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# DEFENSE TRANSPORTATION

## Study Limitations Raise Questions about the Adequacy and Completeness of the Mobility Capabilities Study and Report



## Report Documentation Page

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Highlights of [GAO-06-938](#), a report to congressional committees

## Why GAO Did This Study

The Department of Defense (DOD) issued the Mobility Capabilities Study (MCS), which was intended to identify and quantify the mobility capabilities needed to support U.S. strategic objectives into the next decade. The MCS found that projected capabilities are adequate to achieve U.S. objectives with an acceptable level of risk—that is, current U.S. inventory of aircraft, ships, prepositioned assets, and other capabilities are sufficient, in conjunction with host nation support, and assuming planned investments take place.

The Senate report accompanying the bill for the fiscal year 2005 Defense Authorization Act required GAO to report on the adequacy and completeness of the MCS. GAO assessed the extent to which the MCS met generally accepted research standards that this type of study would be expected to meet to be considered sound and complete.

## What GAO Recommends

GAO recommends that the Secretary of Defense, in future mobility capabilities studies beginning with any study currently under way, develop models and data for critical missions and processes; include in study reports an explanation of how stated limitations might impact results; and, incorporate both mobility and warfighting metrics to determine capabilities. In comments, DOD concurred with two of the recommendations and claimed they did not understand the third, which GAO clarified.

[www.gao.gov/cgi-bin/getrpt?GAO-06-938](http://www.gao.gov/cgi-bin/getrpt?GAO-06-938).

To view the full product, including the scope and methodology, click on the link above. For more information, contact William M. Solis at (202) 512-8365 or [solisw@gao.gov](mailto:solisw@gao.gov).

## DEFENSE TRANSPORTATION

# Study Limitations Raise Questions about the Adequacy and Completeness of the Mobility Capabilities Study and Report

## What GAO Found

DOD used an innovative approach in conducting the study and acknowledged methodological limitations in its report; however, it did not fully disclose how these limitations could affect the MCS conclusions and recommendations. Therefore, it is not transparent how the analyses done for the study support DOD's conclusions. Measured against relevant generally accepted research standards, GAO has identified limitations in the MCS and its report that raise questions about their adequacy and completeness. GAO suggests that Congress and other decision makers exercise caution in using the MCS to make investment decisions. Among GAO's findings:

- Aspects of modeling and data were inadequate in some areas because data were lacking and the models used could not simulate all relevant aspects of the missions. The report did not explain how these limitations could affect the study results or what the impact on projected mobility capabilities might be. Generally accepted research standards require that models used are adequate for the intended purpose, represent a complete range of conditions, and that data used are properly generated and complete. For example, the MCS modeled hypothetical homeland defense missions rather than homeland defense demands derived from a well defined and approved concept of operations for homeland defense, because the specific details of the missions were still being determined and the data used may be incomplete. The MCS also was unable to model the flexible deterrent options/deployment order process to move units and equipment into theater because of lack of data, but the study assumed a robust use of this process. In addition, the MCS report contains over 80 references to the need for improved modeling or data.
- While the MCS concluded that combined U.S. and host nation transportation assets were adequate, in describing the use of warfighting metrics in its analyses, the report does not provide a clear understanding of the direct relationship of warfighting objectives to transportation capabilities. Additionally, the report stated that further analysis is required to understand the operational impact of increased or decreased strategic lift on achieving warfighting objectives. Relevant generally accepted research standards require that conclusions be supported by analyses. The use of both warfighting and mobility metrics would allow decision makers to know whether combat tasks were achieved and how much strategic transportation is needed to accomplish those tasks.
- In some cases, the MCS results were incomplete, unclear, or contingent on further study, making it difficult to identify findings and evaluate evidence. Relevant research standards require results to be presented in a complete, accurate, and relevant manner. For example, the report contains recommendations for further studies and assessments, five of which are under way. However, DOD has no plans to report the impact of these studies on the MCS results after the studies are complete. In addition, the report contains qualified information that is not presented clearly, such as varying assessments of intra-theater assets in three different places.

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United States Government Accountability Office  
Washington, DC 20548

September 20, 2006

Congressional Committees

The National Security Strategy of the United States requires global mobility through rapid, effective, and efficient projections of power at home and abroad to deploy and sustain America's armed forces. To improve its mobility capabilities, the Department of Defense (DOD) plans to spend more than \$50 billion from fiscal years 2006 through 2011 for aircraft, ships, ground transportation, prepositioned assets, and other mobility assets. DOD has conducted several studies to determine mobility requirements and recently completed a study of its mobility capabilities and issued a report in December 2005. The intent of the Mobility Capabilities Study (MCS) was to identify and quantify the mobility capabilities needed to support U.S. strategic objectives into the next decade. The MCS determined that the projected mobility capabilities are adequate to achieve U.S. objectives with an acceptable level of risk during the period from fiscal years 2007 through 2013; that is, the current U.S. inventory of aircraft, ships, prepositioned assets, and other capabilities are sufficient, in conjunction with host nation support. The MCS emphasized that continued investment in the mobility system, in line with current departmental priorities and planned spending, is required to maintain these capabilities in the future. This includes, for example, fully funding Army prepositioned assets as planned and completing a planned reengineering of the C-5 aircraft. The MCS report also made recommendations to conduct further studies, develop plans and strategies, and improve data collection and mobility models. In fact, DOD officials told us that a Mobility Capabilities Study-2006 is underway.

In the Senate report accompanying the bill for the fiscal year 2005 Defense Authorization Act, you asked us to monitor the process used to conduct the MCS and report on the adequacy and completeness of the study.<sup>1</sup> Specifically, our objective was to determine whether the MCS was adequate and complete. On March 1, 2006, we briefed your staff on our preliminary observations. This report expands on that briefing and makes recommendations to the Secretary of Defense.

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<sup>1</sup> S. Rep. 108-260, at 126 (2004).

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To conduct our review of the MCS, we analyzed the final MCS report, the MCS Terms of Reference and MCS Study Plan, as well as other DOD policies and guidance concerning how DOD would conduct the MCS and the databases and models used in the study. We identified generally accepted research standards that define a sound and complete quality study that were relevant to the MCS, and assessed the extent to which the MCS report met these standards. We interviewed study officials, study participants, and subject matter experts from several DOD entities, including the combatant commands and the military services. As we monitored the development of the MCS, we requested that DOD provide documentation supporting and verifying key analytical and decision-making processes.<sup>2</sup> DOD officials could not produce this documentation during the development of the MCS or following issuance of the report. Consequently, we were unable to fully determine whether the analytical and decision-making processes that we believe are significant to the credibility of the study supported the MCS effort and its conclusions. Our scope and methodology are discussed in more detail in appendix I. We conducted our work from July 2004 through July 2006 in accordance with generally accepted government auditing standards.

