United States Government Accountability Office

Report to Congressional Committees

February 2021

DEFENSE TRANSPORTATION

DOD Can Better Leverage Existing Contested Mobility Studies and Improve Training

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GAO-21-125

GAO@100 Highlights

Highlights of GAO-21-125, a report to congressional committees

February 2021

DEFENSE TRANSPORTATION

DOD Can Better Leverage Existing Contested Mobility Studies and Improve Training

Why GAO Did This Study

China and Russia are strengthening their militaries to neutralize U.S. strengths, including mobility—the ability of U.S. military airlift and air refueling aircraft and sealift ships to rapidly move equipment and personnel from the United States to locations abroad to support DOD missions.

Senate Report 116-48 included a provision for GAO to review DOD's ability to operate in a contested mobility environment. This report assesses the extent to which DOD has studied contested mobility and tracked the implementation of study recommendations, assesses the extent to which DOD has revised its training to incorporate contested mobility challenges, and describes the technologies that DOD uses to mitigate contested mobility challenges.

GAO identified contested mobility studies conducted or sponsored by DOD; evaluated DOD's processes for monitoring implementation of study recommendations; analyzed training and exercise documents from DOD combatant commands, the Air Force, and the Navy; and reviewed DOD plans for technological improvements to its mobility forces.

What GAO Recommends

GAO recommends that DOD designate an oversight entity to track the implementation of study recommendations, and that DOD and MARAD evaluate and update sealift training. DOD and the Department of Transportation concurred or partially concurred with each recommendation. GAO believes each recommendation should be fully implemented, as discussed in the report.

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What GAO Found

From 2016 through 2019, the Department of Defense (DOD) conducted or sponsored at least 11 classified or sensitive studies on contested mobility— the ability of the U.S. military to transport equipment and personnel in a contested operational environment. The studies resulted in more than 50 recommendations, and DOD officials stated they believed that some of the recommendations had been implemented. However, officials did not know the exact disposition of the recommendations, as they are not actively tracking implementation activities. Further, no single DOD oversight entity evaluated the studies' recommendations and tracked implementation across the department. As a result, DOD may be missing an opportunity to leverage existing knowledge on mobility in contested environments across organizations, and strengthen its mobility efforts for major conflicts as envisioned in the National Defense Strategy.

DOD has updated aspects of wargame exercises and mobility training to prepare for a contested environment, but has not updated training for the surge sealift fleet—ships owned by DOD and the Department of Transportation's Maritime Administration (MARAD) and crewed by contracted mariners. These crews are primarily trained and qualified to operate the ship, but receive limited contested mobility training. While DOD has updated air mobility training and other aspects of mobility training, sealift crew training requirements have not been updated by DOD and MARAD to reflect contested environment concerns because DOD has not conducted an evaluation of such training. Since sealift is the means by which the majority of military equipment would be transported during a major conflict, it is important that crews be trained appropriately for contested mobility to help ensure that ships safely reach their destinations and complete their missions.

C-17 Performing Defense Maneuvers

Source: U.S. Air Force/Senior Airman William Johnson. | GAO-21-125

DOD has begun to mitigate contested environment challenges through improved technology and related initiatives. The Navy is acquiring improved technologies to deploy on surge sealift ships and replacement ships. The Air Force is equipping current mobility aircraft (see photo above) with additional defensive technologies and planning for the development of future replacement aircraft. According to U.S. Transportation Command, the command is revising its contracts with commercial partners to address cyber threats, and funding research and development projects that address contested mobility concerns. Many of these efforts are nascent and will take years to be put in place.

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Abbreviations

DOD	Department of Defense
USTRANSCOM	U.S. Transportation Command
MARAD	U.S. Department of Transportation's Maritime Administration
OASD(S)	Office of the Assistant Secretary of Defense for Sustainment
AMC	Air Mobility Command
MSC	Military Sealift Command

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February 26, 2021

Congressional Committees

According to the Commission on the National Defense Strategy, changes at home and abroad are diminishing U.S. military advantages and threatening vital U.S. interests.[1] Competitors—especially China and Russia—are seeking to project power globally. They are strengthening their militaries to neutralize or contest U.S. strengths, including "mobility"—the ability of U.S. military airlift and air refueling aircraft and sealift ships to rapidly move equipment and personnel from the continental United States to locations abroad to support Department of Defense (DOD) missions.[2] The commission reported that it has serious reservations about the ability of DOD's mobility forces to support the department's global operations, particularly in the event of a high-intensity conflict or multi-theater operations.

U.S. Transportation Command (USTRANSCOM) is the DOD combatant command that provides air, land, and sea transportation to accomplish DOD's global mobility mission. USTRANSCOM is supported by the U.S. Department of Transportation's Maritime Administration (MARAD), which provides sealift capabilities in times of national emergency or war. U.S. European Command and U.S. Indo-Pacific Command are combatant commands that would receive the forces and equipment transported by USTRANSCOM for potential conflict in their areas of operation. The Joint

[1]Commission on the National Defense Strategy for the United States, *Providing for the Common Defense: The Assessment and Recommendations of the National Defense Strategy Commission*, November 14, 2018. The National Defense Authorization Act for Fiscal Year 2017 established the requirement for DOD to periodically issue the national defense strategy and a commission to examine and make recommendations with respect to the strategy. Pub. L. No. 114-328 §§ 941, 942 (2016). The National Defense Strategy describes, among other things, the priority missions of the Department of Defense and the critical and enduring threats to the United States.

[2]We derived our description of mobility from several related DOD terms, concepts, or capabilities. Strategic mobility is the capability to deploy and sustain military forces worldwide in support of national strategy. Air mobility includes airlift and air refueling. Intertheater air mobility serves continental United States-to-theater and theater-to-theater air mobility needs. Joint Chiefs of Staff, Joint Pub. 4-01, *The Defense Transportation System* at GL-6 and III-1 (July 18, 2017). Sealift forces are used in the transportation of cargoes from one seaport to another or to a location at sea in the operating area. Joint Chiefs of Staff, Joint Pub. 4-0, *Joint Logistics* at F-2 (Feb. 4, 2019) (incorporating change 1, May 8, 2019).

Staff supports the Chairman of the Joint Chiefs of Staff, who is the principal military advisor to the President and the Secretary of Defense. The Joint Staff reviews the combatant commands' operation plans for military contingencies. The Joint Staff J-4 office integrates logistics and mobility planning in support of military operations.

Senate Report 116-48, accompanying a bill for the National Defense Authorization Act for Fiscal Year 2020, included a provision for us to review DOD's ability to conduct mobility in a contested operational environment (which we refer to as contested mobility).[3] We assessed the extent to which DOD has (1) conducted studies on contested mobility and tracked the implementation of any recommendations made, and (2) revised its exercises and training to incorporate the challenges of contested mobility, and we (3) describe the technologies that DOD uses to mitigate contested mobility challenges. In our work, we focused on "intertheater" mobility, which does not include the intratheater transportation done by smaller mobility aircraft or ships, such as C-130 aircraft.[4]

To address the first objective, we conducted a literature review for studies on contested mobility. We then asked officials in USTRANSCOM, Joint Staff J-4, the Transportation Directorate in the Office of the Assistant Secretary of Defense for Sustainment (OASD(S)),[5] and DOD think tanks[6] to identify any additional studies issued from 2016 through 2019 that DOD had either conducted or sponsored on contested mobility. In total, we identified 11 studies on contested mobility; all of them were classified

[3]*See* S. Rep. No. 116-48, at 137-38 (2019).

[4]Intertheater mobility involves the transportation of forces and equipment from the continental United States to theaters of war abroad. It can also include movement from one theater to another.

[5]The Transportation Directorate in OASD(S) ensures that the defense transportation system is effective in providing end-to-end support to the warfighter, utilizing commercial and organic resources.

[6]For the purposes of this report, we refer to the following organizations as think tanks: DOD federally funded research and development centers including the Center for Naval Analyses, the Institute for Defense Analyses, RAND's National Defense Research Institute, RAND's Project Air Force, the MITRE Corporation's National Security Engineering Center; and the Defense Science Board, which is an advisory committee sponsored by the Office of the Under Secretary of Defense for Research and Engineering.

or sensitive.[7] Due to COVID-19's effects on government operations, we collected and evaluated unclassified information about the studies. We determined that the number of studies and the unclassified information we obtained about the studies was sufficient to address our reporting objective. We interviewed DOD officials to understand what approach DOD used to consider, implement, and track recommendations made in the studies. We determined that the monitoring component of internal control was significant to this objective along with the underlying principles of management performing monitoring activities, evaluating deficiencies, and taking corrective actions.[8] We assessed DOD's processes and procedures for monitoring its activities to track and implement identified corrective actions to achieve better outcomes.

