

# **Strategic Mobility and the Transforming Army.**

**A Monograph  
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## Abstract

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The purpose of this monograph is to answer the research question: Will the current and programmed Department of Defense Transportation System (DTS) support the strategic responsiveness requirements of the US Army during the initial phase of transformation. The answer to this question is significant because the US Army is undergoing a transformation to become more strategically responsive. A measure of Army responsiveness is dependent on its ability to rapidly deploy. The Army will only deploy as quickly as the DTS is capable of moving it units and equipment.

In order to answer the question, classified and unclassified sources are used to develop the transportation requirements of the Army through FY 07. These requirements take into account the goal stated in the Army Vision of deploying a brigade in 96 hours, a division in 120 hours, and a five division corps in 30 days.

Classified and unclassified sources are used to develop projected capabilities of the DTS in the FY 07 period. Emphasis is placed on determining the capability of the components of the strategic mobility triad. These components are strategic airlift, strategic sealift, and prepositioned equipment. To make this capability determination, the outcomes of three DoD mobility requirements studies are explored. The findings of these studies reveal issues and trends associated with strategic mobility, which have and will continue to affect the capability of the DTS to support Army mobility requirements.

The method described above reveals that the DTS of FY 07 will not support attainment of the goal stated in the Army Vision. The greatest shortfall in capability is associated with strategic airlift. Strategic sealift and prepositioned equipment are shown to have some capacity to move the Army closer to its responsiveness goals.

The findings and recommendations for improving the projected situation include: studying the supportable, deployment timeline for the IBCTs and to ensure that the units capabilities are understood by Army and Joint planners, support the establishment of a Joint fund to address the strategic airlift shortfall, emphasizing the improvement of IBCT ammunition planning and departure airfield infrastructure, increasing Army prepositioned afloat equipment to one division, and developing a detailed workable concept for sea deployment of the IBCTs. Improvement in these recommended areas may not enable the Army to meet its responsiveness goal immediately, but will improve the FY 07 situation that is currently forecast.

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## CHAPTER ONE: Background and Introduction

In attempting to project whether the Defense Transportation System (DTS) of 2007 can support the strategic responsiveness requirements of the US Army through strategic mobility, it is helpful to look back and establish how the current system came into being. In addition to establishing of a current baseline, such a review also allows for the identification of trends that influence the current system and its future capabilities. After such a review, it is more likely that relevant trends and their potential impact on the DTS's support of the transforming Army's strategic mobility requirements can be assessed and the supportability of the requirements can be judged.

During the Cold War, the United States pursued its national security interests by employing a strategy of containment. The military strategy that supported this security strategy required forward based forces capable of stopping or blunting an initial attack by the Soviet Union or its proxies until the force could be reinforced by continental US (CONUS) based units. The deploying CONUS based troops were to fall in on prepositioned equipment cached in unit sets (POMCUS).<sup>1</sup> Strategic responsiveness was gained through forward based forces as well as prepositioned equipment. Consequently, the strategic lift required to support this strategy emphasized troop movement over equipment movement initially. After an initial surge requirement for personnel movement by airlift, the emphasis of strategic mobility changed to transportation of sustainment equipment and supplies emphasizing sealift.

US security policy changed significantly after the fall of the Soviet Union. The threat was no longer predestined to come through the Fulda Gap; instead, the threat became more global in nature. The strategy of containment changed to a strategy of engagement. Forward deployed units returned to the continental US (CONUS) or inactivated. From 1990 to 1999, more than

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<sup>1</sup> The acronym POMCUS is defined as prepositioning of material configured to unit sets.

239,000 troops returned from forward locations and 82 military installations on foreign soil closed.<sup>2</sup> The engagement strategy adopted by the US was to be executed through the use of the country's worldwide, power projection capability.<sup>3</sup>

To achieve strategic responsiveness and execute the engagement strategy the US armed forces would be required to project military power predominantly for CONUS bases. Strategic responsiveness depended on strategic mobility. Consequently, strategic mobility became essential to the execution of US security strategy. The National Security Strategy states this point explicitly.

*Strategic mobility is a key element of our strategy. It is critical for allowing the United States to be first on the scene with assistance in many domestic or international crises, and is a key to successful American leadership and engagement. Deployment and sustainment of U.S. and multinational forces requires maintaining and ensuring access to sufficient fleets of aircraft, ships, vehicles and trains, as well as bases ports, pre-positioned equipment and other infrastructure.<sup>4</sup>*

Over the last decade, US forces have deployed to numerous small-scale contingencies in support of the engagement strategy. It is clear that strategic mobility has played a crucial role in the execution of these deployments and supported US security and military strategy. It is equally clear that US forces have experienced some challenges in strategic mobility during those contingency deployments. However, the US faced its greatest strategic mobility challenge more than twelve years ago. Operations Desert Storm and Desert Shield (ODS) were the most significant test of the strategic mobility concept. In order to fight and win in ODS, the U.S. deployed an Army force consisting of three corps headquarters and ten divisions plus support units as part of the joint force. The deploying Army units closed in theater by C+205. This closure date was significantly later than planned and brought the US to a strategic crossroad. The

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<sup>2</sup> William S. Cohen, *Annual Report to the President and the Congress* (Washington: GPO, 2000), C-1.

<sup>3</sup> Department of Defense, *National Military Strategy of the United States of America* (Washington: GPO, 1997), 4.

<sup>4</sup> The White House, *National Security Strategy for a New Century* (Washington: GPO, 1999), 11.

question was raised whether the nation could pursue a power projection strategy without the ability to close forces in a theater more rapidly.

To answer this question, DoD sponsored a number of mobility studies. The purpose of most of these studies was to determine DoD's true strategic mobility requirements and develop recommendations for fulfilling those requirements. The studies focused on a concept called "the strategic mobility triad". This triad consists of strategic airlift, sealift, and prepositioned equipment, and is the method by which the US achieves strategic responsiveness through strategic mobility. Several of these studies also addressed issues related to transportation infrastructure because it is an essential enabler for the other three modalities.

The US again finds itself at a strategic crossroad. The Secretary of Defense (SECDEF), the Secretary of the Army (SECARMY) and the Chief of Staff of the Army (CSA) have decided that DoD and the Army must transform themselves in order to stay relevant in the emerging security environment. Army transformation is intended to be a strategic transition that sheds current cold war era based designs for a system more capable of meeting the crises and wars of the 21<sup>st</sup> century.<sup>5</sup> This will not be easy. Transformation will demand more from resources that are stretched to accomplish current military requirements. During the transformation, there will be no significant increase in resources. The US is not planning or programming an expansion of the armed forces, or a return to forward basing. It is clear that strategic mobility will continue to play a crucial role in US security and military strategy, by enabling DoD and the Army to maintain their ability to meet their obligation of fighting and winning our nations battles.

Will the DTS be able to fulfill strategic mobility requirements in the near term future? This monograph attempts to answer the research question: Will the current and programmed Defense Transportation System (DTS) support the strategic responsiveness requirements of the US Army

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<sup>5</sup> Erik K. Shinseki, *The Army Vision: Soldiers on Point for the Nation...Persuasive in Peace, Invincible in War*, [on-line]; available from [http://www.tradoc.army.mil/transformation/Data%20Pages/csa\\_vision.htm](http://www.tradoc.army.mil/transformation/Data%20Pages/csa_vision.htm); Internet; accessed 17 November 2001, 2.

during the initial phase of transformation from the present to FY 2007. The methodology used surveys strategy, planning and programming documents, mobility studies, and other relevant documents to determine the current and projected strategic mobility requirements of the US Army. The current and programmed capabilities of the three components of strategic mobility are determined by surveying mobility requirement studies, strategic plans, programming documents and relevant literature to determine the supportability of the transforming Army's transportation requirements. Supportability will be measured in two ways. First, supportability will be measured in terms of the time associated with force closure in a theater, which is the primary measurement used to assess strategic risk throughout DoD. Second, supportability will be measured in terms of resourcing, which will include both requirements for capital investment and equipment use. Finally, the monograph concludes with recommendations and conclusions for addressing issues raised throughout the paper.

## **CHAPTER TWO: Strategic Mobility Requirements of the Transforming Army**

The DoD has many sources for generating requirements for strategic mobility. The National Security Strategy (NSS), which was last updated in 1999, is one requirements generating document. The National Military Strategy (NMS), which was updated in 2000, is another requirements source. These two primary documents drive DoD and Army warfighting and strategic mobility requirements. In the absence of an updated NSS and NMS, it is possible to gain insight into significant changes in requirements by reviewing other capstone documents such as the Quadrennial Defense Review Report (QDR) released on 30 September, 2001, the FY 2002-2007 Defense Planning Guidance (DPG), the Army Vision and Posture Statements, and The Army Transformation Campaign Plan.

### **Foundational Documents: QDR and DPG**

The QDR and DPG are especially crucial items of information. Not only are they the

highest level strategic guidance the Bush administration has produced thus far, but they also define strategic and resourcing priorities for the period under study in this monograph. The QDR looks at requirements from a strategy perspective, while the DPG takes a resource or budgetary perspective on requirements determination<sup>6</sup>.

The QDR directs a paradigm shift in defense planning. It moves DoD away from a threat based planning model and embraces a capabilities based model.<sup>7</sup> The QDR also backs away from the Two Major Theater Wars (MTW) construct. Instead, the QDR calls for DoD to possess the capability to “swiftly defeat aggression in overlapping major conflicts while preserving for the President the option to call for a decisive victory in one of those conflicts – including the possibility of regime change or occupation; and conduct a limited number of smaller-scale contingency operations.”<sup>8</sup> These fundamental changes in orientation mean that US armed forces must become more concerned about how an adversary will fight rather than who their adversary will be. This change is required because the capabilities based construct does not lend itself to geographical or enemy predisposition as the two MTW construct does. The changes also mean that the armed forces must have a significant power projection capability to combat any adversary regardless of its location. This requirement amplifies the need for strategic mobility because it recognizes that military deployments may be numerous and take forces to places other than traditional US theaters of operation. The QDR also expounds on the need for transformation and states that risk must be balanced between the need to transform quickly and the need to maintain a credible military capability. Finally, the QDR explicitly states that “the US military has an existing shortfall in strategic transport aircraft<sup>9</sup>. The report goes on to say this shortfall is

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<sup>6</sup> Department of Defense, *Deputy Secretary of Defense Wolfowitz Briefing on the Defense Planning Guidance* [on-line]; available from <http://www.defenselink.mil/news/briefings.html>, Internet; accessed 8 November 2001, 2.

<sup>7</sup> US Department of Defense. *Quadrennial Defense Review Report*. Washington, DC: GPO, September, 2001, 17-18.

<sup>8</sup> *Ibid.*, 17.

<sup>9</sup> *Ibid.*, 8.

aggravated by the low readiness rates of the C-5 Galaxy.

The statements from the QDR highlighted here have an impact the Army's strategic mobility requirements. The comments regarding an airlift shortfall imply that strategic airlift will be a resourcing priority. In sum, the QDR emphasizes the importance of strategic mobility and prioritizes strategic airlift as an area for improvement.

The FY 2002-2007 DPG takes another approach to generating strategic mobility requirements. It lists five major goals for guiding the services' resourcing decisions and preparation of their Program Objective Memoranda (POM). These goals support statements made in the QDR, and add definition to those statements so that resources may be applied to the competing priorities. The capability to project and sustain US forces in distant anti-access or area denial environments is included as one of the five goals.<sup>10</sup> This statement not only implies that power projection and strategic mobility are resourcing priorities, but further describes additional attributes and capabilities to be addressed under the heading of strategic mobility. Coping with an access denial strategy is not addressed in this monograph, but it is apparent that this is an aspect of strategic mobility that must be addressed in the future.

The DPG, like the QDR, recognizes the requirement to resource capabilities for small-scale contingencies as well as regional conflicts. The DPG states this requirement in much the same language as it is in the QDR. The challenge with the capabilities based construct of the DPG and QDR is that it does not facilitate quantifying strategic mobility requirements as easily as the two MTW scenario in the NSS and NMS do. The list of eleven Illustrative Planning Scenarios (IPS) included in the DPG help to mitigate this problem. The scenarios outline warfighting situation that the services must address in the resourcing decisions and serve to give definition and scope to the resourcing of both warfighting capabilities and strategic mobility. The two scenarios that tax strategic mobility the most include fighting two nearly simultaneous MTWs in Southwest Asia and Northeast Asia (SWA and NEA) from a forward engaged posture.