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## Results in Brief

DOD used an innovative approach in conducting the study and acknowledged some methodological limitations in its report, as any sound study should. However, it did not fully disclose how these limitations could affect the MCS conclusions and recommendations. Therefore, it is not transparent how the analyses done for the study support DOD's conclusions. As measured against relevant generally accepted research standards, we identified limitations in the MCS study and report that raise questions about their adequacy and completeness. Among our findings:

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<sup>2</sup> Examples of the documentation we requested to support and verify key analytical and decision-making processes used by DOD to conduct the MCS included (1) the accreditation report and supporting documentation or evidence of the verification, validation, and accreditation process for the models and data used in the MCS; (2) copies of MCS working group meeting minutes that verify and validate the analytical processes the various MCS study teams and study participants used to vet and agree upon data, scenarios, assumptions, models, and associated risk; and (3) copies of MCS General Officer Steering Committee and Executive Committee meeting minutes that verify and validate the analytical and decision-making processes the DOD senior leadership used to vet and agree upon the key data, scenarios, assumptions, models, and associated risk used to conduct the MCS, as well as agreement with the study results.

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- Aspects of modeling and data were inadequate in some areas because data were lacking and some of the models used could not simulate all relevant aspects of the missions. The report did not explain how these limitations could affect the study results or what the effect on the projected mobility capabilities might be. Relevant research standards require that models used are adequate for the intended purpose, represent a complete range of conditions, and that data used are properly generated and complete. For example, the MCS modeled hypothetical homeland defense missions rather than homeland defense demands derived from a well defined and approved concept of operations for homeland defense, because the specific details of the missions were still being determined, and DOD acknowledged that the data used may be incomplete. The MCS also was unable to model the flexible deterrent options/deployment order process to move units and equipment into theater due to lack of data, but the study assumed a robust use of this process, which in one scenario accounted for approximately 60 percent of the airlift prior to beginning combat operations.<sup>3</sup> In addition, the MCS report contains more than 80 references to the need for improved modeling, and 12 of these references call for additional data or other refinements. Additionally, the MCS modeled the year 2012 to determine the transportation capabilities needed for the years 2007 through 2013. The year 2012 did not place as much demand for mobility assets in support of smaller military operations, such as peacekeeping, as other years. However, DOD officials considered 2012—the year modeled—as “most likely” to occur and stated that statistically it was not different from other years in the 2007 to 2013 period even though the number of smaller military operations is the least of any of the years reviewed.
  - While the MCS concluded that combined U.S. and host nation transportation assets were adequate to meet U.S. objectives with acceptable risk, the report, in describing the use of warfighting metrics in its analyses, does not provide a clear understanding of the direct relationship of warfighting objectives to transportation capabilities. Acknowledging this point, the report stated that further analysis is required to understand the operational impact of increased or decreased strategic lift on achieving warfighting objectives. Relevant generally accepted research standards require that conclusions be supported by analyses. The use of warfighting metrics is a measure to determine whether combat tasks, such as achieving air superiority, are achieved.

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<sup>3</sup> Deployment orders are issued to deploy specific capabilities as commitment decisions are made, rather than a deploying unit’s full set of equipment or capabilities. Flexible Deterrent Options (FDOs) provide escalation options during the initial stages of a conflict. FDOs are employed under certain conditions to deter adversarial actions contrary to U.S. interests.

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However, they do not measure whether appropriate personnel, supplies, and equipment arrived in accordance with timelines. As a result, we could not determine how the study concluded that planned transportation assets were adequate because the study did not contain a transparent analysis to support its conclusion or a clear roadmap in the report to help decision makers understand what that conclusion meant in terms of type and number of mobility assets needed. Previous DOD mobility studies primarily used mobility metrics, which measured success in terms of tons of equipment and personnel moved per day to accomplish military objectives. The use of both warfighting and mobility metrics to measure success would allow decision makers to know whether combat tasks were achieved and how much strategic transportation is needed to accomplish those tasks.

- In some cases, the MCS results were incomplete, unclear, or contingent on further study, making it difficult to identify findings and evaluate evidence. Relevant research standards require results to be presented in a complete, accurate, and relevant manner. For example, the report contains several recommendations for further studies and assessments, five of which are under way. However, DOD has no plans to report the effect of these studies on the MCS results after the studies are complete. In addition, the report contains qualified information that is not presented clearly, such as varying assessments of intratheater assets in three different places in the report. The lack of clarity and conciseness of the reported results can limit the study's usefulness to decision makers and stakeholders.
- Verification, validation, and accreditation (VV&A) of models and data used to conduct the study was not complete because it was not done in accordance with DOD policy or relevant research standards. Moreover, relevant research standards state that a study report should include a VV&A accreditation report that is signed by the study director and addresses the models and data certification. DOD officials acknowledged that they did not comply with DOD VV&A policy when using legacy models in the MCS because they contended that long-term use of models and data constitutes an equivalent VV&A process. Other than a description of the process contained in the MCS report, DOD officials could provide no additional documentation to verify and validate this equivalent process to provide the assurance that models and data used in the MCS reduced the risk inherent in modeling and simulation and added to the credibility of the results. Moreover, officials could not provide documentation to support key analytical and decision-making processes used by senior DOD leadership, thus undermining the credibility of the reported study results.

These limitations to the study's methodology raise questions concerning the accuracy of the study's finding that projected capabilities are adequate to achieve U.S. objectives with an acceptable level of risk. Until DOD

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conducts an adequate and complete future MCS and clearly discloses all limitations and their effects on the study results, decision makers may be unable to clearly understand the operational implications of the study results and make fully informed programmatic investment decisions concerning mobility capabilities. We are recommending that the Secretary of Defense, when conducting future mobility capabilities studies, beginning with any study currently under way, develop and use models and data for critical missions and processes that are verified, validated, and accredited as required; include in study reports an explanation of how stated limitations might impact the study results and, at a minimum, describe how recommended future studies might be conducted to enhance the results of the original study; and incorporate both mobility and warfighting metrics in determining capabilities.

In commenting on a draft of this report, DOD concurred with the first and third recommendations and claimed that they did not understand the second. We have clarified that recommendation to the Secretary of Defense to include in study reports an explanation of how stated limitations might impact the study results and, at a minimum, describe how recommended future studies might be conducted to enhance the results of the original study. In its comments, DOD also stated that the report contained misleading information and factual errors. We disagree with DOD's assertion. We did modify our report to respond to a DOD technical comment related to homeland defense missions. DOD's comments and our evaluation of them are discussed in the agency comments section of this report.

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## Background

The MCS was the first assessment of DOD's mobility system since 2000. The study was designed to identify changes in DOD's transportation force structure due to changes in threats and national security and military strategies. The MCS is the fourth in a series of major mobility studies that DOD has conducted since the end of the Cold War. The first study, the Mobility Requirements Study, conducted in 1992, was undertaken because of concern about the DOD's strategic mobility capabilities in the wake of Operation Desert Shield and Operation Desert Storm. That study established mobility requirements for the post-Cold War era; defined baseline requirements for intertheater, or strategic, mobility; and proposed a long-range investment plan to meet these requirements. The Mobility Requirements Study Bottom-Up Review Update, conducted in 1994, reaffirmed the need for increases in key mobility components and validated the prior study's recommendation for the procurement of additional ships for afloat prepositioning and for surge deployments of

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forces based in the continental United States. The Mobility Requirements Study—2005, issued in 2001, projected future mobility requirements based on two nearly simultaneous major regional contingencies. It included a broader range of factors, including host nation support and enemy use of weapons of mass destruction, than the previous studies.