To address our second objective, we collected an array of documents describing mobility forces' training processes during calendar years 2018-2020 in the Air Force and the Navy. In addition, we collected training and exercises information for USTRANSCOM, U.S. European Command, and U.S. Indo-Pacific Command. We interviewed officials from these organizations about how contested mobility is integrated into training and exercises. We compared this information to best practices for federal agency training—specifically, the design and development and evaluation components of the training and development process.[9]

To address our third objective, we collected information from the Air Force, Navy, and USTRANSCOM about the defensive capabilities of their existing aircraft and ships, research and development efforts related to potential future technology to mitigate contested environment threats, and plans for future sealift ships and mobility aircraft.

For all three objectives, we reviewed unclassified information about contested mobility because of changes in government operations due to the COVID-19 pandemic.

[7]These studies represent all the relevant studies identified to us by officials or that we identified through research for which unclassified information was available, but they do not constitute the universe of contested mobility studies. For example, according to USTRANSCOM officials, there are additional classified studies for which they could not provide any unclassified details.

[8]GAO, *Standards for Internal Control in the Federal Government*, GAO-14-704G (Washington, D.C.: September 2014).

[9]GAO, *Human Capital: A Guide for Assessing Strategic Training and Development Efforts in the Federal Government*, GAO-04-546G (Washington, D.C.: March 2004).

We conducted this performance audit from December 2019 to February 2021 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

Threats from China and Russia

According to the Summary of the 2018 National Defense Strategy, long-term strategic competitions with China and Russia are the principal priorities for DOD because of the magnitude of the threats they pose to U.S. security and prosperity and the potential for those threats to increase in the future.[10] While the strategy also notes threats from Iran, North Korea, and terrorism, it indicates that the central challenge to U.S. security is the reemergence of long-term, strategic competition by China and Russia.

China: According to the Defense Intelligence Agency's 2019 report on China's military power, China's military is still far from being able to deploy large numbers of conventional forces globally, but China has developed nuclear, space, cyberspace, and other capabilities that can reach potential adversaries across the globe.[11] Specifically, the Defense Intelligence Agency report posits that space and cyber operations will likely be an integral component of Chinese efforts to counter adversaries during military conflicts. For example, the report noted that China's cyberwarfare could target links and nodes in an adversary's mobility system and identify operational vulnerabilities in the mobilization and deployment phase of a U.S. operation.

In addition, the Defense Intelligence Agency's report stated that since the mid-1990s, China has closed gaps in key warfare areas such as air defense. China has built or acquired a wide array of advanced ships and aircraft, including submarines, major combatant ships, missile patrol craft, and surface–to–air missiles. The report also stated that China continues

[10]DOD, *Summary of the 2018 National Defense Strategy of the United States of America: Sharpening the American Military's Competitive Edge* (Jan. 19, 2018)

[11]Defense Intelligence Agency, *China Military Power: Modernizing a Force to Fight and Win* (2019).

to develop a variety of counter-space capabilities designed to limit or prevent an adversary's use of space-based assets during a conflict, such as satellite jammers, directed-energy weapons, and kinetic-energy weapons. China has also developed the world's first road-mobile, anti-ship ballistic missile.

Russia: According to the Defense Intelligence Agency's 2017 report on Russia's military power, one of Russia's core military capabilities is anti-access/area denial.[12] Anti-access/area denial strategies and capabilities either prevent an opposing force from entering an operational area (anti-access) or limit an opposing force's freedom of action within an operational area (area denial).[13] Russia achieves this through a combination of information operations, strategic air operations, an integrated air defense system, and modern precision-strike capabilities.

The Defense Intelligence Agency report also highlighted Russia's extensive cyber capabilities, including but not limited to a troll army, hacktivists, and bots. Russia has also fielded a wide range of ground-based electronic warfare systems to counter global positioning system technology, tactical communications, satellite communications, and radars. According to the report, military academics have suggested Russia's electronic warfare might fuse with cyber operations, allowing electronic warfare forces to corrupt and disable computers and networked systems as well as disrupt use of the electromagnetic spectrum.

A 2019 report from the Center for Strategic and Budgetary Assessments described how Russia might employ its military capabilities against DOD sealift during a conflict.[14] Russian threats to sealift could start in the homeland with a cyber-network attack or other exploitation to slow mobility efforts at their outset. Then, Russian unmanned underwater vehicles, mines, or submarines might attempt to attack sealift as it leaves

[12]Defense Intelligence Agency, *Russia Military Power: Building a Military to Support Great Power Aspirations* (2017).

[13]For instance, GAO has previously reported that anti-access/area denial includes potential adversaries challenging DOD's ability to deploy military forces by using ballistic and cruise missiles to prevent U.S. forces from getting to an operational area by attacking U.S. bases, ships, and logistics hubs. GAO, *Defense Planning: DOD Needs Specific Measures and Milestones to Gauge Progress of Preparations for Operational Access Challenges*, GAO-14-801 (Washington, D.C.: Sept. 10, 2014)

[14]Center for Strategic and Budgetary Assessments, *Sustaining The Fight: Resilient Maritime Logistics For A New Era* (2019).

ports in the United States. En-route sealift ships would be vulnerable to submarines or Russian bombers. Sealift destination ports in Europe might also be vulnerable to tactical air attack, mining, unmanned underwater vehicles, or sabotage.

USTRANSCOM and Its Components

USTRANSCOM is DOD's single manager for transportation.[15] DOD's transportation needs can be numerous and range from supporting normal peacetime operations to major combat operations in which the nation's transportation system could be severely stressed. Furthermore, the transition period from peacetime to war may be extremely short, further exacerbating mobility challenges. USTRANSCOM has two components that perform airlift, aerial refueling, and sealift: Air Mobility Command (AMC) and Military Sealift Command (MSC).[16]

AMC: Mobility aircraft operated by USTRANSCOM's AMC execute the majority of DOD's intertheater airlift missions—transportation from the continental United States to a theater of war or transportation between theaters of war.[17] Figure 1 shows the AMC's aircraft and their roles.

[15]DOD guidance specifies that USTRANSCOM is the DOD single manager for transportation for other than Service-unique or theater-assigned assets. DOD Directive 4500.09, *Transportation and Traffic Management*, para. 2.5 (Dec. 27, 2019).

[16]USTRANSCOM also has an Army component named Surface Deployment and Distribution Command that plays a critical role in the joint deployment and distribution enterprise by operating certain seaports and land-based transportation. Surface Deployment and Distribution Command also provides commercial sealift through liner service—contracts with commercial ships with fixed schedules that charge on a by piece/measurement ton basis. According to USTRANSCOM officials, through liner service contracts, Surface Deployment and Distribution Command actually transports more cargo than MSC. However, Surface Deployment and Distribution Command was not in the scope of our review because they do not own or operate any sealift ships or airlift aircraft.

[17]DOD also augments its military cargo and passenger airlift capability with aircraft from commercial carriers participating in the Civil Reserve Air Fleet program. Under the program, civil air carriers can voluntarily pledge their airlift resources to support DOD mobility requirements in times of emergency or contingency in return for a portion of DOD peacetime airlift business. GAO previously reported on the Civil Reserve Air Fleet program in 2013. GAO. *Military Airlift: DOD Needs to Take Steps to Manage Workload Distributed to the Civil Reserve Air Fleet*, GAO-13-564 (Washington, D.C.: June 20, 2013).

Figure 1: Mobility Aircraft and Their Roles

C-5 Galaxy (left) and the C-17 Globemaster III (right) — mobility aircraft transport light, high-priority forces and supplies, including personnel and equipment required to rapidly integrate units with other equipment and supplies in support of an operation.

KC-10 Extender (left) and the KC-135 Stratotanker (right) air refueling aircraft also support the mobility mission.

Source: U.S. Marine Corps/Lance Cpl. Jeraco Jenkins (C-5); U.S. Air National Guard/Master Sgt. Matt Hecht (C-17); U.S. Air Force/Senior Airman Lawrence Sena (KC-10); Air National Guard/Master Sgt. Jason Rolfe (KC-135). | GAO-21-125

AMC is also a component of the Air Force. The Air Force is responsible for the organization, training, equipping, and provisioning of mobility air forces. AMC establishes and maintains training programs, and advocates for mobility in the Air Force planning, programming, budgeting, and execution process, to include the identification of future mobility modernization demands. AMC provides continuation training—ground and flight training events necessary to maintain mission-ready or basic qualification status.

MSC: USTRANSCOM's MSC provides ocean transportation for all of DOD. Figure 2 shows MSC and MARAD sealift ships and their roles in a military contingency.

Figure 2: Examples of Military Sealift Command and Maritime Administration Sealift Ships and Their Roles

As an operation progresses, sealift delivers heavy military units and their support equipment, such as tanks, as well as vital sustainment for deployed forces. In most operations, sealift accounts for the majority of the total cargo delivered to an operational area.