The IPS in the FY 2002-2007 DPG are very similar to the scenarios included in the FY 2000-2005 DPG. This is significant because the FY 2000-2005 DPG scenarios were studied extensively in the Mobility Requirements Study 2005 (MRS-05). This common area of study allow a connection to be made from the latest DPG and the results of the latest mobility requirements study.

## **Mobility Requirements Studies**

Quantified information regarding the Army's strategic mobility requirements can be gained by analyzing the mobility requirements studies written in the last decade. As the latest DoD mobility study, Mobility Requirements Study 2005 (MRS-05) covers most of the period under study in this monograph and addresses many of the Army's major strategic mobility issues. As such, it can serve as a validated baseline for further projections. The prior mobility studies, Mobility Requirements Study (MRS) and Mobility Requirements Study – Bottom Up Review Update (MRS-BURU), were focused on the current period when they were published. They have been the basis for several of the initiatives that resulted in the current state of the DTS, and as such relate to the assessment of future strategic mobility capability.

The US Army defines its current power projection requirement as the deployment of a five division corps that is tailorable, sustainable and has a vertical insertion capability with the ability to close in a theater of operations in seventy-five days. The sequencing of this force is lead by a brigade on the ground by C+4 followed by a division by C+12. Two heavy divisions arrive via sealift from CONUS by C+30. This sealifted package could include armored, mechanized or air assault units, as called for by the theater CINC. The full corps, five divisions and a corps support command (COSCOM), closes by C+75.<sup>11</sup> This goal was not met during

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<sup>10</sup> Wolfowitz, 2.

<sup>11</sup> Department of the Army. *Army Posture Statement*. [on-line]; available from <http://www.army.mil/aps/00/aps00.htm>, Internet; accessed 15 November 2001, 6.

ODS. In ODS, the deployment of a comparable force took more than 130 days longer than the currently stated goal.

	<b>MRS</b>		<b>MRS-BURU</b>		<b>MRS-05</b>	
<b>Completion Date</b>	Jan-92		Mar-95		Oct-00	
<b>Scenario Time Frame</b>	1999		2001		2005	
<b>Type of National Military Threat</b>	Single MRC/LRC		Two MRC		Two MTW w/ Posture of engagement	
<b>US Strategic Orientation</b>	Conventional		Conventional w/ some Chemical		Chemical and Biological	
<b>Scope</b>	Inter-Theater		Inter-Theater		Inter-Theater and Intra-Theater	
<b>Force Structure Deployed</b>	<b>USA</b>	9+ Div	<b>USA</b>	10 Div	<b>USA</b>	10 Div
		2 Corps		2 Corps		4 Corps
		N/A		0 eSBs		15 eSBs
	<b>USN</b>	8 CVBG	<b>USN</b>	10 CVBG	<b>USN</b>	11 CVBG
	<b>USAF</b>	31 SQDN	<b>USAF</b>	20 FWE	<b>USAF</b>	20 FWE
	<b>USMC</b>	3 MEF	<b>USMC</b>	3 MEF	<b>USMC</b>	3 MEF

**Table 2-1 - Overview of Mobility Studies and their scope.<sup>12</sup>**

This power projection requirement was the point of departure for the first mobility requirements study (MRS). The Joint Chiefs of Staff (JCS) published MRS in 1992. It looked at the DTS strategic mobility requirement of the US armed forces in 1999. The study was initially well received because it succinctly and quantifiably stated DoD's strategic lift requirements and made recommendations for increasing the capability of the DTS to support a 1999 base force deployment. The study was comprehensive, if not exhaustive, and considered the projected threat, projected alliances and coalitions, overseas bases, foreign and domestic port access, projected availability of commercial shipping and maritime capabilities, projected DoD budget levels and lessons learned from ODS. The MRS stated that supporting the deploying force required the DTS to have the capability to move a requirement of 57 million-ton miles per day (MTMs/D) by airlift. MRS recommended the acquisition of 120 C-17s to replace the C-141's in the programmed aircraft fleet. The sealift requirement was stated as 10 million square feet of organic DoD sealift. MRS recommended the acquisition of 20 large medium speed roll-on/roll-

<sup>12</sup> Department of Defense. *Mobility Requirements Study 2005*. (Washington, DC: GPO, 2001), 1-2.

off ships (LMSR) and the expansion of the Ready Reserve Force from 96 to 142 ships. The preposition equipment requirement was stated at six brigade sets on land in POMCUS sites, 1 brigade set afloat to support the Army, and 3 brigade sets afloat to support the Marines.<sup>13</sup> These capacity determinations led to recommendations for significant increases in the airlift and sealift capacity of the DTS as well as changes to the prepositioned equipment concept.

Shortly after the release of the MRS, the SECDEF release a memorandum entitled “Strengthening Department of Defense Transportation Functions”. This memorandum transferred management authority for common-user sealift from the Navy to US Transportation Command (TRANSCOM). This memorandum was not part of the MRS, but served to facilitate implementation of the MRS recommendations. Later in 1992, the SECDEF established the National Defense Sealift Fund (NDSF). The fund was established to provide for DoD common-user strategic sealift operations, maintenance, ship construction, alteration, leasing, and chartering.<sup>14</sup> The NDSF in essence took resourcing decisions for common user sealift away from the Navy and resourced the funding of strategic sealift from the DoD level. This fund was established because DoD officials felt the service had neglected management of the common-user sealift program by prioritizing other Navy program ahead of the sealift program. The NDSF put the common-user sealift program under the direct authority of the JCS with the TRANSCOM Commander serving as the managing agent and obligated users of the sealift fleet to pay for capitalizing the fund. This arrangement, although outside the original MRS, led to continuous improvements in common-user sealift.

DoD intended the MRS requirements and recommendations to be the basis for investment in future lift assets and prepositioned equipment programs for the period 1992 to 1999. Unfortunately, the recommendations of the study did not last long without having to be

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<sup>13</sup> James K. Matthews, United States Transportation Command, the National Defense Reserve Fleet, and the Ready Reserve Fleet: A Chronology, eds. Margret Nigra and Cora J. Holt, (U.S. Transportation Command Research Center: Scott AFB, IL, 1999), 12.

<sup>14</sup> *Ibid.*, 14.

reassessed. While the MRS was underway, the Soviet Union's collapse necessitated a change in the NSS. This development drove a US force draw down and unhinged the basis for the MRS. A second mobility requirements study was undertaken by the JCS.

The Mobility Requirements Study - Bottom Up Review Update (MRS-BURU) was that study. MRS-BURU followed much the same methodology used in developing the original MRS requirements but was less quantitatively oriented.<sup>15</sup> The significant changes from the MRS to the MRS-BURU were that MRS-BURU accounted for changes in the 1994 NSS, size reduction of the total force, and loss of forward bases and service endstrength. The study also included the requirement to fight two nearly simultaneous major regional conflicts (MRC), a chemical threat, and increased the distance US forces were to be transported based on their relocation to CONUS.<sup>16</sup> The total strategic mobility requirement determined by the MRS-BURU changed moderately from the MRS requirement. MRS-BURU stated that supporting the deploying force in a 2001 scenario required the DTS to have the capability to move a requirement of 49.7 MTMs/D by airlift. No recommendation was made on the size of the aircraft fleet. Instead, MRS-BURU recommended a further study to determine the most efficient size and composition for the aircraft fleet. The sealift requirement was increased to twelve million square feet of sealift. A fleet of 19 large medium speed roll on/roll off ships (LMSR) and 308 other government owned, Voluntary Intermodal Shipping Agreement (VISA) ships or contracted vessels was recommended. The preposition equipment requirement was stated at four brigade sets of Army Prepositioned Stocks (APS), with one of those brigade sets afloat, and three brigade sets afloat to support the Marines.<sup>17</sup> Support of these requirements was to be accomplished by using the mobility triad composed of airlift, sealift, and prepositioned equipment.

Additional recommendations came out of the MRS-BURU study as well. First, the MRS-BURU recognized that the strategic airlift portion of the mobility triad was unable to

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<sup>15</sup> Les Aspin, *Report on the Bottom Up Review.*, (Washington, DC: Department of Defense, 1993), 19.

<sup>16</sup> *Ibid*, p. iii.

support the previous airlift requirement identified by the MRS, and was unlikely to gain the capability required in 2001 based on projected DoD funding levels. Consequently, MRS-BURU emphasized common-user sealift capabilities, which were funded in the POM in the form of the National Defense Sealift Fund, Navy, and Department of Transportation funding for the Maritime Administration. DoD organic sealift augmented by commercially contracted ships were recommended for meeting initial transportation requirements. MRS-BURU recommended further changes in the POMCUS prepositioned equipment concept for war reserve stocks and added detail to the requirement for maritime prepositioned Army and Marine equipment and Air Force ammunition. These recommendations increased the overall strategic sealift requirement, but reduced the surge sealift requirement for moving equipment out of Europe to the SWA and the NEA theaters.

MRS-BURU guided the strategic mobility process for nearly five years. As 2001 approached, the study's findings and recommendations lost their relevance for projecting future strategic mobility requirements for planners and programmers because the studies transportation requirements did not project far enough into the Future Years Defense Program (FYDP). In 1999, DoD began MRS-2005 to "determine the wartime demands and understand the mechanisms of power projection should US forces be faced with two major theater wars, one followed almost immediately by the other" in the 2005 time frame.<sup>18</sup>

MRS- 05 analyzed two scenarios based on the Illustrative Planning Scenarios (IPS) of the FY 2000-2005 DPG for MTW–West/East and East/West. These MTW were templated for the SWA and NEA theaters. Threat capabilities in the study were consistent with the June 1998 Defense Intelligence Agency projections for 2005. Threats in the study included forces, weapons, strategies, and tactics projected for 2005 and also included chemical and Special Operations Forces (SOF) attacks against air and seaports of debarkation, as well as mine and submarine

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<sup>17</sup> Ibid, p. vi

<sup>18</sup> *Mobility Requirements Study 2005.*, 1-2

threats against seaport approaches.<sup>19</sup>

US capabilities in the study reflect those forces programmed to exist in 2005 based on the FY 00-05 POM. These capabilities include force structure and weapons, as well as organic mobility capability. This force structure did not include current information related to the Interim Brigade Combat Teams (IBCTs) which was added into the program after 1998 when the FY 2000-2005 program was developed. Estimates for non-governmental capabilities available for wartime use included programs such as Civil Reserve Airlift Fleet (CRAF), Voluntary Intermodal Sealift Agreement (VISA), and Port Planning Orders (PPOs). These capabilities were based on existing agreements, as well as on estimates of commercial assets expected to exist in 2005. Coalition and allied capabilities were those expected to be available in 2005 and reflected guidance contained in the IPS.<sup>20</sup>

Because of its scope and methodology, the analysis contained in MRS-05 is more inclusive than all prior mobility studies. The MRS-05 is an end-to-end analysis of the actions and resources required to deploy forces, equipment, and supplies from CONUS and forward locations to a theater of operations. The analysis focused on three levels of deployment. These levels were CONUS deployment to air and seaports of embarkation, inter-theater deployment to air and seaports of debarkation, and intra-theater deployment to tactical assembly areas. Thus, MRS-05 provides the most complete assessment of DoD's strategic mobility requirements to this time.<sup>21</sup>

MRS- 05's findings and recommendations include assessments that equipment prepositioning, surge sealift, inter-theater lift, and CONUS transportation assets are largely satisfactory, but need some improvements. All of the strategic mobility components had improved generally following the recommendations of the two preceding studies. Strategic airlift, however, was still found lacking. The airlift requirement in MRS-05 was assessed to exceed 49.7 MTM/D, the quantity established by MRS-BURU, and instead ranged from 51.1 to

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<sup>19</sup> Ibid., 5

<sup>20</sup> Ibid., 6-7

67.0 MTM/D through the two scenarios based on changes in assumptions from MRS-BURU to MRS-05. The CJCS and CINCs reviewed the study and settle on a 54.5 MTM/D requirement for strategic airlift. In order to meet this requirement DoD would have to acquire between 126 and 176 C-17's and improve the operational readiness rate of the C-5 dramatically. FY2000-2005 funding levels supported neither of these recommendations, so the study further recommended investigation of commercial sources for the needed airlift.