The current MCS, which began in May 2004, reassessed DOD's mobility capabilities against the backdrop of a revised National Military Strategy that included the ongoing war against violent extremism, an evolving global defense posture, a new force-sizing construct, revised campaign scenarios, and ongoing departmentwide transformation efforts. The study results were intended to support decisions on future strategic airlift, aerial refueling aircraft, and sealift procurements needed to meet varying military requirements. The study used an innovative "capabilities-based" approach, measuring existing and currently projected mobility capabilities against warfighting demands that could be expected in fiscal year 2012 while also considering mobility demands during the 7-year period from fiscal year 2007 through fiscal year 2013. According to DOD officials, the Secretary of Defense believed this approach would give him greater flexibility in deciding which capabilities to fund in a constrained budget environment. In considering each aspect of the National Military Strategy,<sup>4</sup> the MCS modeled warfighting scenarios in the year 2012 using different premises with varying assumptions to develop and evaluate mobility capability mix alternatives. The models were used to evaluate transportation alternatives, including variations in alternative transportation modes (air, land, sea) and sources (military, civilian, foreign), as well as factors that affect transportation mode and source decisions. The scope of the MCS described the study as an assessment of the full range of transportation needs required to support (1) combat operations; (2) smaller military efforts, such as peacekeeping or overseas evacuation of American citizens; (3) homeland defense/civil support, such as disaster relief and antiterrorism response; and (4) other strategic missions, such as strategic nuclear and global strike missions. The study was coauthored by the Office of the Secretary of Defense, Office of the Director, Program Analysis and Evaluation (PA&E), and the Chairman,

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<sup>4</sup> The 2004 National Military Strategy of the United States calls for a force sized to defend the homeland, proactively dissuade adversaries in and from four global regions, and conduct two overlapping "swift defeat" campaigns. Even when committed to a limited number of lesser contingencies, the force must be able to "win decisively" in one of the two campaigns. This "1-4-2-1" force-sizing construct places a premium on increasingly innovative and efficient methods to achieve objectives.

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Joint Chiefs of Staff, Office of the Director of Logistics. Other DOD components involved in the study included the U.S. Transportation Command and its subordinate commands, the Office of the Under Secretary of Defense (Acquisition, Technology and Logistics), the combatant commanders, the military services, and others. The final report was signed on December 19, 2005, by the Deputy Secretary of Defense.

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## Limitations in the MCS Study and Report Raise Questions about Adequacy and Completeness

As measured against relevant generally accepted research standards, limitations in the MCS study and report raise questions about their adequacy and completeness. For example, aspects of modeling and data were inadequate in some areas because data were lacking and some of the models used could not simulate all relevant aspects of the missions. Furthermore, the exclusive use of warfighting metrics in the MCS analyses limited the usefulness of the report. Moreover, in some cases the MCS results were incomplete, unclear, or contingent on further study, making it difficult to identify findings and evaluate evidence. Finally, verification, validation, and accreditation of models and data used to conduct the study were incomplete because they were not done in accordance with DOD policy or relevant research standards, and supporting documentation for key processes could not be provided.

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## Aspects of Modeling and Data Were Inadequate

Aspects of modeling and data were inadequate in some areas because data were lacking and some of the models used could not simulate all relevant aspects of the missions. Relevant research standards require that models used are adequate for the intended purpose, represent a complete range of conditions, and that data used are properly generated and complete. As DOD acknowledged in the MCS report as a study limitation, some modeling tools were not available to analyze key missions. The MCS cited deficiencies in several existing mobility models and the need for follow-on MCS analyses. The MCS report also acknowledged that the identified deficiencies in data hindered analysis of future requirements and transportation system performance. However, the report did not explain how these limitations could affect the study results or what the effect on the projected mobility capabilities might be.

For example, the MCS modeled hypothetical homeland defense missions rather than homeland defense demands derived from a well defined and approved concept of operations for homeland defense, because the specific details of the missions were still being determined, and DOD acknowledged that the data used are incomplete. The MCS report recommended further analysis of mobility capabilities after homeland

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defense needs are refined. However, the report did not identify the potential effect that using these hypothetical scenarios might have on the MCS results. The MCS also was unable to model the flexible deterrent options/deployment order process to move units and equipment into theater because of lack of data on how deployment orders have been issued in the past for major combat operations. However, the MCS assumed a robust use of the flexible deterrent option/deployment order process, which in one scenario accounted for approximately 60 percent of the early airlift movement prior to the beginning of combat operations. Instead, the MCS modeled the flow of forces and equipment contained in the time-phased force deployment data process.<sup>5</sup> Based on the scenarios provided for the MCS analyses, we could not determine how the deployment order process would affect the mobility assets required for major combat operations. The MCS report noted that additional analysis is required to determine the implications of the deployment order process and to provide sufficient information for decision makers concerning the amount of future mobility assets actually needed.

In addition to these modeling and data issues, the MCS report contains more than 80 references to the need for improved modeling, and 12 of these references call for additional data or other refinements, such as follow-on analyses, further assessments, future evaluations, additional study, and investigation of alternatives in a wide range of areas, such as antiterrorism response, infrastructure availability, intratheater airlift, strategic sealift, air refueling, and availability of civil reserve aircraft. Some of these studies are currently underway, as discussed later in this report.

Moreover, our analysis of the MCS report showed that the year modeled (2012) to determine the DOD transportation capabilities needed for the years 2007 through 2013 did not place as much demand for mobility assets in support of smaller military operations, such as peacekeeping, as other years. To establish transportation demands for mission requirements, DOD developed and used a baseline security posture<sup>6</sup> that covered a 7-year

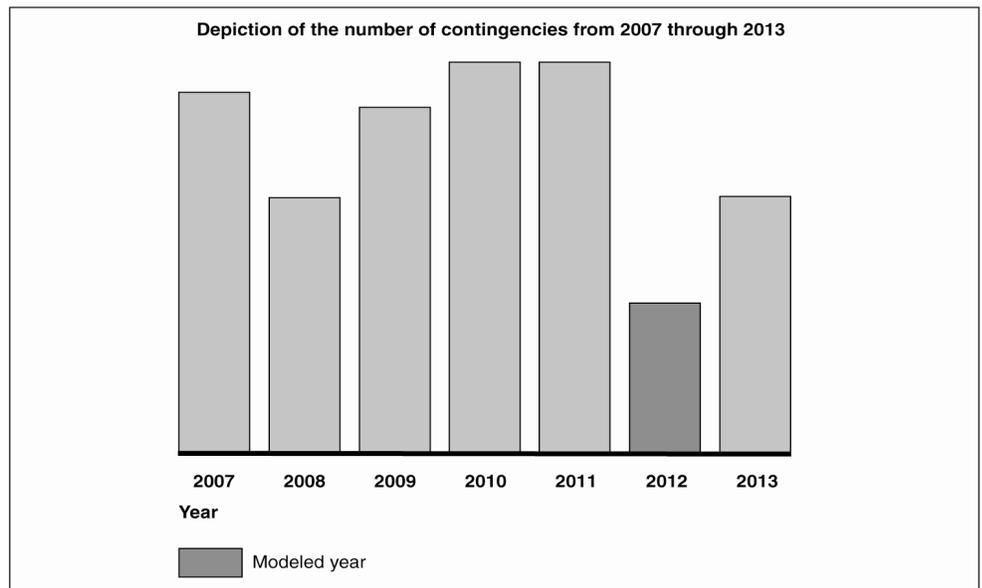
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<sup>5</sup> In joint military planning, time-phased force deployment data are defined as a computer database that contains detailed personnel and cargo planning data; it usually includes priority and sequencing of deploying forces.