Source: (1. & 6.) Military Sealift Command/Jennifer Hunt; (2.) U.S. Navy/Grady T. Fontana; (3.) U.S. Navy/Photographer's Mate First Class Arlo K. Abrahamson; (4.) U.S. Air Force/Airman First Class Kristen Heller; (5.) U.S. Navy/Petty Officer Second Class Nicholas Bauer. | GAO-21-125

MSC owns, operates, and maintains 15 ships within its sealift fleet in reduced operating status; these are among the first ships to activate when additional capacity is needed.[18] In addition, MARAD owns and maintains 46 additional sealift ships in reduced operating status within its Ready Reserve Force that USTRANSCOM can activate whenever needed; activated ships would be under the operational control of MSC.

[18]Ships that are in reduced operating status are docked and have a small crew onboard to assure the readiness of propulsion and other primary systems if the need arises to activate the ship.

Together, the MSC and MARAD ships comprise the 61-ship surge-sealift fleet that could be called upon for major conflicts.[19]

MSC is also a component of the Navy. The Navy is responsible for the organization, training, equipping, and provisioning of sealift forces. This includes the acquisition of sealift ships and related technologies. While MSC employs and trains civil service mariners for certain logistics missions, according to MARAD the mariners who crew the surge-sealift fleet are private U.S. citizen mariners hired by companies that are contracted to crew these ships.[20] MSC said they are not directly responsible for training of sealift crews. Rather, according to MSC and MARAD officials, training requirements for U.S. citizen mariners that crew the surge-sealift fleet are included in the contracts that MSC and MARAD have with the companies that actually crew the surge-sealift fleet.

Training of U.S. Citizen Mariners

U.S. citizen mariners can receive training through many public and private entities. These entities include the U.S. Merchant Marine Academy, the six state maritime academies, community colleges, union-affiliated schools, and about 230 private sector schools. There are multiple U.S. government organizations that have roles in the development of training requirements and implementation of the training for U.S. citizen mariners:

- Navy: The Navy publishes an instruction that details the required operational capabilities for surge-sealift ships, such as the capability

[19]If needed, additional capacity is available through commercial ships enrolled in the Voluntary Intermodal Sealift Agreement, which is a partnership between the U.S. Government and the maritime industry to provide DOD with assured access to additional commercial sealift during a national emergency or wartime operations. Carriers in the program contractually pledge their vessels and intermodal systems capacities in return for priority in DOD peacetime business. As of 2018, there were 99 ships enrolled in this program.

[20]A U.S. citizen mariner, according to MARAD, is anyone who holds a valid U.S. Coast Guard Merchant Marine Credential and is allowed to sail lawfully on a documented vessel per section 8103 of Title 46, U.S. Code. MARAD notes that, under section 8103, the U.S. Coast Guard may also issue Merchant Marine Credentials to seamen who are aliens lawfully admitted to the U.S. for permanent residence. A Merchant Marine Credential allows a mariner to work in the deck, engineering, or steward's departments of a ship, depending on the type of credential they hold. The deck department conducts navigation and operation of a ship. The engineering department handles propulsion and maintenance of the machinery on a ship. The steward's department handles supplies and food services on a ship. Section 8103 provides that, generally, only a U.S. citizen may serve in certain positions on a documented vessel—specifically, as master, chief engineer, radio officer, or officer in charge of a deck watch or engineering watch. *See* 46 U.S.C. § 8103(a); *see also* 46 C.F.R. § 10.221 (2020).

to operate a ship's propulsion plant or prevent and control damage.[21] The Commander of MSC is to periodically review the instruction and recommends changes to the Navy's Combat Logistics and Strategic Sealift Division, OPNAV N42. Separately, the Naval Education and Training Command's Naval Service Training Command maintains the departments of naval science at the U.S. Merchant Marine Academy and at each state maritime academy. The N4 office of the Deputy Chief of Naval Operations and the Commander of MSC are to receive an annual report on mariner training at the academies. Additionally, according to MARAD officials, maritime unions' training schools use approved course materials from MSC for courses on antiterrorism, damage control, and chemical, biological, and radiological incident response.

- USTRANSCOM: USTRANSCOM provides periodic program guidance to MSC and MARAD on the surge-sealift fleet. This guidance includes certain training requirements for the mariners that are contracted to crew the surge-sealift fleet. USTRANSCOM conducts periodic readiness exercises for surge-sealift ships known as Turbo Activations.
- MARAD: MARAD funds and operates the U.S. Merchant Marine Academy at Kings Point, New York. MARAD also provides relatively limited funding and training vessels to the six state maritime academies. The statutory mission of MARAD is to foster, promote, and develop the merchant maritime industry of the United States.[22] Among other things, MARAD is responsible for fostering the development and maintenance of a U.S. merchant marine sufficient to meet the needs of national security.[23] According to MARAD officials, when there are new training and qualification requirements, MARAD

[21]Office of the Chief of Naval Operations Instruction 3501.199C, *Required Operational Capabilities (ROC) and Projected Operational Environment (POE) for Strategic Sealift Ships To Include the T-AKR Fast Sealift Ships (FSS), Large Medium Speed RO/RO (LMSR), Aviation Support Ships (T-AVB), Auxiliary Crane Ships (T-ACS), and Ready Reserve Force (RRF) Dry Cargo Ships* (Dec. 17, 2007).

[22]49 U.S.C. § 109(a).

[23]49 C.F.R. § 1.92(a) (2020).The Secretary of Transportation's general statutory authority relating to the U.S. merchant marine, delegated to MARAD, includes providing for the education and training of U.S. citizens for the safe and efficient operation of the U.S. merchant marine and ensuring that there is a sufficient pool of U.S. mariners to meet certain objectives relating to domestic and foreign commerce, national defense, and training, among other things. *See* 46 U.S.C. §§ 50101, 51103(a); 49 C.F.R. § 1.93(a).

works with MSC, sealift companies, mariner unions, and appropriate training institutions to develop and promulgate the required training.

We have previously reported concerns about the mariner workforce. In 2018, we reported that, according to MARAD and DOD officials, there was a potential shortage of U.S. citizen mariners qualified to crew government-owned reserve vessels.[24] Our report cited findings by MARAD's Maritime Workforce Working Group that the current number of U.S. citizen mariners was insufficient to support sustained activation of the government-owned reserve fleet for military operations.[25] Although the working group concluded that there was a shortage of mariners for sustained operations, its report also detailed data limitations that caused some uncertainty regarding the actual number of existing qualified mariners and, thus, the extent of this shortage. The working group's report contained several recommendations related to improving information on the number of available and willing mariners.

In 2020, we reported that the U.S.-flag maritime industry faced an array of challenges that could negatively affect national defense, including a potential shortage of U.S. citizen mariners.[26] We interviewed 10 maritime industry stakeholders, and nine of them identified potential gaps in the skills or availability of U.S. citizen mariners. Federal officials also indicated there could be too few mariners to support sustained military sealift operations. USTRANSCOM told us that they were concerned with not only the total number of mariners but also their specific mix of skills.

[24]GAO, *Maritime Security: DOT Needs to Expeditiously Finalize the Required National Maritime Strategy for Sustaining U.S.-Flag Fleet*, GAO-18-478 (Washington D.C.: Aug. 8, 2018).

[25]U.S. Department of Transportation, Maritime Administration, Maritime Workforce Working Group Report (Washington, D.C., Sept. 29, 2017).

[26]GAO, *National Maritime Strategy: DOT Is Taking Steps to Obtain Interagency Input and Finalize Strategy*, GAO-20-178 (Washington, D.C.: Jan. 15, 2020).

DOD Has Studied Contested Mobility but Has Not Systematically Addressed Recommendations

DOD and Its Think Tanks Conducted Studies about Contested Mobility

From 2016 through 2020, DOD and its think tanks conducted at least 11 classified or sensitive studies on various aspects of contested mobility, as shown in table 1. DOD and its think tanks used various and often complex methodologies to conduct these studies, involving historical comparisons, the use of focus groups, quantitative analyses, modeling of the transportation of DOD forces during a conflict, and war gaming. The studies included findings on contested mobility related to issues of force structure, concepts of operations, and assumptions. Approximately 59 total recommendations resulted from the studies.[27] Additional information about these studies appears in Appendix I.

Table 1: GAO Identified Department of Defense (DOD) Studies on Contested Mobility

Study	Sponsor	Author	Completion date	Recommendations
Global Mobility Strategic Portfolio Review Final Report	The Secretary of Defense	U.S. Transportation Command (USTRANSCOM)	November 2016	[a]
Final Report of the Defense Science Board (DSB) Task Force on Survivable Logistics[b]	The Under Secretary of Defense for Acquisition, Technology, and Logistics	Defense Science Board Task Force on Survivable Logistics	November 2018	11
Protecting the North Atlantic Sea Lines of Communication	U.S. Naval Forces Europe-Africa	Center for Naval Analysis	May 2018	15
USTRANSCOM Wargame 2016: Contested Environment, Final Report	USTRANSCOM	Center for Naval Analysis	February 2017	10
USTRANSCOM Wargame 2017: Final Report	USTRANSCOM	Center for Naval Analysis	December 2017	5

[27]Based on unclassified information, GAO identified 59 recommendations resulting from DOD's contested mobility studies listed in Table 1. However, the table does not include the entire universe of contested mobility studies. For example, according to USTRANSCOM, there is an additional classified study for which they could not provide any unclassified details.