The study contained several other findings and recommendations that are outside the scope of this document, but these recommendations will have to be address as 2005 approaches. These recommendations bear on strategic mobility requirements as a method of coping with anti-access strategies undertaken by adversaries in the future.<sup>22</sup>

	<b>MRS</b>	<b>MRS-BURU</b>	<b>MRS 2005</b>
<b>Airlift</b>	57 MTMs/D	49.7 MTMs/D	54.5 MTMs/D
<b>Sealift</b>	19 FSS & LMSR	19 FSS & LMSR	19 FSS & LMSR
	224 Ships	308 Ships	330 Ships
	+ Contracts	+ Contracts	+ Contracts
<b>Prepo</b>	6 Bde POMCUS	4 Bde APS	5 Bde APS
	1 Bde APS	3 Bde MPS	3 Bde MPS
	3 Bde MPS		

**Table 2-2 - Final recommendations of three mobility studies.**

### **Mobility Requirements of the Transforming Army**

Developing the mobility requirements for the Army of FY 2007 requires reviewing the established facts regarding the initial period of Army transformation. After this review, assumptions can be made to serve as proxies for information that is not available or unknown. Programmed changes in Army force structure through FY 05 developed after the FY 00-05 POM submission require development. These changes were not included in the POM that served as the

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<sup>21</sup> Ibid., 3

<sup>22</sup> Ibid., 6-7

basis for the MRS-05 study, therefore the changes in transportation requirements would not have been included in the results of MRS-05. Changes to Army structure in the FY 06-07 period are beyond the scope of the MRS-05 and must be accounted for. These changes in Army force structure can be extrapolated from the Army Transformation Campaign Plan and Army Posture and Vision statements. The information can be analyzed using the methodology of MRS-05 and other studies to determine the supportability of the Army's strategic mobility requirements in FY 2007.

The Army began its transformation on 12 October 1999, when the Secretary of the Army and the Chief of Staff of the Army shared their vision designed to posture the Army to meet the demands of the 21<sup>st</sup> Century. The planned result of this transformation is a responsive, deployable, agile, versatile, lethal, survivable, and sustainable Objective Force. Responsiveness, one of the characteristics of the Objective Force, relates to a strategic mobility performance measure developed as a goal for the new force. The Objective Force will be capable of deploying a brigade in 96 hours, a division in 120 hours, and five divisions in thirty days.<sup>23</sup> This force may not exist for another thirty years. In the short term, the Army will develop an Interim Force to fill the gap in capability that currently exists between today's light and heavy mechanized forces. This force also begins the transition to the Objective Force. The Interim Brigade Combat Teams (IBCTs) that will make up this Interim Force will be fielded in FY 2003. By FY 2007, it is projected that five of the six planned IBCTs will be fielded.

The IBCT has a table of organization and equipment (TOE) that includes 3893 soldiers, 470 Interim Armored Vehicle variants, and 413 trucks (HMMWV, HEMMT, LMTV, MTV).<sup>24</sup> In gross terms, an IBCT requires the movement of 3,893 personnel and unit equipment weighing 14,663 STONs, and occupying 165,000 square feet.<sup>25</sup> These quantities represent the quantity

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<sup>23</sup> Shinseki, *The Army Vision: Soldiers on Point for the Nation...Persuasive in Peace, Invincible in War*, 2.

<sup>24</sup> Department of the Army, *FM 7-30X (Draft), Interim Brigade Combat Team Operations*. (Washington DC, 2000), 2-2.

<sup>25</sup> Jennifer Casto, email to author, dated 14 January 2001.

aspect of the movement requirements each of the five IBCTs will place on the DTS when fielded. Another portion of the movement requirements is associated with the geographic location of the brigades. Plans call for the IBCTs to be located at Fort Lewis, WA (2); Fort Richardson, AK; Schofield Barracks, HI; and Fort Polk, LA. The IBCTs will replace three light infantry brigades, one light cavalry regiment, and a mechanized infantry brigade. The overall effect of these replacements is an increase in the movement requirements on the DTS of FY 2007. This increase is based on the IBCT's size relative to the units the IBCTs replace in the Army force structure.

The size of the IBCTs compared to three of the units they replace, and their basing locations, increases the Army's total lift requirement. The five brigades require more than 80,000 STONs of lift. This would require a significant amount of sealift, but even more startling is the airlift requirement. The weight of the five IBCTs moving from their home stations to the Korean peninsula by air would add 423 MTM's (million ton miles) to the Army's airlift requirement. This is a significant fact because the stated Army goal is to deploy the Interim Force brigade in 96 hours by air.

A number of authors have addressed the IBCT's airlift requirements. A monograph by Major William Ward written in FY 2001 using the Joint Flow and Analysis System for Transportation (JFAST) program to simulate the deployment of an IBCT determined that the actual time required to airlift the unit would approach eight days and require 46 C-5s and 54 C-17s.<sup>26</sup> In a more exhaustive study using the Air Flow Model (AFM) program and the Model for Intertheater Deployment by Air and Sea (MIDAS), TRADOC Analysis Center (TRAC) Leavenworth determined that the IBCT exceeded the 96 hour deployment timeline in 56 of 56 scenarios studied. The aircraft fleet in the TRAC study varied from 14 to 60 C-5s and 20 to 84 C-17s.<sup>27</sup> This variance was associated with the TRANSCOM fleet level assumptions made for each run of the deployment scenario. These findings indicate that the IBCT cannot meet its stretch

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<sup>26</sup> William R. Ward, Major, USAF. *Strategic Lift and the Interim Brigade Combat Team*, Monograph, School of Advanced Military Studies, US Army Command and General Staff College, 2001, 31.

goal of a 96 hour air deployment. Furthermore, the findings seem to favor a sea deployment of the IBCTs in an MTW scenario where the strategic airlift fleet is already tasked beyond its capacity. In the following sections the FY 2007 DTS's ability to accommodate the transportation requirements of the IBCT will be addressed.

## **CHAPTER THREE: Airlift as a Part of Strategic Mobility**

Strategic lift allows the US to project military power, especially land-based military power, quickly through rapid global mobility. Airlift is the most flexible and responsive component of strategic lift. It facilitates deployment to undeveloped regions, assuming a suitable airstrip or airfield is available, and can sustain a deployed force until land and sea lines of communication open. Without this initial capability to project force, all other military capabilities are diminished. A crisis generating a US deployment requirement may conclude on terms unfavorable to the US or require more forces to resolve, if the deploying force cannot close in theater in a timely manner. Strategic airlift facilitates timely closure of US forces. With strategic airlift, the complementary components of the strategic mobility triad, prepositioned equipment, and sealift, are provided an opportunity to come to bear on a situation. These qualities of strategic airlift have resulted in a heavy reliance on air mobility by the US.

Changes in the NMS have placed significant stress on an already overburdened US airlift capability.<sup>27</sup> Numerous deployments associated with the engagement strategy and small-scale contingencies have dramatically increased the pace of airlift operations. This has led to two significant findings. First, the airlift fleet is not properly sized or structured to support a number of airlift requirements. Second, the age of aircraft in combination with the heavy workload

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<sup>27</sup> Jennifer Casto, email to author, dated 14 January 2001.

<sup>28</sup> John Cirafici, *Airhead Operations: Where AMC delivers.*, (Maxwell AFB, AL: Air University Press, 1995), 67.

assigned to them negatively affects operational readiness.<sup>29</sup>

These findings have created a great deal of concern regarding the current and future state of US strategic airlift. Every mobility study conducted by the DoD has found that US strategic airlift is insufficient to fully support the NMS. This supportability gap appeared to close between the 1992 MRS and MRS BURU. Unfortunately, MRS-BURU did not account for demands on airlift not associated with the MTW scenario under study. Consequently, MRS-BURU understated the airlift requirement. MRS-05 corrected this oversight and the airlift requirement increased by five MTM/D for the FY 2005 scenario studied.

### **The Government Owned Airlift Fleet.**

The C-141, C-5, C-17 and KC-10 are the aircraft that make up Air Mobility Command's (AMC) strategic airlift fleet and are the assets that will be asked to move the airlift requirement. The KC-10 actually serves a dual role as an aerial refueling and cargo airlift platform. AMC estimates that together these aircraft had the ability to carry 24.28 MTM/D in FY2001.<sup>30</sup> The aircraft in the Civil Reserve Aircraft Fleet (CRAF) will move the remainder of the strategic lift requirement. All of these aircraft must be included in an analysis of the airlift component of strategic mobility and its ability to support the transforming Army.

There is one aircraft not studied here, but that must be mentioned. The C-130 is not considered part of AMC's strategic airlift fleet. This is because the C-130 is not capable of moving cargo strategic distances.<sup>31</sup> However, Army transformation places a heavy emphasis on the use of the C-130. The Interim Armor Vehicle (IAV) and Future Combat System (FCS), Army combat vehicles designed for the transformation period, have as one of their design perimeters C-

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<sup>29</sup> Charles T. Robertson, Jr., General USAF. Statement of Commander-in-Chief United States Transportation Command Before the Senate Armed Services Seapower Subcommittee. *Strategic Airlift and Sealift Imperatives for the 21st Century*, (FDCH Political Transcripts, 26 April 2001): 3.

<sup>30</sup> Air Mobility Command. *AMC Strategic Plan 2002*, [on CD-ROM}(Scott AFB, IL AMC, 2001), 60.

<sup>31</sup> Factsheet. *C-130 Hercules*, available from [http://www.af.mil/news/factsheets/C130\\_Hercules.html](http://www.af.mil/news/factsheets/C130_Hercules.html) *Hercules.html*; Internet accessed 16 November 2001, 3.

130 transportability. It appears that Army planners intend to use the direct delivery capability of the C-130 to position Army assets close to their assigned battlespace. In light of this intention, the strategic and intra-theatre airlift interface must be considered.

The movement of C-130s to inter-theater APODs has several impacts on the airlift system. The presence of C-130s would likely lower throughput at the APOD because the C-130s would take up runway, ramp, and parking space required by inter-theater lift. This added congestion could ultimately lengthen the time needed to close the force.

Another alternative could be to open more APODs. This would put additional stress on all the airlift enablers. The ground support elements of the airlift system are just one example. More APODs would require more air traffic control and Tanker Airlift Control Elements (TALCE). The current ground support side of the US Air Force is fully engaged and could not support this requirement. Currently, the Air Force assigns ground support to multiple Expeditionary Air Force elements. Increased demand for these support assets appears untenable.

Additional APODs would also require a greater number of inter-theater aircraft to feed in the optimal level of cargo. This is one area where the transportability characteristics of the IAV and the FCS work toward an advantage. C-130 transportability requires the IAV and FCS to weigh less than 20 tons. With some reinforcement, commercial aircraft could transport such a load.<sup>32</sup> This means that CRAF airplanes could assist in lifting IAV and FCS units from their home locations to a theater of operations. The use of CRAF aircraft could assist in further closing the airlift capability/requirement gap. However, changes would have to be made to the CRAF activation policy to support activation of the CRAF fleet for other than a major theater war scenario.

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<sup>32</sup> Department of the Army, *Army Science Board FY 2000 Summer Study Final Report: Technical and Tactical Opportunities for the Revolutionary Advances in Rapidly Deployable Joint Ground Forces in the 2015-2025 Era*, (Washington, 2001), I-3.

Aircraft Type	FY 02	FY 03	FY 04	FY 05	FY 06	FY 07
C-141	73	56	31	22	21	0
C-5	126	126	124	122	122	122
C-5 (modified)	0	0	0	0	0	4
C-17	87	102	117	126	137	137
<b>Total Cargo A/C</b>	286	284	272	270	280	263
KC-10 *	59	59	59	59	59	59
KC-135 *	547	547	547	547	547	547
<b>Total Refueling A/C</b>	606	606	606	606	606	606
C-130 E/H	494	494	494	492	489	447
C-130 J	17	17	17	19	22	36
C-130 X	0	0	0	0	0	28
<b>Total C-130s</b>	511	511	511	511	511	511
<b>Total A/C</b>	1403	1401	1389	1387	1397	1380

**Table 3-1 – DoD Aircraft by Type Programmed for FY 2002-2007.<sup>33</sup>**

A close look at the table above shows that the aggregate number of cargo aircraft declines over the period in question. This loss of tail numbers inhibits planning flexibility for airlift planners, but does not negatively affect the airlift situation in terms of weight and square footage capacity. This is true because the C-141 fleet is being retired and replaced by the larger and more capable C-17.