<sup>6</sup> The baseline security posture projects the position from which combatant commanders will perform future missions, including how they will address the global war on terrorism, ongoing operations, and other day-to-day activities to which U.S. forces remain committed and from which they are not likely to disengage entirely.

period. This baseline was developed, in part, using a historical analysis of DOD’s movement of personnel, equipment, supplies, and other items. According to DOD officials, Office of the Under Secretary of Defense for Policy, which developed the baseline security posture, selected the year modeled in the MCS because it was deemed the “most likely” to occur in terms of transportation demands and because it was not statistically different from other years in the 7-year period. However, our analysis showed that 2012 involved the least demand for transportation assets in support of smaller military efforts than any year in the 7-year period and did not fully stress the defense transportation system. Figure 1 depicts the number of hypothetical ongoing contingencies for each year in the baseline as shown in the MCS.

**Figure 1: MCS Hypothetical Ongoing Contingencies during 7-year Baseline Security Posture Time Frame**



Source: GAO’s analysis of MCS notional lesser contingency schedule.

Note: A particular contingency may be ongoing in more than 1 year. Each contingency has unique cargo and passenger requirements. For example, a contingency that may be ongoing over a 2- or 3-year time frame may require more or less mobility capability than a 6-month contingency.

Although not transparent in the study, DOD officials said scenarios in the year modeled were not intended to fully stress the defense transportation system. DOD officials provided no further explanation for the year selected to develop the DOD transportation capabilities other than it was

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directed by Office of the Under Secretary of Defense for Policy and agreed to by the study leadership. We believe that selection of a different year that placed an increased demand on transportation assets for smaller military efforts may have revealed gaps in mobility requirements. Therefore, we found that the selection of 2012 as the modeling year was a limitation in the MCS with respect to smaller military efforts.

Because of these modeling and data limitations, the MCS may have incorrectly estimated the future mobility requirements needed to support homeland defense missions, major combat operations, and smaller contingencies. Until DOD improves aspects of the modeling and data used to conduct the MCS—to include defining its homeland defense mission needs, developing models for the deployment order process, and explaining how identified modeling and data limitations could affect the study results—decision makers may not have adequate and complete information about DOD’s mobility capabilities.

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### Exclusive Use of Warfighting Metrics in MCS Analyses Limited Usefulness of Report

While the MCS concluded that combined U.S. and host nation transportation assets were adequate to meet U.S. objectives with acceptable risk, the report, in describing the use of warfighting metrics in its analyses, does not provide a clear understanding of the direct relationship of warfighting objectives to transportation capabilities. The report acknowledged that further analysis is required to understand the operational impact of increased or decreased strategic lift on achieving warfighting objectives. Relevant generally accepted research standards require that conclusions be supported by analyses. The use of warfighting metrics is a measure to determine whether combat tasks, such as establishing air superiority, are achieved. However, they do not measure success in terms of whether appropriate personnel, supplies, and equipment arrived in accordance with timelines. As a result, we could not determine how the study concluded that planned transportation assets were adequate because the study did not contain a transparent analysis to support its conclusion. In our opinion, it is important for decision makers to have an understanding of both combat tasks that must be achieved and the amount of transportation assets needed to achieve those tasks with some level of success. This understanding would allow creation of a clear roadmap for investment decisions. However, we could not determine how the study calculated the specific numbers of transportation assets needed or whether there are specific gaps, overlaps, or excesses in transportation assets, a key objective of the study. Previous DOD mobility studies, including the Mobility Requirements Study—2005, primarily used mobility metrics, which measured success in terms of tons of equipment and

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personnel moved per day to accomplish military objectives. Million-ton-miles per day is a commonly accepted measure of airlift performance and reflects how much cargo can be delivered over a given distance in a given period of time based on the capability of each type of aircraft. A similar mobility metric—short tons—is used to measure ship capability. However, these studies did not fully integrate combat tasks as a metric. The use of both warfighting and mobility metrics to measure success would allow decision makers to know whether there is sufficient capability to achieve warfighting objectives, as well as to understand the number, type, and mix of mobility assets that are actually needed.

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### Results Are Not Always Complete or Presented Clearly and Are Qualified or Contingent on Further Study or Analysis

In some cases, the MCS results were incomplete, unclear, or contingent on further study, making it difficult to identify findings and evaluate evidence. Relevant research standards require results to be presented in a complete, accurate, and relevant manner; conclusions to be sound and complete; and recommendations to be supported by analyses. Our analysis of the MCS report found that it contains several recommendations for further studies and assessments, five of which are under way. The five studies address intratheater lift capabilities; sealift petroleum, oil, and lubricants; logistics contingency operations capabilities; aerial refueling; and integrated global presence and basing. However, the report does not explain the potential effect of these ongoing studies on the MCS results after the studies are complete, nor does DOD have plans to report the effect of these studies on the MCS results.

In addition, the report contains qualified information that is not presented clearly in the report, such as varying assessments of intratheater assets in three different places. For example, the report states in the assessment section of the executive summary that projected transportation assets are sufficient to address intratheater demands in the fiscal years 2007 through 2013 time frame. However, in the recommendations section of the executive summary, the report states that DOD should take action to determine the proper mix of intratheater assets needed to meet requirements. Then, in the part of the report that discusses intratheater airlift, the report states that a detailed analysis of intratheater airlift needs would require improved modeling tools to accurately capture interactions among land, sealift, and airlift capabilities and that data sets must be developed that accurately describe the requirement in light of emerging concepts.

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## VV&A of Models and Data Was Not Complete

VV&A of models and data used to conduct the study was not complete because it was not done in accordance with DOD policy or relevant research standards. DOD policy issued by the Under Secretary of Defense for Acquisition, Technology and Logistics requires that DOD models and data go through a VV&A process. Moreover, relevant research standards state that a study report should include a VV&A accreditation report that is signed by the study director and addresses the models and data certification. DOD officials acknowledged that they did not comply with the VV&A policy when using legacy models in the MCS because they believed such an approach was not warranted for legacy models that have been used for many years and have proved reliable. Moreover, these officials believe that such long-term use constitutes a VV&A process equivalent to that required in the policy. However, the DOD policy does not specify that the actual use of a model constitutes an equivalent VV&A process. VV&A of models and data reduces the risk inherent in the use of models and simulations by improving the credibility of modeling and simulation results. We previously reported our concerns that DOD did not follow its policy in executing the MCS and had little documentation to support the VV&A process used.<sup>7</sup> We found that the final MCS report contained a description of the equivalent VV&A process, but DOD officials could provide no further documentation to verify and validate this equivalent process other than the description included in the report. We also found no documentation in the study report to support DOD claims that the models have proven reliable.