Study	Sponsor	Author	Completion date	Recommendations
Evaluation of Vulnerabilities of Air and Sea Lines of Communication in Contested and Degraded Operating Environments.	USTRANSCOM	RAND National Defense Research Institute	July 2019	[a]
Evaluation of Vulnerabilities and Mitigation Options for Strategic Lift and Tanker Operations within Denied Environments	USTRANSCOM and Joint Staff J-4	RAND National Defense Research Institute	July 2019	2
Future Deployment and Distribution Assessment FDDA VI, Assumptions and Attritive Effects: The Degradation of Mobility Capabilities in a Contested Environment	USTRANSCOM	USTRANSCOM	February 2018	3
Mobility Capabilities and Requirements Study 2018	[c]	USTRANSCOM	February 2019	[a]
Options to Enhance Air Mobility in Anti-Access/Area Denial Environments	Air Mobility Command	RAND Project Air Force	June 2020	9
Assessing Survivability Options for Air Refueling Tankers	Air Mobility Command	RAND Project Air Force	June 2020	4

Source: GAO analysis of DOD and think tank information. | GAO-21-125

[a]See Appendix I for more information.

[b]The Defense Science Board is a DOD advisory committee sponsored by the Office of the Under Secretary of Defense for Research and Engineering.

[c]In January 2019, DOD produced a mobility capabilities requirements study in response to a requirement to do so in the National Defense Authorization Act for Fiscal Year 2018. Pub. L. No. 115-91, § 144(b) (2017). Subsequently, the National Defense Authorization Act for Fiscal Year 2020 required the Commander, USTRANSCOM, in coordination with other DOD officials, to conduct another mobility capabilities requirements study. Pub. L. No. 116-92, § 1712 (2019).

DOD officials and others have highlighted the value of some of the studies in various ways. For example, according to officials from U.S. Naval Forces, Europe-Africa and MSC, leadership at MSC and USTRANSCOM read the June 2018 Center for Naval Analysis Study and found it to be compelling. In a 2017 Senate Armed Services Committee hearing, the commander of USTRANSCOM highlighted the Mobility Strategic Portfolio Review as identifying top critical areas of concern. Also, the Chairman of the Defense Science Board called on DOD to adopt without delay the recommendations contained in its November 2018 study.[28] Separately, in its November 2018 report, the Commission

[28]The Defense Science Board is a DOD advisory committee sponsored by the Under Secretary of Defense for Research and Engineering.

on the National Defense Strategy called for investments in a more secure transportation infrastructure to be rooted in a careful study of USTRANSCOM.[29]

DOD Used Information from Contested Mobility Studies, but Has Not Systematically Implemented and Tracked the Recommendations

DOD has used the contested mobility studies to inform other studies, identify vulnerabilities, and inform planning and decision making. For example:

- USTRANSCOM officials stated that they used the two RAND studies to inform assumptions in the 2018 Mobility Capabilities and Requirements Study. USTRANSCOM officials also stated that they use these types of studies for informational purposes and that study recommendations are taken into account during decision-making.
- Joint Staff J-4 officials noted that the RAND studies were conducted because of issues identified in the 2016 Mobility in a Contested Environment Strategic Portfolio Review. They also stated that the September 2019 RAND study helped policy makers identify vulnerabilities of current mobility forces and that, generally, such studies can be used to identify critical gaps and to inform budget decisions.
- Naval Forces Europe-Africa officials said they used the 2018 Center for Naval Analysis study to influence operation planning both within their command and U.S. European Command and to gain an understanding of potential enemy actions.
- OASD(S) officials noted that such studies provide a baseline for transportation capacities and throughput in the defense transportation system. Further, they stated that this information informs leadership as they prioritize budgeting and programming decisions.

However, DOD officials did not systematically evaluate, implement, and track recommendations, as determined appropriate, from all of the studies. These officials believed that some of the recommendations from the studies may have been implemented and gave anecdotal accounts of recommendation implementation. For example, Joint Staff J-4 officials

[29]Commission on the National Defense Strategy for the United States, *Providing for the Common Defense: The Assessment and Recommendations of the National Defense Strategy Commission*, November 14, 2018. Specifically, the Commission recommended that DOD invest in a more resilient and secure logistics and transportation infrastructure, especially if it relies on a Dynamic Force Employment model that envisions shifting assets rapidly across theaters. The Commission further recommended that those investments should be rooted in careful study of TRANSCOM's capabilities, capacity, and command structure, and whether there is a sufficiently strong "logistics voice" within the Office of the Secretary of Defense.

said they observed changed mobility assumptions in modeling and planning at combatant commands, and believed this was due to various study recommendations. However, the officials also acknowledged that some recommendations were likely not implemented for various reasons, such as cost and technical feasibility factors or complexity.

Officials from some of the organizations that sponsored the studies did not know the exact implementation status of the recommendations from their individual studies as they are not actively tracking any disposition or implementation efforts. According to these officials, they could theoretically provide status updates on the recommendations from studies they sponsored by conducting research and requesting information from within their organizations about possible actions that might have addressed the recommendations, but they do this only when requested.

For example, OASD(S) conducted such an inquiry for a March 2019 update they provided to the House Armed Services Committee. That update outlined the status of DOD's actions that aligned with the Defense Science Board's recommendations, though even in that instance many of the actions OASD(S) highlighted did not directly address the recommendations or were ongoing activities that were not necessarily initiated in response to the recommendations. In December 2019, we reported that DOD did not track the implementation of recommendations from thinks tanks such as RAND and the Center for Naval Analysis, and that officials believed that the value of such studies went beyond their recommendations.[30]

DOD's contested mobility studies are examples of monitoring that, according to Standards for Internal Control in the Federal Government, an organization conducts to identify deficiencies in the processes it uses to achieve its objectives.[31] As a part of monitoring:

- Management promptly resolves the findings of audits and other reviews—for example by implementing recommendations; and

[30]GAO, *Federal Research: DOD's Use of Study and Analysis Centers*, GAO-20-31 (Washington, D.C.: Dec. 9, 2019).

[31]GAO, *Standards for Internal Control in the Federal Government*, GAO-14-704G (Washington, D.C.: September 2014).

- Management monitors and documents the status of remediation efforts—for example by tracking the implementation status of recommendations.

Standards for Internal Control in the Federal Government also state that management selects an oversight body to exercise oversight responsibility, including for the remediation of deficiencies that cross organizational and unit boundaries.

However, DOD does not have a single oversight entity with the responsibility to evaluate all the recommendations from contested mobility studies and track the implementation status of appropriate recommendations across the department. DOD officials agreed that there is no single oversight entity and noted that studies are usually conducted for internal use by the sponsoring organization. According to DOD officials, the primary reason that a single oversight entity is not systematically evaluating, implementing, and tracking the recommendations is because there is no requirement for it to do so, and organizations that conducted the studies are not required to coordinate their studies across DOD.

Moreover, the officials said that contested mobility issues are now considered in all aspects of their planning and decision-making, and as such systematic consideration and implementation of the recommendations is unnecessary. While officials stated that contested mobility issues are considered in all aspects of their planning and decision-making, this does not necessarily result in the department systematically evaluating, addressing, and tracking the recommendations, as determined appropriate. Furthermore, some of the recommendations required additional resources or coordinated action across multiple organizations, which officials agreed necessitated coordination by an oversight organization.

DOD has benefited from recommendation implementation and tracking in another issue area. Specifically, in response to several incidents involving the nation's nuclear deterrent forces and their senior leadership, the Secretary of Defense in 2014 directed DOD to address recommendations from internal and external reviews of the nuclear enterprise and directed the Office of Cost Assessment and Program Evaluation to track and assess implementation of the recommendations. The Office of Cost Assessment and Program Evaluation identified 247 sub-recommendations, which were directed to multiple military services or other DOD components. It then worked with the military services to

identify offices of primary responsibility for implementing actions to address the recommendations, any offices with coordinating responsibility, and any resources necessary to implement each recommendation. It also developed a centralized tracking tool to collect information on progress in meeting milestones and metrics.[32]

Without a single designated organization to evaluate contested mobility studies and direct and track implementation of appropriate recommendations, DOD may be missing an opportunity to leverage existing knowledge on contested mobility across organizations and mitigate challenges before they inhibit DOD's ability to conduct mobility during major conflicts.