Along with the government owned aircraft included in the table above, DoD's airlift system also relies on the aircraft enrolled in the CRAF to provide strategic airlift. CRAF is a partnership program between commercial airlines and the government that was established as a result of lessons learned during WW II and the Korean War. Because of those conflicts, the US government realized that it could not afford to maintain all the airlift capability required in a war during peacetime. In response to this situation, Congress passed the Defense Production Act of 1950. This act gave the president the authority to deal with allocation of resources related to national defense and established the CRAF program.<sup>34</sup> The CRAF program provides financial

<sup>33</sup> *Air Mobility Strategic Plan 2002*, 14-42.

<sup>34</sup> Jay H. Smith, *Anything, Anywhere, Anytime: An Illustrated History of the Military Airlift Command, 1941-1991*. (Scott AFB, IL: Military Airlift Command, 1991), 36.

incentives to air carriers for enrolling their aircraft. Aircraft enrollment is also a prerequisite to gaining government airlift contracts. The program currently has over 800 aircraft of the following types enrolled:<sup>35</sup>

Passenger		Cargo	
B747	A300	DC8	B747
B757	B767	DC10	MD-11
B777	DC10	L1011	
MD-11	L1011		

These aircraft along with the government owned aircraft make up the strategic airlift component of the DTS. A more detailed look at their capabilities and factors influencing their ability to support the airlift requirements on the DTS will assist in determining their ability to support the Army in FY2007.

The C-141 has been a significant part of the strategic airlift fleet since 1963. The average age of the C-141's currently flying is thirty-one years.<sup>36</sup> During its time in the fleet, the C-141 has provided all aspects of cargo air support to included serving as the primary Special Operations Low Level (SOLL II) weapons system and airdrop platform.<sup>37</sup> The C-141 has also undergone one major modification.

Two hundred and eighty-five C141A's were built and delivered to the Air Force between 1963-1967. Between 1979-1982, 271 of these aircraft were elongated by 23 feet 4 inches and given in-flight refueling capability. The aircraft designation changed from C-141A to C-141B as a result of this modification. The enhancement also had the effect of adding 90 C-141A's worth of capacity to the airlift fleet. This modification was a result of a 1981 Congressionally mandated mobility study that found a shortfall in strategic airlift.<sup>38</sup>

One last modification is in store for the C-141. The C-141B's are being modified to take advantage of the new All weather Flight Control System and Global Positioning System

<sup>35</sup> *Mobility Requirements Study 2005*, G-9.

<sup>36</sup> *Air Mobility Strategic Plan 2002*, 166.

<sup>37</sup> Air Force Association, "Air Force Almanac 2000" *Air Force Magazine* (May 2001): 148-149.

<sup>38</sup> Keith Hutcheson, *Air Mobility: The Evolution of Global Reach* (Vienna, VA.: Point One, 1999) 26.

Enhanced Navigation. This modification will keep the 63 redesignated C-141C's flying capably until their retirement in FY 2007.<sup>39</sup> No other significant modification is in the C-141's future, but the changes that were made and are planned for the aircraft have allowed it to be the workhorse of the strategic airlift fleet for nearly thirty years.

According to the latest figures available, the C-141 represented 10% of the total military organic airlift capability (FY01: 2.5 MTM/D of 24.3 MTM/D) of AMC's strategic airlift. This is down from the 25% capacity the C-141 provided as late as 1998.<sup>40</sup> This workload is testimony to the versatility of the aircraft. Because of its versatility, the aircraft was used extensively throughout its time in service. This usage has accelerated the aging of the aircraft. In addition, aerial refueling, low-level airdrop, and extremely high usage during the Persian Gulf War have also contributed to this accelerated aircraft aging process.

In the last decade, the C-141 has been grounded for cracks in the wings and weep holes, cracks in the cockpit windows and cracks in the tail. The latest fault has resulted in operational flight restrictions.<sup>41</sup> All of these faults have also increased the cost of operating and maintaining the aircraft. Without a Service Life Extension Program (SLEP), this aircraft will continue to have problems related to age and use. A SLEP is not programmed because acquisition rules prohibit major investments in retiring equipment. Because of this situation, the C-141 will continue to perform well below its historical capabilities until its complete retirement and replacement by the C-17 in FY 2007.

A major concern related to the retirement of the C-141 and its eventual replacement by the C-17 is the net loss of airplanes in the strategic fleet. The replacement plan calls for one C-17 to replace two C-141's. Consequently, the airlift fleet is projected to have 138 fewer airplanes than it did during ODS by FY 2007. Total capacity of the airlift fleet will actually increase due to

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<sup>39</sup> *Air Mobility Strategic Plan 2002*, 166.

<sup>40</sup> *Ibid.*

<sup>41</sup> Air Force Association, "Air Force Almanac 2000" *Air Force Magazine* (May 2001): 148-149.

the larger size of the C-17, but flexibility within the system will be lost due to fewer airplanes providing mission support.

The other veteran cargo airplane in the AMC fleet is the C-5 Galaxy. Lockheed-Martin developed the C-5 in the 1960s to haul outsized and oversized cargo. The aircraft was initially fielded in 1970<sup>42</sup>. The C-5 is the largest cargo aircraft in the US airlift fleet and represented over 50% of the FY01 organic airlift capability (13.0 of 24.3 MTM/D). The C-5 has two designations C-5A, which average 30 years old, and C-5B, which average twelve years old.<sup>43</sup>

The C-5 has been at the center of some controversy over the last few years. The controversy has been generated because of significant design flaws in the aircraft that have led to poor operational readiness rates, averaging 58% recently. This is significantly lower than the 75% readiness rate called for in MRS-05.<sup>44</sup> The situation has gotten so bad that priority missions have been assigned to two C-5's to increase the likelihood that the mission will be completed.<sup>45</sup>

A solution to these low readiness rates is necessary if the C-5 is to support current and future airlift requirements. The Air Force Scientific Advisory Board estimates that 80% of the C-5's structural service life remains.<sup>46</sup> This estimate convinced the Air Force to pursue a course of modifications to improve the C-5's readiness. From FY 2004 through FY 2019, the C-5 will undergo a Reliability Enhancement and Re-Engine Program (RERP).<sup>47</sup> This program will not make a significant difference in the C-5's operational readiness rates until FY2007, when modified aircraft begin returning to the fleet.

Future concerns regarding the C-5 all center on its operational readiness. The aircraft will represent the largest proportion of airlift capability until FY 2004. After FY 2004, the C-17

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<sup>42</sup> Factsheet. *C-5 Galaxy*, available from [http://www.af.mil/news/factsheets/C5\\_Galaxy.html](http://www.af.mil/news/factsheets/C5_Galaxy.html); Internet accessed 16 November 2001, 2.

<sup>43</sup> *AMC Strategic Plan 2002*, 100.

<sup>44</sup> Robertson, 13.

<sup>45</sup> *Ibid.*

<sup>46</sup> *AMC Strategic Plan 2002*, 100.

<sup>47</sup> *Ibid.*

will account for the largest airlift capability. Regardless of the percentage of airlift capability assigned to the C-5, it will be counted on to haul nearly 13 MTM/D well beyond FY 2030. The C-5 fleet will not accomplish that task with a readiness rate below 68%. The modifications planned for the C-5 must be successful for the US to approach the 47.9 MTM/D lift capacity required by the MRS-BURU and will still not achieve the 54.5 MTM/D requirement of the MRS-05. The C-5 may have to be the next airplane in the airlift fleet to be replaced.<sup>48</sup>

The airplane that will make the greatest contribution toward achieving the requirements of the MRS-05 is the C-17 Globemaster. Each C-17 can lift 250% the weight capacity of a C-141 and accommodates 166% the square footage of the older aircraft.<sup>49</sup> The C-17 accounted for 22% (5.3 MTM/D of 24.3 MTM/D) of the AMC cargo airlift capacity in FY2001. This capacity will increase through FY 2007 when the last of the 137 programmed C-17 is fielded (15.3 MTM/D of 29.9 MTM/D).<sup>50</sup> Over the next five years, 73 C141Bs will be replaced by 50 C-17s. This completes the replacement of over 450 C-141s by 137 C-17s, an operation that will have taken fourteen years. The C-17 replacement of the C-141 is the one aspect of airlift capability that shows significant improvement.

The C-17 is a much more capable aircraft than the C-141 it replaces. The C-17 can deliver larger payloads to smaller airfields than the C-141. It can also take off and land on smaller less improved airfields. All of this capability comes at a cost. The C-17 is more maintenance intensive than the C-141 was and costs more to operate than the older airplane did. These factors are significant because they create demands on airlift support resources and funding. If these resources are not available, the operational readiness and capability of the C-17 will suffer.

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<sup>48</sup> Robertson, 7.

<sup>49</sup> Factsheet. *C-17 Globemaster and C-141 Starlifter*, available from [http://www.af.mil/news/factsheets/C17\\_Globemaster.html](http://www.af.mil/news/factsheets/C17_Globemaster.html) and [http://www.af.mil/news/factsheets/C141\\_Starlifter.html](http://www.af.mil/news/factsheets/C141_Starlifter.html); Internet accessed 16 November 2001.

<sup>50</sup> *AMC Strategic Plan 2002*, 60.

The KC-10A represents about 10% of the AF tanker fleet and is responsible for 13% of the total military organic airlift capability (3.1 of 24.28 MTM/D). The KC-10 is expected to maintain this capacity well beyond FY 2007. The KC-10A is a near-commercial derivative of the McDonnell Douglas DC-10-30 and had 88% of its design and components in common with that airplane when delivered in 1981.<sup>51</sup> The KC-10 is relatively new in comparison to the other aircraft in the airlift fleet. The 59 KC-10's delivered to the Air Force between 1981-1990 average 14.7 years of age. Because of its age and near-commercial design, the KC-10 has had very high operational rates.

The KC-10's primary drawbacks can also be attributed to its near commercial design. Current issues with the KC-10 include replacement of wing pylon trusses, GATM compliance, and the lack of a defensive system onboard the aircraft.<sup>52</sup> The pylon truss replacement and avionics are funded. The Air Force is working to develop a defensive system for the aircraft. This will become a priority-funding requirement for the aircraft once it is developed. A longer term concern relates to the retirement of commercial DC-10s in the FY 2010 timeframe. Parts and logistics support will become more expensive and harder to obtain as the commercial version of this aircraft retires and demand for related items decreases. This will affect the latter part of the KC-10's lifecycle since it will fly in the DoD airfleet until FY 2040.

### **The CRAF Fleet.**

The CRAF fleet is in much better shape than the DoD owned fleet. Expansion in the global shipping market has increased the number of cargo and passenger aircraft eligible for CRAF enrollment.<sup>53</sup> At the same time, the competitive nature of the air delivery industry has provided an incentive for air delivery companies to upgrade and enroll their aircraft in the program to secure government funding and gain access to government contracts. CRAF aircraft

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<sup>51</sup> Ibid., 203.

<sup>52</sup> Ibid., 213.

are essential to DoD strategic airlift. They carried 91% of the personnel deployed to the Persian Gulf War and will likely be asked to do so again in a MTW deployment.<sup>54</sup> The CRAF fleet also possesses a significant portion of the airlift capability of the DTS. In FY 2001, CRAF made up 20.5 MTM/D of the total 44.78 MTM/D capacity of the airlift system. The CRAF fleet is expected to maintain this capacity through FY 2007.<sup>55</sup>

There are several limiting factors affecting the amount of CRAF lift used by the DoD. First, commercial aircraft require well-developed airfields. They cannot or will not fly in hostile airspace. Second, a CRAF mobilization could negatively impact the economy by squeezing out private sector demand for airlift. CRAF mobilization is such a contentious issue that the ODS mobilization is the only CRAF mobilization in the fifty year history of the program. In addition to these industry concerns, DoD is concerned about the negative impact commercial aircraft may have on APOD throughput. This concern is based on the greater service and time requirements for turning commercially design aircraft around. After repeated studies, the Air Force and DoD have determined that 20.5 MTM/D of capacity is the limit of the airlift support the DTS can efficiently utilize from the CRAF program.<sup>56</sup>

CRAF and DoD owned airlift capacity is expected to equal 49.6 MTM/D by FY2005. The MRS-05 airlift requirement is 54.5 MTM/D by FY 2005. This creates a nearly 5 MTM/D shortfall. The strategic airlift system is programmed to achieve 50.26 MTM/D by FY 2006 with incremental movement upward as the C-5 RERP aircraft increase in numbers. Thus, currently programmed airlift resources will not close the projected gap.