Furthermore, DOD officials were unable to provide documentation to support and verify key analytical and decision-making processes used by senior DOD leadership throughout the study. Relevant research standards support documenting the study's analytical and decision-making processes to ensure the accuracy, completeness, and credibility of study results. DOD officials told us that the study's key analytical and decision-making processes were validated and approved by study participants during working group meetings and by senior leadership during General Officer Steering Committee meetings and Executive Committee meetings. PA&E officials could not produce documentation of these meetings because they said documentation did not exist. Nor could they produce other documents we requested during the development of the MCS or following

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<sup>7</sup> See GAO, *Defense Transportation: Opportunities Exist to Enhance the Credibility of the Current and Future Mobility Capabilities Studies*, [GAO-05-659R](#) (Washington, D.C.: Sept. 14, 2005), for a more detailed discussion.

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issuance of the report. Consequently, we were unable to determine the adequacy and completeness of the analytical and decision-making processes that supported the MCS effort and that we believe are significant to the credibility of the study and its conclusions.

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## Conclusions

The methodological limitations in the MCS that we identified—some of which were acknowledged by DOD in the MCS report—raise questions about the adequacy and completeness of the study and its report. Until DOD improves aspects of the modeling and data used to conduct the MCS—such as defining its homeland defense mission needs and developing models for the deployment order process—decision makers may not have adequate and complete information about DOD’s mobility capabilities to enable them to make fully informed investment decisions. Furthermore, in the absence of an explanation of how identified modeling and data limitations could affect the study results or how such limitations could affect projected mobility capability requirements, the accuracy of the study’s finding that projected capabilities are adequate to achieve U.S. objectives with an acceptable level of risk during the period from fiscal years 2007 through 2013 is unclear. Moreover, without a transparent comparison between existing mobility assets and projected needed assets, decision makers will be unable to use study results to identify and quantify the specific types and mix of mobility assets needed to address mobility gaps, overlaps, and excesses. Until DOD conducts an adequate and complete future MCS and clearly discloses all limitations and their effects on the study results, decision makers likely will not have full information concerning DOD’s mobility capabilities. As a result, we suggest that Congress and other decision makers exercise caution in using the MCS to make programmatic investment decisions.

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## Recommendation for Executive Action

To provide decision makers with adequate and complete information concerning mobility capabilities so they are able to clearly understand the operational implications of the study and make fully informed programmatic investment decisions, and to improve the usefulness of future mobility capabilities studies, we recommend that the Secretary of Defense take the following three actions, when conducting future mobility capabilities studies beginning with any study currently underway:

- develop models and data for all critical missions, such as homeland defense, and processes, such as the flexible deterrent options/deployment order process;
- include in study reports an explanation of how stated limitations might impact the study results and, at a minimum, describe how recommended

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future studies might be conducted to enhance the results of the original study; and

- incorporate both mobility and warfighting metrics in determining capabilities.

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## Agency Comments and Our Evaluation

In commenting on a draft of this report, DOD concurred with our first and third recommendations. DOD stated it did not understand our second recommendation that the Secretary of Defense, when conducting future mobility studies, beginning with any study currently underway, include in study reports an explanation of how ongoing and follow-on studies and modeling and data limitations that are referenced in the report could affect the reported results. DOD also noted that it plans to continue its ongoing efforts to enhance the models and data collection processes used to assess mobility capabilities across the full range of strategic missions and supports the notion that continual improvements are needed. As we noted throughout our report, the MCS report contains numerous and repeated references to the need for improved modeling and additional data or other refinements, such as follow-on analyses, further assessments, future evaluations, additional study, and investigation of alternatives in a wide range of areas. DOD further commented that while a completed study can recommend that follow-on studies be conducted, it cannot explain how future studies might affect the results of the current study. We acknowledge that DOD cannot quantitatively predict the outcome of an ongoing or future study. However, we believe DOD should be able to explain what ongoing follow-on studies or evaluations seek to determine, what changes are being made to the data inputs and modeling tools that are being used to conduct the studies, and how DOD expects the results may differ from current study results. While the explanation may be hypothetical, as are many operations research study hypotheses, it can provide decision makers with a better understanding of the current study's limitations and results and how an ongoing or future study's results may differ. Therefore, we refined our recommendation to recommend that the Secretary of Defense, when conducting future mobility studies, beginning with any study currently under way, include in study reports an explanation of how stated limitations might impact the study results and, at a minimum, describe how recommended future studies might be conducted to enhance the results of the original study. For example, if modeling and data are limitations to a study, the report should discuss the ways in which the results might change with better models and data.

DOD also commented that our report contained misleading information and factual errors and that it stands by the adequacy and completeness of

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the MCS. The department provided examples in its technical comments where it believed our report contained misleading information and factual errors. We disagree with the department's comments regarding the facts in our report and have addressed each of the department's comments in appendix II.

Lastly, DOD stated that the MCS and its conclusions are well accepted by the civilian and military leadership of the department, and pointed out that in March 2006 testimony before the House Armed Services Committee, the Commander, U.S. Transportation Command, stated that the planned strategic airlift fleet determined by the MCS is "about the right capacity". However we note that in the same hearing, the Commander also stated that he thought DOD needed "somewhere in the neighborhood of" 20 C-17 cargo aircraft beyond what is planned. We also note that in the Commander's April 2006 testimony before the Senate Armed Services Committee, Subcommittee on Sealift, he stated that, in an internal Focused Mobility Analysis to study strategic mobility from a Transportation Command perspective, the MCS will be the baseline, "but we will explore how changes in key assumptions may impact the analytical outcome."

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We are sending copies of this report to the Secretary of Defense; the Director of PA&E; and the Office of the Chairman, Joint Chiefs of Staff. We will also make copies available to others upon request. In addition, the report is available at no charge on the GAO Web site at <http://www.gao.gov>. If you or your staff have any questions regarding the briefing or this report, please contact me at (202) 512-8365 or [solisw@gao.gov](mailto:solisw@gao.gov). Contact points for our Offices of Congressional Relations

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and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix III.

A handwritten signature in black ink, appearing to read 'W. Solis', with a long horizontal flourish extending to the right.

William M. Solis  
Director, Defense Capabilities and Management

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*List of Congressional Committees*

The Honorable John Warner  
Chairman  
The Honorable Carl Levin  
Ranking Minority Member  
Committee on Armed Services  
United States Senate

The Honorable Ted Stevens  
Chairman  
The Honorable Daniel K. Inouye  
Ranking Minority Member  
Subcommittee on Defense  
Committee on Appropriations  
United States Senate

The Honorable Duncan L. Hunter  
Chairman  
The Honorable Ike Skelton  
Ranking Minority Member  
Committee on Armed Services  
House of Representatives

The Honorable C.W. Bill Young  
Chairman  
The Honorable John P. Murtha  
Ranking Minority Member  
Subcommittee on Defense  
Committee on Appropriations  
House of Representatives

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# Appendix I: Scope and Methodology

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To conduct our review of the Mobility Capabilities Study (MCS), we reviewed and analyzed the final MCS report; the MCS Terms of Reference; the MCS Study Plan; applicable Department of Defense (DOD) strategic planning guidance; as well as other DOD guidance, directives, instructions, and memos that describe how DOD would conduct its MCS. We also reviewed the National Security Strategy of the United States of America and the National Military Strategy of the United States of America; DOD guidance concerning data collection, development, and management in support of strategic analysis; DOD modeling and simulation instruction; Defense Modeling and Simulation Office guidance; descriptions of models used to conduct the study; and the databases used in the models. We interviewed study officials from the Office of the Secretary of Defense, Program Analysis and Evaluation (PA&E), and the office of the Chairman, Joint Chiefs of Staff, Logistics, as well as study participants and subject matter experts from the U.S. Transportation Command, Air Mobility Command, Surface Deployment and Distribution Command, the combatant commands, and the military services concerning the extent of their input to the study. We also interviewed officials from the Office of the Secretary of Defense, Acquisition, Technology and Logistics, and the Modeling and Simulation Technical Director at the Defense Modeling and Simulation Office.