DOD Has Updated Aspects of War Game Exercises and Mobility Training to Prepare for a Contested Environment, but Has Not Updated All Training

U.S. European Command and U.S. Indo-Pacific Command—DOD's geographic combatant commands responsible for military operations in and around Europe and the broader Indo-Pacific regions[33]—have updated some of their wargame exercises to reflect potential contested

[32]DOD later transitioned tracking and analysis responsibilities from CAPE to the military departments and other DOD components. However, CAPE remains responsible for providing guidance to inform the analyses, overseeing these analyses, and assessing recommendations for closure. In March 2020 GAO reported that DOD continued to make progress in implementing recommendations to improve the nuclear enterprise. GAO, *Defense Nuclear Enterprise: Systems Face Sustainment Challenges, and Actions Are Needed to Effectively Monitor Efforts to Improve the Enterprise*, GAO-20-296 (Washington, D.C.: March 2020). GAO first reported on the implementation of nuclear enterprise recommendations in 2016. GAO, *Defense Nuclear Enterprise: DOD Has Established Processes for Implementing and Tracking Recommendations to Improve Leadership, Morale, and Operations*, GAO-16-597R (Washington, D.C.: July 14, 2016).

[33]U.S. European Command is responsible for all of Europe, large portions of Central Asia, and parts of the Middle East, the Arctic Ocean and the Atlantic Ocean while U.S. Indo-Pacific Command is responsible for Southwest Asia, Australia, South Asia, large parts of the Pacific Ocean, and part of the Indian Ocean.

mobility challenges.[34] Additionally, USTRANSCOM and two of its component commands, AMC and MSC, have updated some training and created supplementary programs to address contested mobility concerns. However, DOD has not evaluated or updated sealift crew training for a contested environment.

DOD Commands Have Updated Wargame Exercises with Some Contested Mobility Challenges

DOD combatant commands have incorporated some potential contested mobility challenges into their staff-level wargame exercises. Wargames are analytic exercises that DOD conducts as a means to develop and evaluate possible courses of action for military missions based on a variety of factors, such as enemy capabilities, most likely course of action, and most dangerous course of action.[35] Our review found the following examples of combatant commands updating exercises.

U.S. European Command: According to U.S. European Command officials, the command's wargames simulate threats to the intertheater transportation of forces as well as other logistical challenges. For example, recent U.S. European Command wargames simulated disruptions at air and seaports. Officials noted, however, that they do not fully incorporate contested mobility challenges into wargames because the objectives of the wargames focus on command and control of forces already in the theater rather than the airlift and sealift of forces and equipment into the theater. European Command officials also noted that the classification of its war plans further inhibits the simulation of possible contested mobility challenges that may occur if those plans are executed.

To mitigate classification issues in wargames, U.S. European Command officials said they simulate the flow of forces and equipment from the U.S. to Europe based on representative scenarios that do not precisely reflect the actual plans. Nonetheless, recognizing the threat to intertheater sealift operations and the potential to encounter a contested environment in the event of a war with Russia, in July 2019, the North Atlantic Treaty Organization activated Joint Force Command Norfolk with the mission to

[34]DOD doctrine states that wargames are representations of conflict or competition in a synthetic environment. DOD staff involved in wargame exercises, whether computer-assisted or manual, analyze potential courses of action to identify approaches that are valid as well as their advantages and disadvantages. *See* Joint Chiefs of Staff, Joint Pub. 5-0, *Joint Planning* at V-31 (June 16, 2017).

[35]Commanders and staff involved in wargaming exercises make decisions and respond to the consequences of those decisions. As a result, the commanders, staff, and subordinate commanders gain a common understanding of friendly and enemy courses of action, and other actor actions that may work in opposition to attaining desired end-state conditions.

protect North Atlantic airlift and sealift routes. European Command officials expect that as this command matures, it will be able to provide them with more information on how to wargame and plan for the protection of mobility operations.

U.S. Indo-Pacific Command: U.S. Indo-Pacific Command officials said they have incorporated some contested mobility challenges into their wargames as well. Specifically, officials said that in the 2019 Pacific Sentry series of wargames, they simulated attacks on mobility aircraft and sealift ships that were transporting replenishment resources to their combat forces.[36] Officials also said that they incorporated the potential loss of C-17 aircraft, airfields, and fuel distribution to simulate other contested mobility challenges. They considered the incorporation of these factors to be important given the distance that mobility aircraft and ships must travel to transport forces and equipment into the Indo-Pacific region.

USTRANSCOM: USTRANSCOM conducted two contested mobility wargames in 2016 and 2017.[37] As shown in the margin, it also conducts a variety of exercises that address elements of contested environment. In addition to wargaming, USTRANSCOM officials said they also conduct modeling and simulations in support of war planning that inform geographic combatant commands about the feasibility of transporting required forces and equipment to their theaters during a potential conflict. According to officials, these simulations realistically model friendly and enemy capabilities and how mobility forces would execute their mission in a contested environment. These results are then taken into account in operation plans.

USTRANSCOM Recurring Exercises

- Turbo Challenge: Exercises plans, policies and procedures through storylines related to near-peer competitors.
- Ultimate Guardian: Exercises response to cyber-related weapons and infrastructure vulnerabilities.
- Ultimate Caduceus: Exercises operational plans and joint force headquarters in response to a European crisis.
- Turbo Distribution: Exercises USTRANSCOM's ability to rapidly establish and operate ports.
- Turbo Activation: No-notice exercises of the surge-sealift fleet.
- Joint Logistics Over-the-Shore: Exercises distribution operations in a complex environment with a diverse cargo set.

Source: GAO Analysis of USTRANSCOM Information. | GAO-21-125

[36]Pacific Sentry is a series of training exercises that focus on joint training integration among U.S. forces. The exercises involve U.S. Indo-Pacific Command headquarters staff and command components in a real world, operational level war scenario.

[37]The details of these wargames are classified.

AMC Has Updated Its Training to Prepare for Potential Contested Mobility Challenges

According to AMC officials, in 2018 the AMC commander provided guidance to the mobility air forces about training and preparing for conflict with adversaries such as China and Russia, and as a result AMC has made a number of training changes. Additionally, AMC officials said they updated training to reflect contested mobility based on feedback received during training review meetings. For example:

- According to AMC officials, in response to the commander's guidance, AMC added a new training requirement that each air mobility pilot complete an integrated mission sortie—a training event that gives pilots experience planning and practicing flights and maneuvers to recognize and evade attack in a contested environment and integrate with other friendly forces and intelligence.
- Officials said that AMC also eliminated some unnecessary training requirements in response to feedback received at training review board meetings, which allowed them to refocus on contested environment training.[38] Specifically, the officials noted that between 2018 and 2020, AMC adjusted training requirements to remove or reduce the frequency of requirements that squadron leaders had identified as unrealistic, outdated, and unnecessarily burdensome for mobility pilots. For example, for the C-17, AMC reduced the frequency of certain training for chemical, biological, radiological, and nuclear environment training events, which mobility forces had been conducting semiannually. AMC also replaced requirements to conduct certain basic or instructor-led training sorties for the C-17 with a requirement to conduct mission-specific contested environment training events.

Despite these changes, training officers from three different mobility squadrons told us there are not enough opportunities to participate in mobility-focused contested environment training exercises. These training officers cited causes that included the time demands of ongoing operations and a need for changes in existing guidance. According to AMC officials, these issues will be partially redressed in future training review board meetings, but they noted that there are resource constraints that govern how often such exercises are conducted and how many aircraft can participate.

[38]According to AMC and mobility training officials we spoke to, AMC conducts biannual training review board meetings to assess the effectiveness of training, identify deficiencies, and suggest improvements.

MSC Is Training Military Personnel to Supplement Sealift Crews in a Contested Environment, but DOD and MARAD Have Not Updated the Training of Sealift Crews

MSC is developing three programs to create a cadre of uniformed military personnel trained to operate in a contested environment. In the event of war, these personnel would supplement surge-sealift crews.

Strategic Sealift Officers: In October 2020, MSC officials said they revised the training curriculum for Strategic Sealift Officers to reflect some contested environment challenges and that updated courses were set to begin the same month. Strategic Sealift Officers are commissioned officers in the U.S. Navy Reserve assigned to activities that support sealift in times of national defense or emergency. MSC is the flag sponsor of the Strategic Sealift Officer program.[39] In September 2020, MSC officials said the command recognized that it could better leverage this program by also training strategic sealift officers how to operate in contested environments.