One cause of this situations is that there has been no significant increase in strategic airlift funding since resources were programmed to meet the lower requirements of the MRS-BURU (49.7 MTM/D). This under resourcing has been exacerbated by the poor operational

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<sup>53</sup> Department of Transportation, *National Transportation Statistics 2000* (Washington: GPO, 2001), 13-15

<sup>54</sup> Ronald N. Priddy, *A History of the Civil Reserve Air Fleet in Operations Desert Shield, Desert Storm, and Desert Sortie* (Cambridge, MA: Volpe National Transportation Systems Center, 1993), 148-150.

<sup>55</sup> *Air Mobility Strategic Plan 2002*, 60.

readiness of the C-5 and C-141. MRS-05 provides the justification for increased resources. The question is whether the Air Force and DoD place enough priority on increasing strategic airlift capability to fund improvements in the future.

An IBCT deployability study commissioned by the Army and Joint Staff has added detail to the deployment requirements of the IBCT.<sup>57</sup> The study analyzed 56 IBCT deployment scenarios using a projected FY 05 airlift fleet and infrastructure. Analyzing deployments from seven potential IBCT APOEs to eight potential APODs generated the scenarios. In the 56 scenarios tested, the IBCT averaged almost 9 days to deploy with a range from six and a half days to 17 days. These results were generated in spite of the optimistic assumptions used throughout the study. The most obviously optimistic assumptions generated the fastest deployment times involved an airlift fleet of 60 C-5 and 84 C-17s. The level of commitment required to generate this airfleet would require the virtually entire C-5 fleet (126 aircraft at an OR of 55%) and over 60% of the entire C-17 fleet. The assumptions in this scenario also included a most on ground (MOG) assumption of 7 aircraft with ammunition handled on the ramps.<sup>58</sup> Few airfields could meet these assumptions. Those that could are sizeable, well-equipped, and developed facilities.

It appears that the IBCT would require over 20 days to deploy by air in the worse case scenario. The IBCT deployability study recommends Army adjustments to the deployment ammunition concept and increased funding for airfield infrastructure.<sup>59</sup> Given the result of the study it appears the Army should investigate sea deployment of the IBCTs because strategic sealift may be capable of delivering the IBCTs to most theaters of operation in less than twenty days.

As FY 2007 approaches, the initial phase of Army transformation will significantly increase airlift requirements. Moving all five IBCT's to the Korean theater would add over 360

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<sup>56</sup> Mobility Requirements Study 2005, C-3-5.

<sup>57</sup> Jennifer Casto emailed to author 8 February 2001.

<sup>58</sup> Jennifer Casto emailed to author 8 February 2001, slide 5.

<sup>59</sup> Jennifer Casto emailed to author 8 February 2001, slide 6-9.

MTM to the current movement requirements.<sup>60</sup> This requirement alone would increase a full-scale airlift deployment by at least seven days if the entire US airlift fleet were dedicated to the task. Analysis beyond the scope of this monograph must be done to determine the capability of IBCT's to generate decisive results. If the IBCTs can be decisive earlier than current legacy forces, a deployment delay may not be significant. However, if the capabilities of the IBCT's cannot mitigate the seven-day delay, risk in the Korean theater would increase and may exceed the moderate range. Given all of this information, it seems unlikely that the airlift portion of the mobility triad can fully support the transforming army's increased requirements for airlift within current resource and funding levels.

## **CHAPTER FOUR: Sealift as a Part of Strategic Mobility**

While strategic airlift provides responsiveness to the strategic mobility triad, strategic sealift provides capacity. One large medium speed roll-on/roll-off (LMSR) ship displaces over 62,000 STONs, while the maximum allowable cabin load (ACL) of a C-5 is 135 STONs.<sup>61</sup> The strategic sealift fleet is more than bulk capacity however. The fleet is composed of three complementary elements: afloat prepositioning, surge sealift, and sustainment sealift. Through afloat prepositioned equipment and surge sealift, the sealift fleet also provides a degree of responsiveness to the mobility triad.

In an MTW deployment scenario, the components of the strategic sealift fleet would move the bulk of unit equipment and supplies. Prepositioned shipping would move the prepositioned afloat brigade sets of equipment, several CSS companies of equipment, ammunition, as well as project and sustainment stocks. Surge sealift would move the main battle tanks, assault vehicles, artillery, helicopters, trucks, and immediate combat provisions to "marry

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<sup>60</sup> This statement is based on the size of the IBCTs and the distance from their garrisons to Korea.

<sup>61</sup> Factsheet. LMSR available at <http://www.chinfo.navy.mil/navpalib/facfile/ships/ship-takr2.html>, 2 and the C-5 Factsheet accessed November 2001, 3.

up” with troops and aircraft from early deploying units flown into theater.<sup>62</sup> Sustainment shipping would focus on resupplying coalition and US forces to meet daily consumption and build up stocks while sustaining combat operations.<sup>63</sup> The US deployment to Operation Desert Storm/Desert Shield (ODS) established the magnitude of this sealift requirement.

Before this deployment, the Military Sealift Command (MSC) controlled 128 ships. Of these, 61 ships made up the active sealift force.<sup>64</sup> By September 1990, one month into the ODS deployment, the sealift fleet had grown to 161 ships. This was a 168% increase from the pre-Desert Shield sealift force. The enlarged force not only included all of the MCS controlled ships able to deploy, but also included 35 foreign flagged charter vessels.<sup>65</sup>

During ODS, sealift delivered 85% of the supplies and equipment the US transported to the theater.<sup>66</sup> Although this was an impressive accomplishment, ODS revealed significant problems in US strategic sealift. The shortfall in sealift structure was already discussed, but the readiness of the Ready Reserve Force (RRF) was also cited as a sealift shortfall following ODS.<sup>67</sup> Before the Persian Gulf War, MSC maintained most ships in the Ready Reserve Force (RRF) in a five-, 10-, or 20-day readiness status (known as RRF-5, RRF-10, or RRF-20). In compliance with these readiness standards, many of the RRF ships were kept at anchor and unmanned. This maintenance practice resulted in low readiness rates for the RRF force. The poor state of readiness resulted in only 76 of 96 RRF ships being activated for ODS. The 76 ships activated deployed an average of nine days later than DoD planned.<sup>68</sup> This late and partial activation created a shortage in sealift capacity that was ultimately offset by the use of foreign flagged ships.

In light of the ODS experience and the increase in wartime sealift requirements, all three

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<sup>62</sup> “National Transportation Institute National Defense Role.” at Transportation Institute Page [http://www.trans-inst.org/national\\_def\\_role.html/](http://www.trans-inst.org/national_def_role.html/) accessed 28 November 2001, 8.

<sup>63</sup> Ibid.

<sup>64</sup> Frances R. Donovan, “Surge and Sustainment.” *Sea Power*, November 1990, 42.

<sup>65</sup> Ibid., 43.

<sup>66</sup> James K. Matthews, “So Many, So Much, So Far, So Fast: United States Transportation Command and Strategic Deployment for Operation Desert Shield/Desert Storm.” Scott AFB, IL: USTRANSCOM Office of History, 1993, 40-53.

<sup>67</sup> Ibid., 52.

DoD mobility studies have produced a number of recommendations regarding sealift. In general, the requirement for sealift has consistently risen with each succeeding study. The 1992 MRS came on the heels of ODS and addressed many of the lessons learned in that conflict. The MRS determined that DoD had a 10 million square foot requirement for organic sealift. The sealift requirement was an attempt to correct a 3 million square foot shortfall in surge sealift and provide two million square feet for Army prepositioned afloat capacity. The requirement was validated during the study and discovered from the Marines' experience with their prepositioned afloat equipment during ODS.<sup>69</sup> This requirement was a significant increase from the pre-ODS sealift requirement and required an expansion of the RRF from 96 to 142 ships. This expansion of the RRF fleet was intended to provide the US with a unilateral deployment capability in an MTW scenario. The study also stated that readiness of the sealift fleet must improve since low readiness rates prior to ODS were responsible for the late and partial activation of the RRF during the conflict. The MRS recommended that the RRF ships increase readiness by changing maintenance standards to a Reduced Operating Status (ROS). The ROS readiness levels for the RRF were set at four, five, ten, and twenty days (ROS-4 through 20). In order to achieve these levels, the MRS recommended that RRF ships be assigned crews to ensure their readiness. The MRS also recommended a series of sea trials and exercises to test RRF vessel readiness. These findings, although expected, generated some controversy because they doubled the previous capacity requirement, significantly increased the readiness standard, and increased the funding levels required to maintain the RRF. All of these changes demanded a large investment of resources.

Congress had recognized the sealift problems before the release of the MRS and begun addressing the sealift shortfall by appropriating \$2.1 billion for ship acquisition in FY1990.<sup>70</sup>

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<sup>68</sup> Ibid., 43.

<sup>69</sup> Douglas M. Norton, CAPT, US Navy, *Sealift: Keystone of Support*, Proceedings, May 1991, 49.

<sup>70</sup> Martin M. Ferber, Director Naval Issues, GAO, "Shipbuilding: The Navy's Plan to Acquire Additional Strategic Sealift," Report to Congressional Committee on Armed Services, 30 July 1992, 1.

After the release of the MRS, Congress authorized between \$400 million and \$1.4 billion annually in the FY 1993-1998 POM for the acquisition of additional ships to meet the sealift requirement.<sup>71</sup> These authorizations were intended to correct the strategic sealift shortfall by funding the purchase of 20 LMSRs, for use in both prepositioned equipment and surge sealift roles, and expansion of the Ready Reserve Sealift fleet from 96 to 142 ships. These acquisitions were projected to correct the sealift shortfall in six years.<sup>72</sup>

This timeline failed to materialize. Acquisition of the 20 LMSRs will be completed in FY 2003 and the RRF was not expanded to 142 ships, but instead was targeted at 76 vessels. Expansion of the RRF proved to be cost prohibitive. The total POM funding to correct sealift deficiencies exceeds \$18 billion for the period FY 1992 to FY 2007.<sup>73</sup> The cost of acquiring additional vessels and the annual readiness funding of \$1.4 to 2.4 million dollars per ship per year could not be justified by the services so an alternate approach leveraging commercial vessels was developed. The additional sealift capability required was gained through the funding of the Voluntary Intermodal Sealift Agreement (VISA).<sup>74</sup>

The MRS-BURU findings were released in 1995, three years after the MRS recommendations were made. MRS-BURU increased the sealift requirement to 12 million square feet. The MRS-BURU recognized the change in military strategy from fighting one major war to two nearly simultaneous MRCs. MRS-BURU's increased sealift requirement also captured changes in the armed forces structure and positioning associated with the drawdown prescribed in the Bottom Up Review (BUR). MRS-BURU redefined the types of sealift that accounted for the 12 million square feet requirement. MRS-BURU stressed a 4.3 million square feet capacity of rapidly deployable sealift to moderate risk in the halting phase of both MRCs. This 4.3 million

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<sup>71</sup> Department of the Navy, *FY 1998/1999 Biennial Budget Estimates*, (Washington: GPO, 1997), 4.

<sup>72</sup> Ferber, 9.

<sup>73</sup> Department of Defense, Inspector General's Office, *Audit Report on Surge Sealift and Forces Supported by Land and Sea-Based Prepositioning*, (Washington: GPO, 2001), 8.

<sup>74</sup> Robertson, 13.

square feet was to be composed of surge and preposition sealift. The sealift was designed to accommodate the prepositioned afloat equipment ships and prepositioned ships that could be uploaded by C+4. The afloat equipment was intended to facilitate the closure of an Army heavy brigade by C+15, while the prepositioned ships enabled the closure of two divisions by C+30.

The results of MRS-05 were released five years after those of MRS-BURU. MRS-05 recommended only moderate changes to the sealift support concept. MRS-05 increases the initial sustainment sealift requirement by one million square feet to nearly 14 million square feet.<sup>75</sup> This increase was based on higher consumption factors associated with the programmed force of FY 2005. Because this is a relatively new requirement, a validated solution for increasing sealift capacity has yet to be developed. The solution to this increase will effect the sealift system through FY 2007. In all likelihood, the solution to the increased sustainment requirement will involve changes short of acquiring additional vessels. A likely solution is increasing the container carrying capacity of the sealift fleet and ensuring available capacity in the VISA fleet.<sup>76</sup>

Given this as a backdrop, a description of the current strategic sealift is appropriate. The current sealift system is the result of recommendations from the mobility requirements studies and resources provided by the National Defense Sealift Fund (NDSF), US Navy and Department of Transportation funding. A favorable situation for the strategic sealift portion of the mobility triad currently exists. This is due to the consistent nature of the sealift requirement through three mobility requirement studies combined with the efficiency in resourcing facilitated by TRANSCOM management and interagency and joint funding through the NDSF.