Additionally, we reviewed research literature and DOD guidance and identified frequently occurring, generally accepted research standards that are relevant for defense studies such as the MCS that define a quality or sound and complete study. The following were our sources for these standards:

- GAO, *Government Auditing Standards*: 2003 Revision, [GAO-03-673G](#) (Washington, D.C.: June 2003);
- GAO, *Designing Evaluations*, [GAO/PEMD-10.1.4](#) (Washington, D.C.: March 1991);
- GAO, *Dimensions of Quality*, GAO/QTM-94-1 (Washington, D.C.: February 2004);
- RAND Corporation, *RAND Standards for High-Quality Research and Analysis* (Santa Monica, Calif.: June 2004);
- Air Force Office of Aerospace Studies, *Analysts Handbook: On Understanding the Nature of Analysis* (January 2000);
- Air Force, Office of Aerospace Studies, *Air Force Analysis Handbook, A Guide for Performing Analysis Studies: For Analysis of Alternatives or Functional Solution Analysis* (July 2004);

- Department of Defense, *DOD Modeling and Simulation (M&S) Verification, Validation, Accreditation (VV&A)*, Instruction 5000.61 (Washington, D.C.: May 2003);
- Department of Defense, *Data Collection, Development, and Management in Support of Strategic Analysis*, Directive 8260.1 (Washington, D.C.: December 2, 2003); and
- Department of Defense, *Implementation of Data Collection, Development, and Management for Strategic Analyses*, Instruction 8260.2 (Washington, D.C.: January 21, 2003).

During the process of identifying generally accepted research standards we noted that not all studies are conducted the same way. For example, while all studies use data, not all use baseline data. Likewise, all studies require analyses, but not all use models or simulation to conduct analyses. We tailored the research standards we identified as relevant to the MCS, as shown in table 1.

**Table 1: Generally Accepted Research Standards Relevant to MCS Requirements**

<b>Design: The Study is well designed</b>	
<b>I.</b>	<b>Study plan, scope, and objectives follow Defense Planning Guidance</b>
I.a	(Do the study scope and objectives fully address the charter presented in the 2004 Defense Planning Guidance?)
I.a.1	Does the study plan address specified guidance?
I.b	Was the study plan followed?
I.c	Were deviations from the study plan explained and documented?
I.d	Was the study plan updated over the course of the study and the updates explicitly identified in the study and updated study plan?
<b>II</b>	<b>Assumptions and constraints are reasonable and consistent</b>
II.a	Are assumptions and constraints explicitly identified?
II.a.1	(Are the study assumptions necessary and reasonable?)
II.b	Do the study assumptions support a sound analysis?
II.c	Are the assumptions used in analyses common throughout the study and models?
II.d	Do the assumptions contribute to an objective and balanced research effort?
<b>III</b>	<b>Scenarios and threats are reasonable</b>
III.a.	Are scenarios traceable back to formal guidance?
III.b	Were the threat scenarios validated and Defense Intelligence Agency approved and documented?
III.c	Do scenarios represent a reasonably complete range of conditions?
III.d	(Were the threats varied to allow for the conduct of sensitivity analysis?)
<b>Execution: The study is well executed</b>	
<b>IV</b>	<b>Methodology is successfully executed</b>
IV.a	Was the study methodology executed consistent with the (MCS) study plan and schedule?

**Appendix I: Scope and Methodology**

IV.b	(Does the methodology support accomplishing the objectives presented in the study plan?)
IV.c	Were the models used to support the analyses adequate for their intended purpose?
IV.d	Were the model input data properly generated to support the methodology?
<b>V</b>	<b>(Analytical ) Baseline data and other data used to support study and analyses validated, verified, and approved</b>
V.a	Is the (analytical) baseline fully and completely identified and used consistently throughout the study for the various analyses?
V.b	Were data limitations identified (and the impact of the limitations fully explained?)
V.c	Were the (baseline security posture) data verified and validated?
V.d	Was the data verification and validation process documented?
<b>VI</b>	<b>Models, simulations, and verification, validation, and accreditation are reasonable</b>
VI.a	Was a VV&A accreditation report that addresses the models and data certification signed by the study director and included in the report?
VI.b	Were modeling and simulation limitations identified and explained?
VI.c	Has each model in the study been described?
VI.d	Are the model processes clearly explained, documented and understood?
<b>VII</b>	<b>Measures of effectiveness (MOEs) and essential elements of analysis (EEAs) are addressed</b>
VII.a	(Do MOEs adhere to the guidance in the study terms of reference?)
VII.b	(Are the MOEs fully addressed in the study?)
VII.c	(Are the EEAs addressed in the study?)
<b>Presentation of results: Timely, complete, accurate, concise, and relevant to the client and stakeholders</b>	
<b>VIII</b>	<b>Presentation of results support findings</b>
VIII.a	Does the report address the objectives?
VIII.b	Does the report present an assessment that is well documented and conclusions that are supported by the analyses?
VIII.c	Are conclusions sound and complete?
VIII.d	Are recommendations supported by analyses?
VIII.e	Is a realistic range of options provided?
VIII.f	Are the study results presented in the report in a clear manner?
VIII.g	Are study participants/stakeholders (i.e., services and Combatant Commands) informed of the study results and recommendations?

Source: GAO analysis of industry and DOD study and research standards.

We used these relevant standards as our criteria to assess the reported MCS results. All eight key areas of the study process were considered to have equal importance relative to the soundness and completeness of the study; that is, a sufficiently serious concern in any category could raise questions concerning the adequacy and completeness of the report. The analysts independently reviewed evidence relevant to each subquestion, including the study itself, the study Terms of Reference, and its strategic planning guidance. For each of the subquestions in the key study process areas, the analysts determined whether (1) the evidence had no limitations

or raised no concerns, (2) the evidence had some limitations or raised some concerns, (3) the evidence had significant limitations or raised significant concerns, or (4) we could not determine the extent of limitations or concerns because there was not sufficient information. The analysts then met, compared, and discussed their individual assessments, and reached an overall assessment for each subquestion. Areas of the study where we identified either “some” or “significant” limitations or concerns were considered to affect the adequacy or completeness of the study. Additionally, areas of the study that could not be assessed because of the lack of supporting documentation were considered to affect the credibility of the study.

Throughout our review PA&E officials told us that the documentation needed to support and verify the key analytical and decision-making processes used to conduct the MCS, documentation that was vetted and approved by DOD leadership and all of the study participants, would not be completed and available for our review until the study report was issued. However, after the report was issued, we were told that the report provides all of the supporting documentation needed and that the other documentation we requested could not be provided. As a result, we were unable to determine the adequacy and completeness of the analytical and decision-making processes that supported the MCS effort to evaluate the credibility of the study. We believe these processes are significant to the credibility of the study and its results.