Tactical Advisors: In 2018, MSC created the Tactical Advisor program to train a cadre of uniformed Navy reserve personnel that would supplement sealift crews in order to help them better operate in a contested environment.[40] In the event of a war, tactical advisors would serve on surge-sealift ships to advise the ship's crew of potential threats to the vessel and enhance protection and survivability of the ship's personnel, cargo, and equipment.[41] MSC officials said that as of October 2020, 82 Tactical Advisors were trained and qualified to be deployed across the 61-ship surge-sealift fleet, as well as potentially dozens of additional commercial ships that MSC might activate via the Voluntary Intermodal

[39]The Navy's N4 Office of the Deputy Chief of Naval Operations for Fleet Readiness and Logistics serves as the program sponsor of the Strategic Sealift Officer Program and the Commander of MSC is the flag sponsor. According to DOD, the Navy's N1 Office of the Deputy Chief of Naval Operations for Manpower, Personnel, Training and Education is the resource sponsor for Strategic Sealift Officer Individual Ready Reserve Mobilization Training.

[40]Commander Military Sealift Command, Decision Memorandum 18-11, *Tactical Advisor (TACAD) Employment* (Aug. 16, 2018).

[41]The MSC instruction on Tactical Advisor Employment indicates that, in future operations, the Director for Operations and Plans will coordinate to employ Tactical Advisors onboard all required missions and onboard Ready Reserve Force or Surge-sealift ships for exercises and activations. Commander Military Sealift Command Instruction 3120.21, *Tactical Advisor Employment* (Jan. 24, 2020).

Sealift Agreement program during a major contingency.[42] According to MSC officials, they expect to be able to increase the number of trained and qualified Tactical Advisors to approximately 150 by 2021, but they also stated that may not be enough Tactical Advisors for a major military contingency. Tactical Advisors are typically Navy reserve strategic sealift officers and surface warfare officers. As previously noted, however, Navy Strategic Sealift Officers might be activated to crew sealift ships in the event of war, which would make them unavailable to serve as Tactical Advisers.

Mobile Communications Personnel: MSC officials said that as of June 2020, they were establishing a program to train enlisted Navy personnel to set up secure communications equipment on surge-sealift ships, which generally do not have secure communications capabilities.[43] However, officials also said that the program was not as formalized as the Tactical Advisors program and only 22 personnel have been trained for the program as of September 2020. According to MSC officials, their goal is to further define the program and train additional personnel.

While these efforts are promising, DOD and MARAD have not updated training requirements for the U.S. citizen mariners crewing the surge-sealift fleet to reflect potential contested environment challenges. According to MSC and MARAD officials, training requirements and qualifications for these mariners are specified in contracts that MSC and MARAD have with sealift companies who hire U.S. citizen mariners to crew the surge-sealift fleet. The officials said that these U.S. citizen mariners are trained and qualified primarily to conduct maintenance, load the ship's cargo, get underway, maintain the ship's systems, and unload the ship's cargo; they receive very little, if any, contested environment training.

USTRANSCOM and the Navy provide direction on the training and qualification requirements for the U.S. citizen mariners contracted to crew the surge-sealift fleet. According to MSC and MARAD officials, the

[42]MARAD's Voluntary Intermodal Sealift Agreement (VISA) program is a partnership between the U.S. government and the maritime industry to provide DOD with assured access to commercial sealift equipment and services when DOD deploys military forces during a national emergency or wartime operations. Carriers in the program contractually pledge their vessels and intermodal systems' capacities in return for priority in DOD peacetime business.

[43]This equipment enables secure telephonic and radio communication and computer messaging with command and control and DOD components.

mariner training and qualification requirements in their contracts for the surge-sealift fleet reflect previous guidance from USTRANSCOM to MSC and MARAD, issued in 2015 and effective through fiscal year 2022. The 2015 guidance states that each strategic sealift vessel must comply with MSC guidance related to anti-terrorism and force-protection training, as well as chemical, biological, and radiological defense training. However, MSC and MARAD officials agreed that this training does not reflect contested mobility challenges against a near-peer adversary. The 2015 USTRANSCOM guidance also references a 2007 Navy instruction that, according to MARAD officials is used to inform sealift training expectations, but is out of date.[44] That Navy instruction lists mobility, logistics, and strategic sealift capabilities as primary missions of the surge-sealift fleet, and capabilities related to contested environment are listed as secondary missions.[45]

MSC has tried using Tactical Advisors to provide contested environment training to U.S. citizen mariners, but their efforts have been limited. MSC's Tactical Advisors provided this training during Turbo Activation exercises.[46] However, the after-action reports from two of four Turbo Activation exercises in 2019 emphasized that: (1) a shortage of MSC Tactical Advisors curtailed the expected contested environment training, and (2) MSC needed to refine the contested environment training syllabus and implementation plan used by Tactical Advisors to ensure that contested environment awareness and skill-set competencies are advanced through Turbo Activation exercises. Furthermore, MARAD officials stated that approximately 16 to 22 ships out of the 61-ship surge-sealift fleet are annually subjected to Turbo Activations. Thus, only a

[44]Specifically, Office of the Chief of Naval Operations Instruction 3501.199C, regarding the required operational capabilities and projected operational environment for strategic sealift ships has not been updated since it was issued in 2007. According to DOD, as of February 2021, the Navy is working with MSC, MARAD, and USTRANSCOM to update Instruction 3501.199C.

[45]Although certain capabilities under the mobility mission area may relate to operation in a contested environment, the following capability categories are among those identified as secondary mission areas: anti-surface ship warfare; command, control, and communications; command and control warfare and information warfare; and fleet support operations.

[46]USTRANSCOM periodically tests the readiness of surge-sealift crews and their ships through "Turbo Activation" exercises—no-notice activations of sealift ships that test the crews' ability to meet certain time frames and perform in-port procedures and at-sea operations.

portion of U.S. citizen mariners receive whatever contested environment training might be delivered at Turbo Activations.[47]

Best practices for federal agency training state that well-designed training and development programs are linked to agency goals and to the organizational, occupational, and individual skills and competencies needed for the agency to perform effectively.[48] According to the 2018 National Defense Strategy, strategic mobility is one of the foundational capabilities of a global operating model, which describes how the joint force will be postured and employed to achieve its competition and wartime missions. The 2018 National Defense Strategy also lists strategic mobility assets as among the capabilities to be prioritized as part of ensuring logistics sustainment while under persistent multi-domain attack. Although MSC has developed or updated other training programs to address contested environment concerns for sealift, MSC and MARAD have not updated the training and qualification requirements for the U.S. citizen-mariner sealift crews that are contracted to actually operate surge-sealift ships.[49]

Sealift crew training requirements have not been updated to reflect contested environment concerns because DOD has not conducted an evaluation of sealift crew training nor of the guidance that informs it. The best practices for federal agency training also state that agencies should

[47]According to MARAD officials, there is also no way to track which U.S. citizen mariners have received contested environment training via a Turbo Activation. Surge-sealift ships have skeleton crews in their reduced operating status. Turbo Activation exercises simulate an actual activation in that the contracted company brings the ship to full operating status with a full crew. Officials stated that via solicitations to sealift unions, sealift companies temporarily hire additional U.S. citizen mariners to fully crew the ship for the Turbo Activation. When the Turbo Activation is completed, the temporary crew moves on to other jobs.

[48]GAO, *Human Capital: A Guide for Assessing Strategic Training and Development Efforts in the Federal Government*, GAO-04-546G (Washington D.C.: Mar. 1, 2004). This guide introduces a framework, consisting of a set of principles and key questions that federal agencies can use to assess how they plan, design, implement, and evaluate effective training and development programs that contribute to improved organizational performance and enhanced employee skills and competencies.

[49]MSC and MARAD have different contracts on different timelines with different companies to operate surge-sealift ships. For example, according to a MSC document, a contract for the operation of five of its surge-sealift ships by a single company was set to end in September 2020 (the end date for the final option period). A separate contract with a different company operating seven different surge-sealift ships is set to end in September 2022 (the end date for the final option period).

evaluate training and development efforts to assess, among other things, how their training enables the agency to meet new and emerging transformation challenges.[50] A sealift advisory group meeting in January 2020 that focused in part on contested environment challenges from Iran recommended that MSC, which is a component of both USTRANSCOM and the Navy, conduct such a review. However, as of September 2020, MSC officials said they had not conducted a review of sealift crew training. MARAD officials also said that as of October 2020 they requested that DOD conduct an evaluation of the functions and tasks needed for operating in a contested environment and of the required number of crew to complete such tasks. They said such an evaluation is a necessary first step to update training and qualification requirements in contracts and then develop objectives for new or revised training courses.[51]

According to MSC officials, supplementary personnel, such as Tactical Advisors and Strategic Sealift Officers, are intended to provide sealift crews with the skills and competencies needed to navigate a contested environment, and as such they have not evaluated sealift crew training with an eye toward operating in a contested environment. However, officials acknowledged that Tactical Advisors and Strategic Sealift Officers may not be available for all sealift ships. Furthermore, the Navy agreed that their guidance for surge-sealift capabilities is outdated and had begun updating it as of July 2020. USTRANSCOM officials said that the threat to surge sealift may not be certain enough to warrant contested environment training for U.S. citizen mariners; USTRANSCOM officials said the details of their rationale are classified. However, USTRANSCOM officials also acknowledged there is not consensus regarding the certainty of threats. For example, MARAD briefings detailed multiple potential threats to surge sealift. Further, the commander of Joint Force Command Norfolk was quoted in a September 2020 Navy Times article stating that there is a real threat from Russian submarines in the Atlantic and that ships there can no longer expect to operate unhindered.