The strategic sealift portion of the mobility triad is composed of the Afloat Prepositioning Force, Surge Sealift Force, and the Sustainment Sealift Force. The US Navy's Military Sealift Command in conjunction with the Office of the Secretary of Defense (OSD), and the Department of Transportation's Maritime Administration (MARAD) resource, manage and operate the

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<sup>75</sup> Robertson, 2.

<sup>76</sup> Ibid.

government owned strategic sealift fleet.<sup>77</sup> The surge sealift force is composed of sixteen large vessels (8 fast sealift ships (FSS) and 8 large medium speed roll-on roll-off ships (LMSR) based at locations that facilitate the upload of early deploying units. These 16 vessels provide over 2 million square feet of militarily useful capacity. The sustainment force is the largest component of the sealift fleet and includes the RRF and ships enrolled in the Voluntary Intermodal Sealift Agreement (VISA) program. The strategic sealift fleet had an 8.4 million square foot capacity in FY 2000.<sup>78</sup> This capacity was increased by the delivery of four new Bob Hope class LMSRs in FY 2001. The estimated capacity of the sealift fleet at the end of FY 2001 was 9.56 million square feet of military useful cargo space.<sup>79</sup> This capacity is projected to increase through FY 2003, when the last of 20 LMSRs is brought into service, and organic DoD capacity exceeds 10 million square feet. These launches will conclude a procurement project initiated in 1994 to meet the requirement for military useful sealift established in the 1992 MRS.

### **Afloat Prepositioning Force.**

Thirty-eight ships make up MSC's Afloat Prepositioned Force.<sup>80</sup> The Afloat Prepositioned Force supports all branches of the US armed forces. To provide this support, the Afloat Prepositioning Force is divided in three units. Fifteen Maritime Prepositioning Ships are divided into three squadrons, each carrying equipment and supplies sufficient to sustain a Marine Corps Air/Ground Task Force for up to 30 days of operations. Squadrons are located at Diego Garcia in the Indian Ocean, in the Mediterranean Sea and at Guam/Saipan in the Western Pacific Ocean.

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<sup>77</sup> James K. Matthews, United States Transportation Command, the National Defense Reserve Fleet, and the Ready Reserve Fleet: A Chronology, eds. Margret Nigra and Cora J. Holt, (U.S. Transportation Command Research Center: Scott AFB, IL, 1999), 39

<sup>78</sup> Audit Report on Surge Sealift and Forces Supported by Land and Sea-Based Prepositioning, i.

<sup>79</sup> Military Sealift Command, "MSC: 2001 in Review - Commander's Perspective" available from [www.msc.navy.mil/MSC\\_2001\\_in\\_Review\\_-\\_Commanders\\_Perspective.htm](http://www.msc.navy.mil/MSC_2001_in_Review_-_Commanders_Perspective.htm) accessed on 16 January 2001.

<sup>80</sup> Military Sealift Command, "MSC: 2001 in Review - Prepositioning Program" available from [www.msc.navy.mil/MSC\\_2001\\_in\\_Review\\_-\\_Prepositioning\\_Program.htm](http://www.msc.navy.mil/MSC_2001_in_Review_-_Prepositioning_Program.htm) accessed on 16 January 2001

Logistics Prepositioning Ships included six prepositioning vessels carrying various cargoes for the US Navy, Defense Logistics Agency and US Air Force. Two vessels currently carry munitions for the Air Force. The end of FY 2002 will see the addition of a third ship to the US Air Force ammunition carrying fleet. All of these ships carry ammunition in containers as opposed to the break-bulk configuration prevalent during ODS. Three government-owned tanker vessels preposition jet fuel for the Defense Logistics Agency. These vessels are based in Diego Garcia (2), and Guam. These tankers provide a total capacity of about 750,000 barrels of fuel.<sup>81</sup>

Combat Prepositioning Ships carry the equipment and supplies needed to support a US Army 2x2 heavy brigade of up to 6,000 personnel for up to 15 days. At the end of FY 2001, there were 15 Combat Prepositioning Ships: eight LMSRs, four container ships; one heavy-lift ship; one float-on/float-off ship and one crane ship activated from the Ready Reserve Force.<sup>82</sup> This preposition afloat equipment will be elaborated upon in the next chapter.

### **Surge Sealift.**

Surge sealift capability is provided by sixteen government owned FSSs (8) and LMSRs (8) operated by the Military Sealift Command (MSC) as well as RRF vessels maintained by MARAD. The FSSs and LMSRs are maintained at ROS-4 standards so they can be rapidly alerted to support contingency deployments. The FSS and LMSRs are capable of lifting two heavy divisions' unit equipment and supplies and are based at ports along the East Coast and Gulf Coasts of the US to facilitates rapid upload of early deploying units.<sup>83</sup>

The FSS ships are capable of loading up to 150,000 square feet of heavy military cargo each, while the LMRs are capable of loading over 380,000 square feet. Unlike most roll-on/roll-off ships, FSS and LMSRs are equipped with large pedestal cranes that can operate singly or in

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<sup>81</sup> Ibid.

<sup>82</sup> Ibid.

<sup>83</sup> Military Sealift Command, "MSC: 2001 in Review – Sealift Program" available from [www.msc.navy.mil/MSC\\_2001\\_in\\_Review\\_-\\_Sealift\\_Program.htm](http://www.msc.navy.mil/MSC_2001_in_Review_-_Sealift_Program.htm) accessed on 16 January 2001.

pairs. This capability makes the ships self-sustaining in undeveloped ports and capable of discharging cargo at anchorage during logistics-over-the-shore operations. Three LMSRs, USNS Mendonca, USNS Pililaau, and USNS Gilliland, joined the surge fleet in FY 2001 bringing the current total to eight. By 2003, MSC will have an 11-ship LMSR surge force.<sup>84</sup>

### **Sustainment Sealift.**

Sustainment sealift has received less investment, but no less attention than the rest of the strategic sealift fleet. The lower level of investment is possible due to the configuration of the sustainment sealift fleet. The fleet is composed of some government owned RRF ships and commercial vessels enrolled in VISA.

The RRF, which at the end of FY 2001 comprised 76 militarily useful government-owned merchant ships, is operated and maintained by commercial ship managers under contract to the U.S. Maritime Administration (MARAD). The ships can be activated in four, five, 10 or 20 days. When activated, RRF ships come under MSC's operational control. These 76 ships include roll-on/roll-off vessels (31), breakbulk ships (15), auxiliary crane ships (10), tankers (5), offshore petroleum discharge system ships (4) LASH (lighter aboard ship) vessels (4), Seabee vessels (3), aviation support ships (2), and troop ships (2).<sup>85</sup>

The VISA portion of the sustainment fleet is relatively new and was developed by Congress to address concerns with the shortfall in sustainment sealift capacity, a continuing loss of US flagged shipping, and a growing shortage of American merchant seaman. VISA is intended to leverage the capabilities of the US commercial fleet and augment the sealift capabilities of military vessels.<sup>86</sup> The military ships, operated or leased by MSC, predominantly carry cargoes that cannot be put in containers, such as vehicles or large pieces of equipment.

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<sup>84</sup> Ibid.

<sup>85</sup> Ibid.

<sup>86</sup> Ira Lewis and Daniel Y. Coulter, "The Voluntary Intermodal Sealift Agreement: Strategic transportation for national defense"; *Transportation Journal* (Lock Haven; Fall 2000), 31-34.

Commercial shipping adds to the military's capabilities by resupplying combat forces with a variety of materials, including ammunition that can move by container.

For the US merchant marine, the Maritime Security Program (MSP) of VISA offers a long-term tourniquet to the rapid hemorrhaging of the US flag fleet. Without the MSP, American President Lines and Sea-Land, America's two largest commercial carriers, which together represent 85 percent of US flag ocean-going ship capacity, would have been forced to reflag several of their ships to foreign registries.<sup>87</sup> More important, VISA and MSP afford the US military access to a modern commercial fleet and associated intermodal system. This access gives military planners the ability to get supplies rapidly from factories and military installations in the US to a theater of operation

As of January 1999, 109 U.S. vessels were enrolled in VISA. This total included 89 containerships, 12 roll-on/roll-off (RO/RO) vessels, 4 Lighter Aboard Ship (LASH) vessels, and 4 breakbulk (general cargo) ships. Additionally, over 100 ocean-going tugs and barges, and 52 ocean supply vessels are enrolled.

The US strategic sealift fleet provides tremendous capability, but has been shown to have a significant challenge. The LMSRs and FSSs in the surge sealift fleet and carrying prepositioned afloat equipment are large vessels. These ships are more than 900 feet in length and have a draft exceeding 35 feet.<sup>88</sup> During the deployment to Somalia for Operation Restore Hope, two of these ships could not enter the port of Mogadishu because the port was too shallow. The vessels were diverted to a well-developed port in Mombassa. Where the contents of the ships were to be transloaded to smaller vessels. The port at Mombassa was also incapable of handling the ships. Thus, the ships were returned to Diego Garcia where they downloaded enough cargo to enter the

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<sup>87</sup> Ibid.

<sup>88</sup> Factsheets, LMSR and FSS fact sheets available at <http://www.chinfo.navy.mil/navpalib/factfile/ships/ship-takr2.html> and <http://www.chinfo.navy.mil/navpalib/factfile/ships/ship-sl7.html> accessed 16 November 2001.

port of Mogadishu.<sup>89</sup> This operation caused a two-month delay in the arrival of the deploying equipment. While potential adversaries focus on access denial strategies, US planners will need to address the self-imposed access denial created by the size of US deployment vessels.

One potential solution to this dilemma has been tested jointly by the Army and Navy. In a joint test and evaluation program called Joint Venture, the Army and Navy tested a high-speed sealift ship built by INCAT Inc. of Australia.<sup>90</sup> The tested vessel cruises at 43 knots with militarily useful payloads and has a draft of ten feet.<sup>91</sup> This vessels has the possibility of offsetting not only the sealift access problem, but also could augment intra-theater airlift.

Ongoing tests are fully funded in the FY 02-07 POM. The entire strategic sealift program is funded at approximately 87-96% of requirements throughout the period.<sup>92</sup> The higher percentage funding is late in the period. After FY 03 the last year of LMSR acquisition, sealift funding appears to go into a maintenance funding pattern. In spite of this flat funding stream, the US strategic sealift fleet promises to possess the capability to support US armed forces strategic deployment through the FY 07 period.

## **CHAPTER FIVE: Prepositioned Equipment as a Part of Strategic Mobility**

Prepositioned equipment is undoubtedly the oldest method of projecting military power. Since the seventeenth century when Le Tellier and Louvois developed their magazine system for supporting French power projection, prepositioned equipment has exercised a decisive influence on the conduct of war.<sup>93</sup> The US has used a prepositioned equipment concept for military power projection since the Cold War.<sup>94</sup> The Cold War predecessors to the current Army Prepositioned

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<sup>89</sup> David Kassing, *Transporting the Army for Operation Restore Hope*, (Santa Monica, CA: Rand Arroyo Center, 1994), 30-32.

<sup>90</sup> Owen Spivey, *High Speed Sealift (HSS) INCAT 046 CAT Evaluation*, (14 July 1999), 5.

<sup>91</sup> *Ibid.*, 9.

<sup>92</sup> David McDonnough, email to author, dated 16 March 2001.

<sup>93</sup> Martin Van Creveld, *Supplying War: Logistics from Wallenstein to Patton*. (Cambridge: Cambridge University Press, 1977), 17.

<sup>94</sup> Department of the Army, FM 100-17-2 Army Prepositioned Land. (Washington: HQDA, 1999) 1-6.

Stocks program were called POMCUS (prepositioning of material configured to unit sets) in the central region in Europe and TRU/ARPS (theater reserve in unit sets/Army readiness package south) in Italy.<sup>95</sup> These programs identified specific CONUS based units that would deploy to Europe and fall in on a given equipment set. Annual Reforger (Return of Forces to Germany) exercises validated the process. APS has made some changes to the POMCUS and TRU/ARPS concepts to increase flexibility and responsiveness, but the basic prepositioned equipment concept remains the same.