We conducted our review from July 2004 through July 2006 in accordance with generally accepted government auditing standards.

# Appendix II: Comments from the Department of Defense



DEPUTY SECRETARY OF DEFENSE

1010 DEFENSE PENTAGON  
WASHINGTON, DC 20301-1010



AUG 30 2006

The Honorable David M. Walker  
Comptroller General of the United States  
U.S. Government Accountability Office  
441 G Street, N.W.  
Washington, DC 20548

Dear Mr. Walker:

This is the Department of Defense (DoD) response to the GAO draft report, GAO-06-938, "DEFENSE TRANSPORTATION: Study Limitations Raise Questions about the Adequacy and Completeness of the Mobility Capabilities Study (MCS) and Report," dated August 21, 2006 (GAO Code 350558). DoD's responses to the report's recommendations are enclosed.

The GAO draft report contains misleading information and factual errors. The Department stands by the adequacy and completeness of the MCS, which is one of the most comprehensive capability studies ever conducted by the Department of Defense. The data and models used by the study are sound, and the results of the study are valid. Furthermore, in its groundbreaking assessment of homeland defense mission needs, the MCS accurately reflects the Department's most current understanding of this developing national mission. Lastly, MCS insights – drawn from the study's broad array of mobility metrics and detailed operational simulations – significantly enhanced senior leaders' deliberations during the 2005 Quadrennial Defense Review.

The MCS was a collaborative effort led by the Office of the Secretary of Defense and the Joint Staff, and its conclusions are well accepted by the civilian and military leadership of the Department. In his March 2006 Congressional testimony, the Commander, U.S. Transportation Command acknowledged the study's finding by stating that the planned strategic airlift fleet of 292 aircraft "is about the right capacity." Likewise, during a press conference in November 2005, the Vice Chairman of the Joint Chiefs of Staff expressed his support for the study, citing the MCS finding that the Department has "a very capable and adequate airlift fleet."

Enclosure:  
As stated

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**GAO DRAFT REPORT – DATED August 21, 2006  
GAO CODE 350558/GAO-06-938**

**“DEFENSE TRANSPORTATION: Study Limitations Raise Questions about the  
Adequacy and Completeness of the Mobility Capabilities Study and Report”**

**DEPARTMENT OF DEFENSE COMMENTS  
TO THE RECOMMENDATIONS**

**RECOMMENDATION 1:** The GAO recommended that the Secretary of Defense, when conducting future mobility capabilities studies, beginning with any study currently underway, develop models and data for all critical missions, such as homeland defense, and processes, such as the flexible deterrent options/deployment order process.

**DOD RESPONSE:** DoD concurs. The Department plans to continue its ongoing efforts to enhance the models and data collection processes used to assess mobility capabilities across the full range of strategic missions. The models used in the MCS are sound and have consistently produced valid results in the four mobility studies conducted by DoD since the end of the Cold War. Furthermore, as recommended in the MCS report, DoD supports the notion that continual improvements are needed to provide enhanced analytic tools for the Department as it strives to address complex real-world processes.

**RECOMMENDATION 2:** The GAO recommended that the Secretary of Defense, when conducting future mobility studies, beginning with any study currently underway, include in study reports an explanation of how ongoing and follow-on studies and modeling and data limitations that are referenced in the report could affect the reported results.

**DOD RESPONSE:** DoD does not understand this recommendation. While a completed study can recommend that follow-on studies be conducted, it cannot explain how future studies might affect the results of the current study.

**RECOMMENDATION 3:** The GAO recommended that the Secretary of Defense, when conducting future mobility capabilities studies, beginning with any study currently underway, incorporate both mobility and warfighting metrics in determining capabilities.

**DOD RESPONSE:** DoD concurs. In fact, the MCS employed a rigorous process by which the Services, Combatant Commands, and the Joint Staff collaboratively developed warfighting metrics. These metrics were used along with a comprehensive set of mobility metrics for airlift, sealift, surface transport, and prepositioned equipment to determine the adequacy of the full spectrum of mobility capabilities.

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GAO DRAFT REPORT – DATED August 21, 2006  
GAO CODE 350558/GAO-06-938

**“DEFENSE TRANSPORTATION: Study Limitations Raise Questions about the  
Adequacy and Completeness of the Mobility Capabilities Study and Report”**

**DEPARTMENT OF DEFENSE TECHNICAL COMMENTS**

The following are three examples of factual errors and misleading information contained in the draft GAO report:

See comment 1.

**1. Page 3: “The [modeled] year of 2012 did not place as much demand for mobility assets in support of smaller military operations, such as peacekeeping, as other years.”**

Response: False. The seven-year demand (2007-2013) developed as part of the Baseline Security Posture, and used by the MCS, does not have significant variance from year to year. 2012 demand is not significantly less than 2009, and is larger than 2013.

It is important to note the fact that the MCS modeled a surge demand on the mobility system in 2012 that far exceeds anything this nation has experienced since World War II. In doing so, the study correctly applied the Department’s strategic planning framework (1-4-2-1) and its guidance with respect to the conduct of concurrent lesser contingencies during overlapping war fights. GAO has incorrectly focused on the number of operations, not the level of effort.

See comment 2.

**2. Page 4: “The use of war fighting metrics is a measure to determine whether combat tasks, such as achieving air superiority, are achieved. However, they do not measure whether appropriate personnel, supplies, and equipment arrived in accordance with timelines.”**

Response: False. The war fighting metrics developed by the MCS do measure whether appropriate personnel, supplies, and equipment arrived in accordance with timelines.

In fact, the MCS employed a rigorous process to develop war fighting metrics that were used along with a comprehensive set of mobility metrics for airlift, sealift, and surface transport. These metrics were used to determine if the modeled war fights accomplished the commander’s objectives within the right timelines. As we explained to GAO, being able to achieve a desired task within the desired timeline requires the appropriate personnel, supplies and equipment to be in place on time, indicating that the transportation capabilities are adequate.

See comment 3.

**3. Page 3: “The MCS also was unable to model the flexible deterrent options/deployment order process . . .”**

Response: False. The MCS DID analyze flexible deterrent option (FDO) movements to the theater. As part of the MCS analysis, the study modeled the flow of forces in response to rising tensions in various regions of the world. Forces were flowed to the region in anticipation of operations before war plans were executed. These flexible deterrent options were included in the MCS analysis. What the study did not do was model the deployment order process used in OIF. Rather, the study used the time-phased force deployment data (TPFDD) process as the accepted methodology for flowing follow-on forces.

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See comment 4.

**4. Page 3: “The MCS modeled hypothetical homeland defense missions rather than actual homeland defense demands because the specific details of the missions were still being determined, and DoD acknowledged that the data used may be incomplete.”**

Response: The statement is misleading. We are not sure what the report means by “actual homeland defense demands.” Actual demands are encountered in response to actual events. The MCS was intended to inform the DoD leadership concerning the impact of potential demand on the mobility system, and to assess the risks associated with different potential demand levels. The study used the latest approved homeland defense scenarios developed by NORTHCOM and PACOM, as well as the Department’s current planning guidance, to determine the range of mobility assets needed to support a range of missions. Given the many unknowns associated with homeland defense, the study assessed low, moderate, and high levels of DoD support for these missions.

