF, 2002.

forces and defines the capabilities that they provide. They are intended to more effectively enable force phasing and rapid tailoring so that combatant commanders understand the value of potential Army force options and how they will fit into the overall operational deployment scheme. The intent is that when commanders ask for a capability, the “right force”—with known associated demand on lift assets—can quickly be made available for movement. The force-positioning recommendations deal with means for not only reducing deployment time but also airlift requirements once a force package has been selected. While the Army has been thinking primarily in terms of speed, the combatant commander must consider the second as well. It is in this context that forward basing and selected prepositioning of equipment and supplies are especially useful; for any desired deployment time, they free assets the commander could use for other purposes. Recommendations to improve throughput ensure that the base structure can be used as effectively as possible. In some cases there is synergy between the two—e.g., forward basing leverages faster ground times. Overall, rather than a specific solution, we have tried to provide a conceptual framework for thinking about how to deploy units within the context of the broader challenge facing combatant commanders.

---

## BIBLIOGRAPHY

---

- Brady, Roger, Air Mobility Command Director of Operations, "Airlifting the SBCT in the Near and Long Term," unpublished briefing, January 23, 2003.
- Cato, Lloyd, and Owen Spivey, "An Evaluation of the Impact of Deploying Future Military Forces by Civil Reserve Air Fleet (CRAF)," unpublished report, 2000.
- Galway, Lionel, Mahyar A. Amouzegar, R.J. Hillestad, and Don Snyder, *Reconfiguring Footprint to Speed Expeditionary Aerospace Forces Deployment*, Santa Monica, CA: RAND, MR-1625-AF, 2002.
- Galway, Lionel, Robert S. Tripp, Timothy L. Ramey, and John G. Drew, *Supporting Expeditionary Aerospace Forces: New Agile Combat Support Postures*, Santa Monica, CA: RAND, MR-1075-AF, 2000.
- Gebman, Jean R., Lois J. Batchelder, and Katherine M. Poehlmann, *Finding the Right Mix of Military and Civil Airlift, Issues and Implications: Volume I. Executive Summary*, Santa Monica, CA: RAND, MR-406/1-AF, 1994.
- Headquarters, 101st Airborne (Air Assault) Division, Data from deployments to Afghanistan, Fort Campbell, KY, 2002.
- Headquarters, Air Mobility Command, C-17 Deliveries and Basing Data, 30 January 2002.
- Headquarters, Air Mobility Command, Health of the Force briefing, October 2002.

- Headquarters, U.S. Air Force, *Air Mobility Planning Factors*, Washington, D.C.: Air Force Pamphlet 10-1403, 1 March 1998.
- Headquarters, U.S. Air Force, *Deployment Planning and Execution*, Washington, D.C.: Air Force Instruction 10-403, 9 March 2001.
- Headquarters, U.S. Army, *Concepts for the Objective Force*, United States Army White Paper, 2001.
- Headquarters, U.S. Army Forces Command, 9–13 Sep 02 SBCT EAB CSS Update briefing, 1 October 2002.
- Headquarters, U.S. Transportation Command, “Interim Brigade Combat Team Air Mobility Deployment Analysis,” unpublished report, 2002.
- Hoskin, Stan and Steve Joachim, “Joint Deployment Process Improvement (JDPI) Update to the JCS,” unpublished briefing, May 23, 2003.
- Huggins, Barry, Headquarters, 3-2 SBCT, “Early-Entry Operations in the SBCT,” unpublished briefing, September 2002.
- Huggins, Barry, Headquarters 3-2 SBCT, “SBCT Airflow,” Excel spreadsheet, November 12, 2002.
- The Interim Brigade Combat Team, Organizational and Operational Concept, v 4.0, 30 June 2000.
- Kassing, David, *Getting U.S. Military Power to the Desert: An Annotated Briefing*, Santa Monica, CA: RAND, N-3508-AF/A/OSD, 1992.
- Lund, John, Ruth Berg, and Corinne Replogle, *Project AIR FORCE Analysis of the Air War in the Gulf: An Assessment of Strategic Air-lift Operational Efficiency*, Santa Monica, CA: RAND, R-4269/4-AF, 1993.
- Mills, Patrick, unpublished research on the deployment requirements of Air Force deployment packages.
- Nardulli, Bruce R., Walter L. Perry, Bruce Pirnie, John Gordon IV, and John G. McGinn, *Disjointed War: Military Operations in Kosovo 1999*, Santa Monica, CA: RAND, MR-1406-A, 2002.

- Peltz, Eric, John Halliday, and Steve Hartman, "Combat Service Support Transformation: Emerging Strategies for Making the Power Projection Army a Reality," unpublished research paper, 2002.
- Solveson, Keith and Bill Tarantino, "Enabling Strategic Responsiveness Results (ESR) aka 'The Prepo Study,'" unpublished briefing, Department of the Army, Deputy Chief of Staff, G-3, and Center for Army Analysis, 2002.
- "Stryker Brigade Combat Team Loaded in C-17," briefing by Boeing Corporation.
- Stucker, James P. and Ruth T. Berg, *Understanding Airfield Capacity for Airlift Operations*, Santa Monica, CA: RAND, MR-700-AF/OSD, 1998.
- Tripp, Robert S., Lionel Galway, Timothy L. Ramey, Mahyar A. Amouzegar, and Eric L. Peltz, *Supporting Expeditionary Aerospace Forces: A Concept for Evolving to the Agile Combat Support/Mobility System of the Future*, Santa Monica, CA: RAND, MR-1179-AF, 2000.
- U.S. Army Force Management Support Agency, Table of Organization and Equipment, 07015L000 Infantry Battalion (Light).
- U.S. Army Force Management Support Agency, Table of Organization and Equipment, 07245L200 Infantry Battalion (Bradley Fighting Vehicle).
- U.S. Army Force Management Support Agency, Table of Organization and Equipment, 17375L000 Tank Battalion (Heavy Division).
- U.S. Army Force Management Support Agency, Table of Organization and Equipment, 47100F300, IBCT, 18 May 2000.
- U.S. Army Force Management Support Agency, Table of Organization and Equipment, 63390F000, CBT SER SPT CO (CSSC) BSB, 6 September 2000.
- Vick, Alan, David Orletsky, Bruce Pirnie, and Seth Jones, *The Stryker Brigade Combat Team: Rethinking Strategic Responsiveness and Assessing Deployment Options*, Santa Monica, CA: RAND, MR-1606-AF, 2002.