Today's prepositioned equipment is not designated for a specific unit. Instead, the Army Material Command (AMC) manages the prepositioned equipment and supplies as a common user pool to support the requirements of the entire Army. The APS system has an afloat prepositioned equipment set which POMCUS and TRU/ARPS did not have. This afloat equipment came into being in 1994 because of lessons learned from the ODS deployment. Units deploying to a contingency or exercise can receive equipment and supplies from anyone of the four categories of prepositioned equipment and supplies: Prepositioned Sets, Army Operational Project Stocks, War Reserve Stocks, and War Reserve Stocks for Allies.

## **Prepositioned Sets**

This category of prepositioned equipment includes Army Prepositioned Stocks (APS) 1 through 5. APS-1 consists of eleven Operational Project (OP) stocks and sustainment stocks stored in many locations in CONUS. These OP stocks are generally composed of high-volume, low-demand items such as clothing, tentage, aircraft mating, bridging, and water supply equipment as well as other logistics and engineer assets. APS-2 consists of three brigade sets of equipment (2-2x1 and 1-2x2), eight OP stocks, a 155 self-propelled FA battalion set, and ammunition stocks for allies stored in six countries (Belgium, The Netherlands, Luxembourg, Italy, Norway, and Israel). APS 3 consists of two mechanized brigade sets (1-2x2 and 1-1x1),

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<sup>95</sup> Ibid.

several CSS unit sets, five OP stocks, and sustainment stocks loaded on fifteen ships afloat based out of Diego Garcia in the Indian Ocean. APS 4 consists of a mechanized brigade set (2x1), five OP stocks, and sustainment stocks in Korea and four OP stocks, and sustainment stocks in Japan. APS 5 consists of a mechanized brigade set (2x1) in Kuwait, and a mechanized brigade set (2x1) and a Division set in Qatar, and one OP stock (2 hospitals) in Bahrain.<sup>96</sup>

The most striking characteristic of the prepositioned brigade and unite sets is their positioning. Since the fall of the Soviet Union, the likelihood of armed conflict in central Europe has diminished dramatically. In spite of this development, three brigades of combat equipment are located in Europe. It appears the Army would receive more responsive support out of the APS system by relocating these unit sets to more likely areas of conflict like SWA or NEA. The Army would gain the most flexibility by placing this equipment afloat. A Joint decision would have to be made, but leveraging APS afloat with additional surge sealift or RRF vessels and combat equipment currently based in Europe would improve the Army's ability to respond to a contingency situation.

## **Army Operational Project and War Reserve Stocks**

Army Operational Project Stocks are authorized equipment and supplies above normal table of organization and equipment (TOE), table of distribution and allowances (TDA) and common table of allowances (CTA) authorizations. These stocks are tailored to key strategic capabilities essential to the Army's ability to execute its power projection strategy. The stocks are designed to complement organic unit capabilities to support Army operations, plans, and contingencies. AOP stocks are primarily located in CONUS (APS-1) location, but some smaller tailored portions and packages are prepositioned overseas and afloat.<sup>97</sup>

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<sup>96</sup> Jeff Angers, Army Prepositioned Stock Briefing from DALO-AMW dated 25 April 2000 e-mailed to author 5 March 2002, 10.

<sup>97</sup> FM 100-17-2, 1-4.

War Reserve Stocks are major end items and secondary material aligned and designated to satisfy the Army's sustainment requirements during combat. The requirements for stockage levels of these class VII major end items and class II, III(P) and IX war reserve secondary items are determined in the Total Army Analysis process as well as through consumption data gained from warfighting simulations. These stocks are generally located in or near potential theaters of operations. Through forward positioning of these items, the US lessens its requirement for surge and sustainment sealift.

Funding for prepositioned stocks through the period FY 02-07 is approximately 85% of validated Department of the Army requirements. APS-3 is funded at 99% of requirements while APS-1 is funded at 64%.<sup>98</sup> This funding structure seems a prudent way to spread risk. APS-2 through 5 are the immediate response portions of the prepositioned equipment system. Needed CONUS based stocks could be acquired at the onset of a crisis with little immediate negative impact on the war fight.

The most troubling aspects of the Army prepositioned stocks relates to the age and equipment on hand levels of the equipment in the prepositioned unit sets. The main battle tanks in APS are M1A1s. The Army has upgraded a significant portion of the CONUS based armored force to M1 SEP or M1A2 tanks. These upgrades will continue throughout the FY 02-07 period.<sup>99</sup> The M1 SEP and M1A2 are "digitized" weapons systems. The M1's in APS are not. This means there is a training issue that must be resolved for units equipped with digitized tanks who fall in on the less capable tanks in the APS system. This shortfall must be addressed so soldiers are not sent into combat in equipment they are not completely trained to use. Another deficiency in APS relates to equipment on hand (EOH) level. The EOH fill rate for APS 2-5 ranges from a high of 95% for the brigade set of APS-4 in Korea to a low 16 % for the Division

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<sup>98</sup> Jeff Angers, Army Prepositioned Stocks Brief from DA PAED dated 16 October 2001 e-mailed to author 7 March 2002, 3-7.

<sup>99</sup> John Basso, CPT, US Army, "M1A2: One Year Later." *Armor Magazine* January-February 1998, 32.

HQ base set in Qatar.<sup>100</sup> The funding to upgrade the main battle tanks in APS and completely fill these unit sets are unsupported in the FY02-07 POM. These shortfalls negatively impact the Prepositioned equipment programs ability to support the Army during the initial phase of transformation.

## **CHAPTER SIX: Findings and Recommendations**

The early phase of Army transformation emphasizes the fielding of the IBCTs. This fielding will serve as the initial step to the Objective Force. Other areas of emphasis will be investment in science and technology leading to the capabilities needed to field the objective force as well as recapitalization of the legacy force.<sup>101</sup> The fielding of the IBCTs will be the aspect of this period that challenges the Defense Transportation (DTS) most and will increase the strategic mobility requirements of the Army. Based on current forecasts it is clear that the strategic airlift fleet will not support the Army's goal of deploying a medium brigade in 96 hours. This time standard is a stated goal of the Objective Force and was initially intended to be a stretch goal for the IBCT. The findings and recommendation of MRS-05, the TRANSCOM IBCT Deployability Study, and DoD and Army funding levels projected through FY 07 will not allow the DTS to support the deployment of an IBCT to a theater of war in 96 hours.

Given these findings, there are a number of initiatives the Army should undertake in order to improve its strategic mobility situation as transformation continues through FY 07. First, the Army must determine a realistic, supportable, deployment timeline for the IBCT and publicize the timeline. Second, the Army should support the establishment of a DoD level fund, similar to the National Defense Sealift Fund (NDSF) to resource strategic airlift. Third, the Army must address the constraints to the IBCT's rapid deployability under its control. Those constraints are ammunition load planning for the IBCT and departure airfield infrastructure. Fourth, the Army should consider the relocation of APS stocks from Europe to afloat status in

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<sup>100</sup> *Army Prepositioned Stocks Brief*, 18.

order to increase the afloat prepositioned force to a full division. Finally, since it appears that sea deployment of the IBCT will be faster than air deployment of the force in the near term, the Army must develop a detailed concept for sea deployment of an IBCT. In undertaking all of these initiatives, the Army must emphasize the capability provided by the “medium weight” IBCT and demonstrate its capability to deploy the units quickly. Positive outcomes from initial IBCT deployments could be leveraged to ensure support of further transformation initiatives.

The TRANSCOM deployability study is the most extensive study of IBCT’s air transportability. This study made some optimistic assumptions in simulating 56 IBCT deployment scenarios and came up with a nine-day average deployment timeline for the IBCT with a range from six to 17 days. The actual deployment of the IBCT may exceed the seventeen day upward bound of this range because the FY 02-07 POM does not contain the funding to improve infrastructure to meet the assumptions made in the deployment study. Given this information, the Army should conduct another transportability assessment based on programmed capability of the DTS. The Army should publicize the results of this study so that unreal expectations of IBCT capabilities are not propagated. As the IBCTs reach initial operating capability (IOC), they will be written into war plans. Unreal deployment expectations by joint planners would place US forces at risk and adversely affect support for continued Army transformation.

Second, the Army must support the establishment of a DoD level fund, similar to the National Defense Sealift Fund (NDSF) for resourcing strategic airlift. The Army has chosen to emphasize air deployability for both the IBCT’s and the Objective Force. This is understandable given that air deployment is the most likely candidate for supporting the Army’s 96-hour deployment goal for a brigade-sized unit. The airlift fleet projected for FY 07 cannot support the 96-hour goal. The inability to support the goal is due to a number of reasons. One of the primary reasons for the inability to support the 96-hour goal is the size and readiness of the strategic airlift

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<sup>101</sup> Shinseki, 2.

fleet. Following ODS, the strategic sealift fleet was challenged by the same difficulties. The National Defense Sealift Fund and Joint oversight and management of the sealift fleet has corrected most of the problems identified a decade ago. The strategic airlift fleet is still experiencing the same shortfalls identified in the 1992 MRS in spite of tremendous resource investment in the fleet. Part of the problem is that the Joint oversight used to correct the sealift problems has not been used on the airlift fleet. The Commander of USTRANSCOM is dual hatted as the Commander of Air Mobility Command (AMC). This command relationship ensures that resourcing and management of the strategic airlift fleet is an Air Force dominated situation. Establishment of a joint fund for resourcing strategic airlift would reduce Air Force domination of strategic airlift and provide greater joint visibility of airlift issues. This construct has the potential of improving the strategic airlift situation the way the NDSF and joint management have enabled the improvement of the strategic sealift fleet.

The Army must address the most significant constraints to the IBCTs rapid deployment under its control. The two most significant limiting factors identified in the TRANSCOM IBCT Deployment Study were ammunition loading planning of aircraft transporting the IBCT and transportation infrastructure at Army APOEs. The IBCT deployment scenarios in the TRANSCOM study that took the longest were deployments associated with ammunition on 100% of the deploying aircraft. Ammunition not only increases weight and handling times for each aircraft, but also influences the number of aircraft that can operate on a given airfield. AMC would not likely fly airlift aircraft into a contested airfield. Given this assumption, deploying IBCT units would not need to come off of the aircraft ramp shooting. This means that there is no need for ammunition to be placed on 100% of the IBCT's deployment aircraft. The TRANSCOM deployability study demonstrates that reducing ammunition on board deploying aircraft from 100% of the aircraft to 0% of the aircraft reduces deployment time from 17 days to slightly over 6 days. It seems unlikely that the IBCT would deploy without ammunition. Army analysts should determine levels of ammunition to deploy with the IBCT at different threat levels

and mission profiles. The remainder of the ammunition needed by the deploying IBCT could be transported on aircraft completely laden with ammunition or could potentially be placed on a preposition afloat vessels to marry up with the deploying force. The advantages of the sealift option are that a ship is capable of transporting much more ammunition than an aircraft is, and ammunition movement by sea would reduce ammunition handling requirements at airfields supporting the IBCT's air deployment.

Since the end of the Cold War, the likelihood of US combat equipment being used to defend central Europe has faded. Contrary to this situation, there are currently three brigades of equipment in Army Prepositioned Stocks (APS) in Europe. A portion of this equipment will be moved to prepositioned afloat ships by the end of FY 02. These afloat assets will expand the current APS capability and provide the Army with a more flexible and responsive means of supporting the current military strategy. Given this evolving situation, the Army should move to establishing a division size unit aboard APS ships.

There will be eleven LMSRs in the surge sealift fleet by FY 03. Four of these vessels could be used to upload the remainder of a heavy division. This diversion of four ships would improve US force projection. The four ships transferred to APS would deliver their cargo to theater more rapidly than if they began the deployment sequence empty on ROS-4 status in CONUS port.

A division afloat would provide the Army tremendous capability. Deployment times would be shortened because the fort to port and ship loading portions of the deployment would have already occurred for the APS ships. The APS ships could move from their base to a potential theater of operation much earlier in a crisis increasing responsiveness. The US would also have the capability to use an afloat prepositioned brigade more readily than it current does because there would be additional afloat assets in reserve. These advantages would make the Army more responsive and agile. These attributes of the Objective Force can be gained by using legacy equipment in this innovative way.

Based on projected airlift capabilities in FY 2007, the air deployment of the IBCT is likely to exceed twenty days. A twenty-day air deployment timeline may shift the advantage of speed from air deployment to sea deployment. An LMSR could deliver an entire IBCT to a theater of operations 9200 nautical miles away in twenty days. The army must develop a detailed concept for sea deployment of the IBCT.