See comment 5.

**5. Page 3: “Aspects of modeling and data were inadequate . . .”**

Response: This statement is misleading. These are the same models that the Department has relied on to complete three previous mobility studies since the end of the Cold War. Furthermore, the Department has dedicated significant resources to make sure that these models and the data collection processes are adequate. The fact that the study recommends future improvements was meant to focus future enhancements as the Department strives to address increasingly complex real world issues. The MCS models and data were adequate to assess relevant aspects of the missions required to support the National Military Strategy.

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## GAO's Responses to DOD's Technical Comments

1. DOD disagreed with our assessment that the modeled year—2012—did not place as much demand for mobility assets in support of smaller military operations, such as peacekeeping, as other years. DOD also stated that we incorrectly focused on the number of operations, not the level of effort. We disagree. The MCS report (Annex A to Appendix F) made no distinction between the number of lesser contingencies and the level of effort. Specifically, the Vignettes for Baseline Security Posture Analysis did not report the level of effort by year and instead aggregated the data, in many instances across several modeled years. Consequently, we compared the number of operations conducted in the model year. Throughout our review, PA&E officials consistently told us that the completed MCS report would contain all the documentation needed to support its analyses. Furthermore, although demand in the modeled year may exceed previous efforts, the MCS was chartered to assess the ability of the mobility system to support the National Military Strategy into the next decade. The size of the selected model year in relation to efforts conducted between 1941 and 2006 is not at issue. As our report makes clear, our concern is that modeling what appears to be the least demanding year does not address whether the United States has sufficient capability to support national objectives during a peak demand period and may underestimate and underreport demands to senior decision makers.
2. DOD disagreed with our observation that the MCS report does not provide a clear understanding of the direct relationship of warfighting objectives to transportation capabilities. We disagree. We understand that achieving a combat task requires delivering the right commodity to the right place at the right time. However, the specific combat tasks (e.g., attaining air superiority) necessary to satisfy the commander's campaign objectives are not a direct measure of mobility capability. For example, the problems in using a single metric are reflected in the MCS Appendix H, where the MCS report states that "the study itself still had difficulty in evaluating the operational impact of the delivery of theater support elements," adding that "we [DOD] were unable to develop a satisfactory mechanism to capture the linkage of the closely related, but delayed, follow-on support needed..." Finally, the MCS concludes that "there was no way to model a decrease in [Air Force] squadron effectiveness if this support was late. Additional effort is required to develop a methodology for evaluation the operational impact of support equipment availability." We continue to believe, and DOD agreed with our recommendation, that warfighting metrics, in conjunction with mobility metrics, can give decision makers a full picture of the capabilities needed to meet a specific warfighting goal.

3. DOD disagreed with our statement that the MCS was unable to model the flexible deterrent options/deployment order process and that the study in fact analyzed flexible deterrent option (FDO) movements to theater. We do not dispute that DOD analyzed FDO movements as part of the MCS analysis. However, the degree to which the MCS analyses successfully modeled FDOs is in question. The MCS report, Appendix H, stated that an individual FDO is essentially the same as a deployment order. It also states in that section that “Deployment orders [DEPORDS] are issued to deploy specific capabilities as commitment decisions are made. This was not modeled due to lack of data on how DEPORDS would have been issued for an MCO [major combat operation] deployment.” In the same paragraph, the MCS concludes that “the impact on the mobility system of the DEPORD process should be assessed in follow-on MCS analyses,” adding that “there is a data deficit on how to model and execute a DEPORD process.” Furthermore, the MCS report states that “additional analysis is required to investigate the implications of the DEPORD process decisions and provide data for future decision-makers to develop a DEPORD execution process.”
  
4. DOD believes our statement concerning homeland defense missions is misleading and is not sure what the report means by “actual homeland defense demands.” We removed the word “actual” and clarified our report to discuss “demands derived from a well defined and approved concept of operations for homeland defense”, which were not available for the study according to the MCS report. Furthermore, in chapter 4, the MCS report states that “maintaining a dedicated capability to support multiple, nearly simultaneous homeland defense/civil support events concurrent with the peak demand period of two overlapping warfights, greatly exceeds programmed lift capabilities”. This raises questions about the conclusions of the MCS that there are adequate mobility capabilities to meet national security objectives. Also, in Chapter 3 of the MCS report, it states that the DOD homeland defense concept of operations required refinement and was one of nine issue areas cited within the homeland defense portion of the study that “need to be addressed and investigated in more detail.” All of these nine areas potentially impact mobility support for homeland defense operations. Moreover, the MCS Executive Summary notes that reassessment of these missions is required as DOD’s role in homeland defense evolves. The MCS report, chapter 4, concludes by calling for further refinement of mission requirements, continuing risk assessments, and an effort to determine corresponding mobility solutions. We continue to believe that the MCS conclusion that adequate mobility capability exists is conditional given the results of

the homeland defense portion of the study and that the accuracy and completeness of the data, modeling, and results for this portion of the MCS remain in question.

5. We disagree with DOD's characterization that our information was "misleading" regarding the adequacy of some aspects of the MCS' modeling and data. Furthermore, we continue to disagree with DOD's statement that the models and data used by the study were sound and adequate to assess relevant aspects of missions required to support the National Military Strategy, and that the results of the study are valid. In this report, as in our September 14, 2005 report,<sup>1</sup> we reaffirm our concern that the data and models used by the study may not be sound and the results may not be valid since the verification, validation, and accreditation (VV&A) of the models and data used to conduct the study was not done in accordance with DOD policy or relevant research standards. VV&A of models and data reduces the risk inherent in the use of models and simulations by improving the credibility of modeling and simulation results. We do not dispute DOD's assertion that it has relied upon the same models to produce mobility studies done "since the end of the Cold War". However, as we discuss in our report, the MCS report fails to explain or qualify the impact that identified data or modeling limitations might have on its results. For example, in the MCS chapter 4, entitled Operational Data, the MCS states that "data deficiencies negatively affected MCS's ability to use current execution data to project future requirements and assess system performance." Unclear is the extent to which these deficiencies impacted the MCS ability to meet the objective of identifying mobility capability gaps, overlaps, or excesses and provide associated risk assessments, an MCS objective. Similarly, in the section of chapter 4 entitled Analysis Tools, the report states that "MCS analysis revealed several deficiencies in existing mobility models." The section concludes with five recommended tool enhancements but it does not explain the impact that the absence of these enhanced tools may have. We continue to believe that because of these modeling and data limitations, the MCS may have incorrectly estimated the future mobility requirements needed to support homeland defense missions, smaller contingencies, and major combat operations.

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<sup>1</sup> See GAO, *Defense Transportation: Opportunities Exist to Enhance the Credibility of the Current and Future Mobility Capabilities Studies*, [GAO-05-659R](#) (Washington, D.C., September 14, 2005), for a more detailed discussion.

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# Appendix III: GAO Contact and Staff Acknowledgments

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## GAO Contact

William M. Solis, (202) 512-8365 or solisw@gao.gov

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## Acknowledgments

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