If DOD, in coordination with MARAD, does not evaluate the training and associated guidance for sealift crews to determine the skills and

[50]GAO, *Human Capital: A Guide for Assessing Strategic Training and Development Efforts in the Federal Government*, GAO-04-546G (Washington, D.C.: March 2004).

[51]MARAD previously worked with DOD to develop and offer a course at the U.S. Merchant Marine Academy to train mariners for operating during a military contingency—the National Sealift Training Program course. That course was discontinued in 2009, according to MARAD officials.

competencies they need for a contested environment and update the training and associated guidance as appropriate, it risks having mariners who are not prepared for their missions. Moreover, since sealift is the means by which the majority of military equipment will be transported during major military operations, it is imperative that DOD be sure that it can operate in a contested environment.

DOD Has Begun to Mitigate Contested Mobility Challenges through Improved Technology and Other Related Initiatives

The Navy is acquiring improved communication and navigation technologies to put on sealift ships, as well as used and new replacement ships for its aging fleet. The Air Force is equipping current mobility aircraft with additional defensive technologies and planning for the development of future replacement aircraft. According to USTRANSCOM, the command is revising its contracts with commercial partners to address cyber threats and funding research and development projects that address contested environment concerns.

The Navy Has Been Adding Some Improved Technologies to Current Sealift Ships and Acquiring Replacement Ships

To address potential threats, MSC has been acquiring improved communication and navigation technology and the Navy has been pursuing long-term replacements for aging sealift ships. Surge-sealift ships average 40 years in age and do not have the defensive capabilities that might be required in a contested environment. For example, according to MSC and MARAD officials, the current fleet of surge-sealift ships is susceptible to communication disruptions and GPS spoofing while underway.[52] The officials stated that they believe China and Russia could use their cyber and electromagnetic capabilities to disrupt ship communications and navigational systems.

MSC plans to overcome potential communication and navigational threats to the surge-sealift fleet by providing some ships with new secure communications equipment. Specifically, MSC is acquiring Mobile Expeditionary Communications Kits, which can provide secure and classified communication capabilities to a sealift ship. According to MSC officials, these communication kits enable ship crews to receive alerts on nearby threats, as well as other critical information needed for navigating in a contested environment. As of September 2020, MSC officials said

[52]GPS spoofing is a navigational disruption involving manipulated signals that mimic true satellite signals which deceive a GPS receiver's operation.

they had acquired nine Mobile Expeditionary Communications Kits and plan to acquire at least 31 more by the end of 2021.

In addition, MSC has been planning to acquire emission control systems for the surge-sealift fleet.[53] According to MSC officials, these systems will allow the crew to limit their electromagnetic emissions, thereby avoiding enemy detection.[54] Specifically, the emission control systems would assist crews by detecting any signals onboard their ships that need to be turned off prior to entering a contested environment. MSC officials said they have been testing two different emission control systems. These systems are early in the acquisition process and will not be fielded until at least 2023.

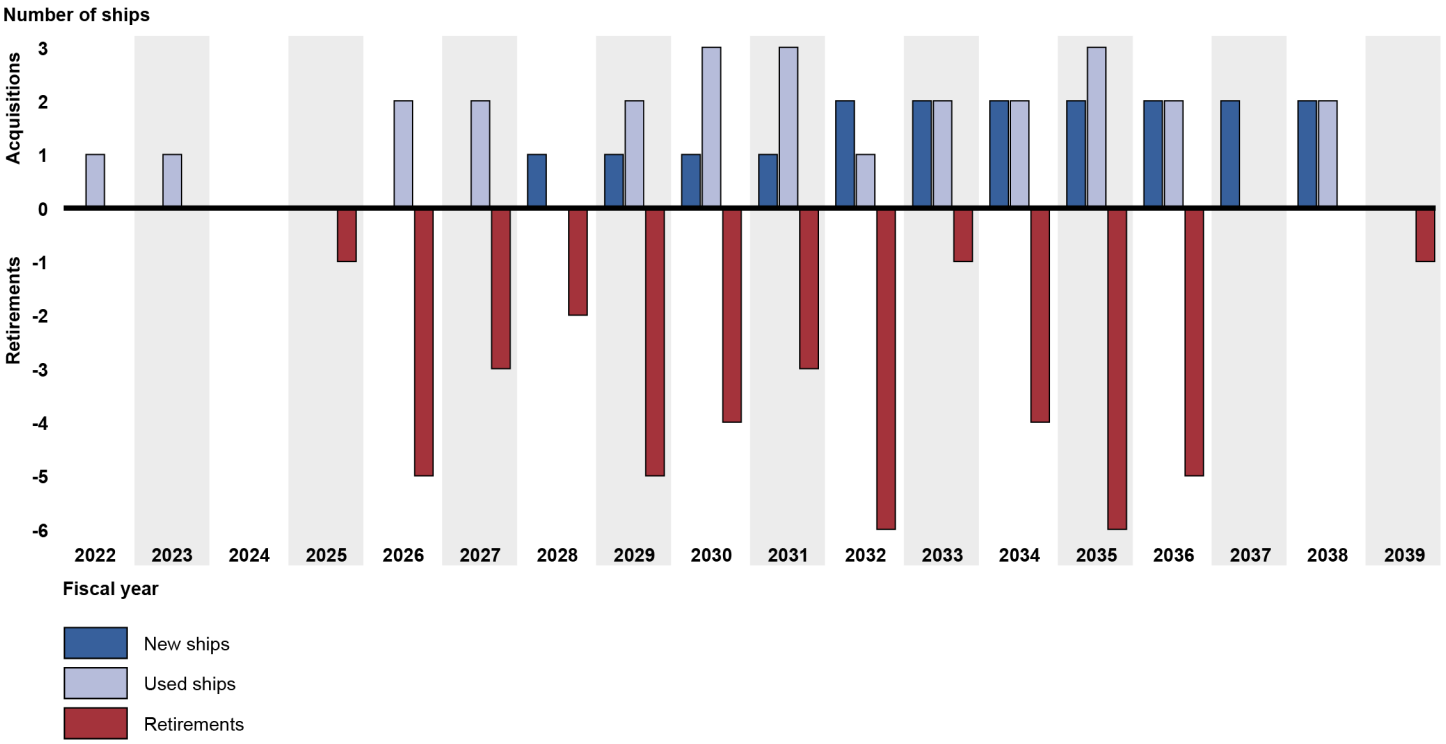
The Navy also has been pursuing the acquisition of replacement ships for its aging surge-sealift fleet as part of a long-term recapitalization plan. In August 2017, we reported concerns about the age of the surge-sealift fleet and its extended maintenance periods.[55] The Navy's sealift recapitalization plan involves three phases: (1) extension of the service life of certain aging sealift ships by 10 years; (2) acquisition of used commercial sealift ships; and (3) building of new sealift ships based on a common-hull multi-mission platform design. Figure 3 shows the sealift recapitalization plan's timeline of ship retirements and replacements.

[53]According to officials, emission control systems assist sealift crews with detecting leftover electromagnetic emissions, such as cell phone signals, which can be detected and located by an adversary.

[54]According to MARAD officials, the new emissions control system does not address acoustic emissions or protect against shore-based high frequency radar detection.

[55]GAO, *NAVY READINESS: Actions Needed to Maintain Viable Surge Sealift and Combat Logistics Fleets*, GAO-17-503 (Washington, D.C.: Aug. 22, 2017).

Figure 3: Projected Sealift Acquisitions and Retirements



Source: GAO presentation of U.S. Navy information. | GAO-21-125

The Navy and MARAD have begun taking action on the recapitalization plan. According to Navy officials, phase 3, the construction of new sealift ships by the Navy, is in the early planning stages. As of July 2020, Navy officials stated that the Navy was still developing a capabilities document that would outline what, if any, defensive capabilities they might require in newly constructed sealift ships. As shown in figure 3, new sealift ships are not expected until 2028.

The Air Force Has Been Equipping Mobility Aircraft with Additional Defensive Technologies and Planning Future Replacement Aircraft

The Air Force, in light of the potential threat to air mobility aircraft in a contested environment, plans to improve the defensive capabilities of its air mobility fleet through an array of technologies. AMC officials stated that certain aircraft are already equipped with some of these technologies. For example, some airlift aircraft have infrared detection and countermeasure technologies that provide them some protection against precision-guided anti-aircraft missiles. According to AMC, air refueling aircraft capabilities are more limited.