The IBCT TOE calls for the unit to weigh 16,000 STONs and occupy 185,000 square feet of space. In gross terms, the IBCT is small enough to fit entirely on one LMSR with 100,000 square feet of capacity remaining for additional supplies and equipment. These ships are capable of traveling at 24 knots per hour. A sea deployment of the IBCT's would likely take four days plus transit time based on a two day estimated upload and down load on each end of the deployment. An IBCT sealift deployment has inherent advantages and cannot be ignored. Such a deployment requires careful research and planning. In the near term, it may present the best option for deployment of the IBCT.

The DTS of FY 2007 will have significant challenges meeting the strategic mobility requirements of the US Army. The bulk of these challenges are associated with the fielding of the IBCTs. A great deal of work needs to be done to allow the Army to begin closing the gap towards its goal of transporting a brigade to a theater of operations in 96 hours, a division in 120 hours and a five division corps in 30 days. The 30-day portion of the deployment goal seems most attainable now due to the capacity of the strategic sealift system. Based on deficiencies in the airlift fleet and the size and weight of deploying Army units, the 96 and 120 hour portions of the goal seem unattainable in the period approaching FY07.

## BIBLIOGRAPHY

Air Mobility Command, Department of the Air Force. *2002 Air Mobility Strategic Plan*. Scott Air Force Base, IL: US Air Force, November 2001.

Air Force Association, "Air Force Almanac 2000" *Air Force Magazine* May 2001.

\_\_\_\_\_. *Strategic Airlift Force Mix Analysis*. Scott Air Force Base, IL: US Air Force, November 1995.

Angers, Jeff Major, USA. *Army Prepositioned Stock Briefing* from DALO-AMW dated 25 April 2000 e-mailed to author 5 March 2002.

Aspin, Les, Secretary of Defense. *Report on the Bottom-Up Review*, Washington D.C.: Government Printing Office, 1993.

John Basso, CPT, US Army, "M1A2: One Year Later." *Armor Magazine* January-February 1998, 32-36.

Casto, Jennifer, Briefing slides of IBCT Deployability Study conducted by TRAC Leavenworth. Email to author 14 January 2001.

Cirafici, John. *Airhead Operations: Where AMC delivers*. Maxwell AFB, AL: Air University Press, 1995

Cohen, William S., *Annual Report to the President and the Congress*. Washington D.C.: Department of Defense, 2000.

Department of the Air Force. *AF Pamphlet 10-1403, Air Mobility Planning Factors*. Washington, D.C. Government Printing Office, 1998.

\_\_\_\_\_. *C-5 Galaxy Fact Sheet*. [on-line]; available from <http://www.af.mil/news/factsheets/C5Galaxy.html>; Internet; accessed 16 November 2001.

\_\_\_\_\_. *C-130 Hercules Fact Sheet*. [on-line]; available from <http://www.af.mil/news/factsheets/c130Hercules.html>; Internet; accessed 16 November 2001.

\_\_\_\_\_. *C-141 Starlifter Fact Sheet*. [on-line]; available from <http://www.af.mil/news/factsheets/c141Starlifter.html>; Internet; accessed 16 November 2001.

\_\_\_\_\_. *C-17 Globemaster III Fact Sheet*. [on-line]; available from <http://www.af.mil/news/factsheets/C17GlobemasterIII.html>; Internet; accessed 16 November 2001.

Department of the Army. *Army Posture Statement*. [on-line]; Available from <http://www.army.mil/aps/00/aps00.htm>, Internet; accessed 15 November 2001.

- \_\_\_\_\_. *The Army Transformation*. [on-line]; Available from <http://www.army.mil/armyvision/transform.htm>; Internet; accessed 17 November 2001.
- \_\_\_\_\_. *Army Science Board FY 2000 Summer Study Final Report: Technical and Tactical Opportunities for the Revolutionary Advances in Rapidly Deployable Joint Ground Forces in the 2015-2025 Era*, Washington D.C.: 2001.
- \_\_\_\_\_. *Field Manual 100-17. Mobilization Deployment Redeployment. Demobilization*, Washington D.C.: GPO, 1992.
- \_\_\_\_\_. *Field Manual 100-17-2. Army Prepositioned Land*, Washington D.C.: GPO, 1999.
- Department of Defense. *Defense Planning Guidance Fiscal Years 2002 -2007* (U). Washington, DC: GPO, 2001 SECRET.
- \_\_\_\_\_. *Deputy Secretary of Defense Wolfowitz Briefing on the Defense Planning Guidance* [on-line]; available from <http://www.defenselink.mil/news/briefings.html>, accessed 8 November 2001.
- \_\_\_\_\_. *Mobility Requirements Study Volumes I-III* (U), Washington D.C.: JCS, 1992. SECRET.
- \_\_\_\_\_. *Mobility Requirements Study Bottom-Up Review Update* (U). Washington, DC: GPO, 1995. SECRET.
- \_\_\_\_\_. *Mobility Requirements Study 2005*. Washington, DC: GPO, 2001
- \_\_\_\_\_. *National Military Strategy of the United States of America*. Washington, DC: GPO, 1997.
- \_\_\_\_\_. *Quadrennial Defense Review Report*. Washington, DC: GPO, 2001
- Department of Defense, Inspector Generals Office, *Audit Report on Surge Sealift and Forces Supported by Land and Sea-Based Prepositioning*, Washington, DC: GPO, 2001
- Department of the Navy. *FY 1998/1999 Biennial Budget Estimates*. Washington: GPO, 1997.
- \_\_\_\_\_. LMSR Fact Sheet. [on-line]; available at <http://www.chinfo.navy.mil/navpalib/facfile/ships/ship-takr2.html>
- \_\_\_\_\_. FSS Fact Sheet. [on-line]; available at <http://www.chinfo.navy.mil/navpalib/facfile/ships/ship-sl7.html>
- Department of Transportation. *National Transportation Statistics 2000*. Washington: GPO, 2001
- Donovan, Francis R., VADM, US Navy. "Surge and Sustainment." *Sea Power*. November 1990, 39-45.

Drach, Ann K., LTC., USA. "The strategic mobility shortfall: underrepresented, underfunded and unresolved." Monograph, School of Advanced Military Studies, US Army Command and General Staff College, 1995.

Ferber, Martin M., Director Naval Issues, GAO, "Shipbuilding: The Navy's Plan to Acquire Additional Strategic Sealift," Report to Congressional Committee on Armed Services, 30 July 1992, Washington DC: GPO, 1992.

Government Accounting Office. *Military Airlift: Options Exist for Meeting Requirements While Acquiring Fewer C-17s*. Washington, DC: GPO, 1997.

---

\_\_\_\_\_. *Strategic Mobility--Serious Problems Remain in U.S. Deployment Capabilities*, Testimony (to) The Subcommittee on Readiness, Committee on Armed Services, House of Representatives, Washington D.C., 1994.

Hutcheson, Keith. *Air Mobility: The Evolution of Global Reach*. Vienna, VA.: Point One, 1999.

Kassing, David. *Transporting the Army for Operation Restore Hope*. Santa Monica, CA: RAND, 1994.

Keltz, Ilean K, Major, USA. "Follow-up Mobility Studies: How They Compare?" Thesis, US Army Command and General Staff College, 1999.

Krepinevich, Andrew F. Jr. "Assessing the Bottom -Up Review." In *Joint Forces Quarterly*, Winter 1993-94, pp. 22-24.

Lewis, Ira and Daniel Y. Coulter, "The Voluntary Intermodal Sealift Agreement: Strategic transportation for national defense"; *Transportation Journal* Lock Haven; Fall 2000, 28-39.

Matthews, James K., *United States Transportation Command, the National Defense Reserve Fleet, and the Ready Reserve Fleet: A Chronology*, eds. Margret Nigra and Cora J. Holt, Scott AFB, IL: U.S. Transportation Command Research Center, 1999

Matthews, James K. *So Many, So Much, So Far, So Fast: United States Transportation Command and Strategic Deployment for Operation Desert Shield/Desert Storm*. Scott AFB, IL: USTRANSCOM Office of History, 1993.

Matthews, William. "Report: storage, ships could reduce C- 17 fleet". *Air Force Times*, 17 March 1997, 30.

McDonnough, David. *Strategic Sealift Funding Levels MSC/MARAD POM FY 02-07* email to author, dated 16 March 2001.

Mehaffey, Michael "Vanguard of the Objective Force," *Military Review*, September-October 2000, 6-16.

Military Sealift Command. "MSC: 2001 in Review - Commander's Perspective" available from [www.msc.navy.mil/MSC\\_2001\\_in\\_Review\\_-\\_Commanders\\_Perspective.htm](http://www.msc.navy.mil/MSC_2001_in_Review_-_Commanders_Perspective.htm) accessed on 16 January 2001.

- \_\_\_\_\_. "MSC: 2001 in Review – Prepositioning Program" available from [www.msc.navy.mil/MSC\\_2001\\_in\\_Review\\_-\\_Prepositioning\\_Program.htm](http://www.msc.navy.mil/MSC_2001_in_Review_-_Prepositioning_Program.htm) accessed on 16 January 2001
- \_\_\_\_\_. "MSC: 2001 in Review – Sealift Program" available from [www.msc.navy.mil/MSC\\_2001\\_in\\_Review\\_-\\_Sealift\\_Program.htm](http://www.msc.navy.mil/MSC_2001_in_Review_-_Sealift_Program.htm) accessed on 16 January 2001.
- National Transportation Institute. *National Transportation Institute National Defense Role*. available at [http://www.trans-inst.org/national\\_def\\_role.html/](http://www.trans-inst.org/national_def_role.html/) accessed 28 November 2001.
- Nelson, Victor L., LTC, USA. "Power Projection of an Army Corps by C+75 – On Target or Wishful Thinking?" Monograph, School of Advanced Military Studies, US Army Command and General Staff College, 1998.
- Norton, Douglas M. CAPT, US Navy, "Sealift: Keystone of Support", Proceedings, May 1991, 46-59.
- Owen, Robert C. and Todd A. Fogle, "Strategic Mobility: Air Mobility Command and the Objective Force a Case for Cooperative Revolution." *Military Review*, Jan/Feb 2001, 10-20.
- Priddy, Ronald N. *A History of the Civil Reserve Air Fleet in Operations Desert Shield, Desert Storm, and Desert Sortie*. Cambridge, MA: Volpe National Transportation Systems Center, 1993
- Robertson, Charles T., General, USAF, CINC USTRANSCOM, "Strategic Airlift/Sealift Imperatives." Testimony before Senate Armed Services Committee, Subcommittee on Seapower. Washington DC: FDCH Political Transcripts, 2001.
- Shinseki, Eric K. "*The Army Vision. Soldiers On Point for the Nation... Persuasive in Peace, Invincible in War*", [on-line]; available from [http://www.tradoc.army.mil/transformationJData%20pages.csa\\_vision.htm](http://www.tradoc.army.mil/transformationJData%20pages.csa_vision.htm)~ Internet; accessed 17 November 2001.
- Simon, Seena. "Changes will mean more air missions." In *Air Force Times*, 22 January 2001, 17.
- Smith, Jay H., *Anything, Anywhere, Anytime: An Illustrated History of the Military Airlift Command, 1941-1991*. Scott AFB, IL: Military Airlift Command, 1991.
- Spivey, Owen. *High Speed Sealift (HSS) INCAT 046 CAT Evaluation*, 14 July 1999
- Turabian, Kate L. *A Manual for Writers of Term Papers, Theses, and Dissertations. 6th ed.* Chicago: University of Chicago Press. 1996.
- The White House. *National Security Strategy for a New Century*. Washington, DC: GPO, 1999.
- US Congress. Congressional Budget Office. *Moving US Forces: Options for Strategic Mobility*. Congressional Session 105-1, Washington, DC: GPO, 1997.

U.S. Congress. Senate. Senate Armed Services Committee. Subcommittee on Seapower. *US Senator Jeff Sessions (R-AL) Holds Hearing on Strategic Airlift and Sealift Imperatives*. Washington DC: FDCH Political Transcripts, 2001.

Van Creveld, Martin. *Supplying War: Logistics from Wallenstein to Patton*. Cambridge: Cambridge University Press, 1977.

Ward, William R., Major, USAF. "Strategic Lift and the Interim Brigade Combat Team"  
Monograph, School of Advanced Military Studies, US Army Command and General Staff College, 2001.