According to AMC officials, they plan to acquire additional detection and countermeasure systems for airlift and air-refueling aircraft pending program funding, which they characterized as limited. They are considering an array of new technology options, including:

- New heads-up displays for improved situational awareness;
- Large Aircraft Infrared Countermeasures systems;[56]
- Jam resistant GPS antennas; and
- Updated cockpit systems to support situational awareness.

Additionally, as of May 2020, Air Force officials stated they have been in the early stages of planning for future mobility aircraft. Headquarters Air Force officials were examining options for new airlift aircraft with improved capabilities to operate in a contested environment, such as vertical take-off and landing capability. In addition, Headquarters Air Force officials have been considering ways to leverage other new and developing technologies, such as autonomous systems. Headquarters Air Force officials said that before planning new capabilities, they need to complete their coordination with other military departments to clarify future air mobility requirements. In the interim, they said that they and Joint Staff officials have been developing concepts that would adapt the current air mobility fleet for the future.

In addition, the Air Force has already developed a new aerial refueling aircraft, known as the KC-46A. However, the production of this aircraft has been delayed because of defects.[57] The House Armed Services Committee directed the Air Force to submit a report to the congressional defense committees on the Air Force's 30-year vision for the aerial refueling fleet. [58] The Air Force submitted this report in September 2020.[59] According to the report, the Air Force plans to acquire a total of

[56]Large Aircraft Infrared Countermeasures is a defensive system that combines a Missile Warning System and infrared laser jammer countermeasure system to protect the aircraft from infrared-guided missiles.

[57]In June 2019, we reported that after a nearly 3-year delay, the Air Force conditionally accepted the first KC-46A aircraft—but with critical deficiencies. GAO, *KC-46 TANKER MODERNIZATION: Aircraft Delivery Has Begun, but Deficiencies Could Affect Operations and Will Take Time to Correct*, GAO-19-480 (Washington, D.C.: June 12, 2019).

[58]*See* H.R. Rep. No. 116-120, at 26-27 (2019) (directing the Air Force to submit a report on the 30-year vision for the tanker force structure).

[59]Department of the Air Force. *Report to Congressional Committees: Tanker Force Structure and Modernization. (September 2020).*

179 KC-46A aircraft by 2029. Moreover, the report highlights the Air Force's development of a capabilities document for future advanced aerial refueling aircraft. Specifically, the Air Force is identifying capabilities, such as battlespace awareness and self-protection for contested environments in the year 2030 and beyond. However, according to Air Force officials, future plans and procurement of advanced aerial refueling aircraft is contingent on future program funding.

USTRANSCOM Has Been Updating Contracts to Address Cyber Threats and Funding Research and Development Projects

According to USTRANSCOM, the command has been updating its contracts with commercial partners to ensure that their information technology has adequate cyber security protections. The contract updates are to help protect the approximately 90 percent of USTRANSCOM's unclassified communications that are conducted over commercial networking systems and are vulnerable to cyber attacks. Specifically, according to USTRANSCOM officials, they added language to certain contracts that require contractors to comply with cyber security standards as prescribed by the National Institute of Standards and Technology. These standards pertain to basic cyber security requirements, such as access control, awareness and training, reporting of incidents, audit and accountability, and risk assessment.[60]

In addition, USTRANSCOM, in collaboration with other DOD organizations, has been funding research and development projects for future technologies that could further help mitigate contested environment threats and concerns, as shown in table 2. USTRANSCOM projects an average budget for research, development, test and experimentation of approximately $29.6 million. USTRANSCOM has used the funds for projects in its priority areas. USTRANSCOM's 2020 call for government-proposed research, development, test and evaluation projects highlighted priority areas such as the cyber and electronic security of mobility platforms and delivery technologies that provide delivery and sustainment in an anti-access/area denial environment.

[60]National Institute of Standards and Technology, Special Publication 800-171*, Protecting Controlled Unclassified Information in Nonfederal Systems and Organizations* (revision 2, Feb. 2020).

Table 2: Examples of U.S. Transportation Command Research and Development Programs

Project	Project Description
Resilient Expeditionary Agile Littoral Logistics	Littoral-based structures that support fuel and resupply operations within an anti-access/area denial environment.
Expedient and Expeditionary Airfield Damage Repair	Provides rapid repair of aircraft operational surfaces damaged from adversarial attack.
Unmanned Logistics Systems	An assessment of varying unmanned air systems' abilities to distribute supplies and equipment to warfighters at the edge of the battlefield.
35K Airdrop	Extends the C-17's airdrop capability to an altitude of 35,000 feet as a means to improve aircraft and aircrew safety and provide offset delivery options.
Web-based Seaport Explosive Safety Planning	Computer program that is used to rapidly analyze the movement and storage of ammunitions at seaports.
End-to-End Deployment and Distribution Modeling	State of the art modeling programs used to plan and schedule global airlift and sealift transportation for major future military operations.

Source: GAO analysis of USTRANSCOM information. | GAO-21-125

Note: With the exception of the End-to-End Deployment and Distribution Modeling project listed, all other projects are collaboratively funded as part of the Department of Defense's initiatives. This collaboration brings together the other combatant commands, the military services and USTRANSCOM to develop new and viable capabilities to mitigate contested environment threats.

USTRANSCOM officials said that their annual research, development, test and evaluation budget only allows funding for initial research of the projects, and that acquisitions are coordinated through the military departments.

Conclusions

Russia and China will continue to improve their militaries and threaten DOD's mobility capability, without which the U.S. military would not be able to project force around the world. DOD and its think tanks have conducted a number of contested mobility-related studies in recent years, and DOD has used the studies to inform planning and decision making, according to DOD officials. However, DOD cannot account for the implementation, as appropriate, of all the studies' recommendations. DOD may be missing opportunities to leverage existing studies to further mitigate threats before they contest DOD mobility in an actual military contingency.

DOD has also updated a variety of mobility forces exercises and training. However, training requirements for the U.S. citizen mariners who are contracted to crew surge-sealift ships that might have to operate in contested environments have not been evaluated and updated as appropriate. Because sealift accounts for the majority of military equipment that is transported for major military operations, the ability of sealift to operate in a contested environment is critical to supporting the U.S. military's global operations.

Recommendations for Executive Action

We are making a total of three recommendations, including two to DOD and one to the Department of Transportation. Specifically:

The Secretary of Defense should ensure the designation of an oversight entity to evaluate the results of contested mobility studies and track the implementation of recommendations deemed appropriate. (Recommendation 1)

The Secretary of Defense, in coordination with the Chairman of the Joint Chiefs of Staff, should ensure that the Secretary of the Navy and the Commander of U.S. Transportation Command, in coordination with the Department of Transportation's Maritime Administrator, evaluate surge-sealift crew training and related guidance to ensure it reflects the skills and competencies that might be required of sealift crews in a contested environment. (Recommendation 2)

The Secretary of Transportation should ensure that the Maritime Administrator, in coordination with the Secretary of the Navy and the Commander of U.S. Transportation Command, updates surge-sealift crew training, as appropriate and feasible, to reflect the results of the training evaluation conducted by DOD. (Recommendation 3)

Agency Comments and Our Evaluation

We provided a draft of this report to DOD and the Department of Transportation for review and comment. DOD partially concurred with our first recommendation, and concurred with our second and third recommendations. The Department of Transportation partially concurred with our third recommendation. Their comments are reproduced in appendixes II and III. DOD also provided technical comments, which we incorporated as appropriate.

In its comments, DOD concurred with aspects of our first recommendation and proposed to designate an oversight entity to coordinate the results of contested mobility studies and monitor the implementation of recommendations deemed appropriate by study

sponsors. However, DOD's proposal did not include an evaluation of the results of studies by the oversight entity. DOD stated that study sponsors use study results to inform various processes that balance risk with available resources and that once a study recommendation has passed through such a process to become a requirement, it is then appropriately prioritized by the responsible organization. DOD also stated that USTRANSCOM is well positioned to establish a central repository of contested mobility studies, results, and recommendations. While DOD's approach may partially address our concerns, relying on individual study sponsors to prioritize their own recommendations may not account for recommendations that cross organizational boundaries or require more resources than the sponsoring organization typically receives. We continue to believe that the oversight entity should evaluate the results of studies.

In its comments, the Department of Transportation partially concurred with our third recommendation for MARAD. The Department of Transportation stated that they believe DOD, not MARAD, is better suited to determine the skills and competencies that sealift crews will need in a contested environment. DOD is responsible, the Department of Transportation stated, for identifying requirements for operating sealift ships through a contested environment. They further stated that if DOD identified and documented requirements, and developed and implemented a comprehensive, relevant and structured training schema, MARAD would be in a position to determine if updates to surge sealift crew training were feasible and appropriate in terms of the level of resources and coordination required to implement such training. We believe that the Department of Transportation's concerns are addressed by the sequencing and structure of our recommendations 2 and 3 as written, and that the Secretary of Transportation should coordinate with DOD to evaluate and update sealift crew training.

We are sending copies of this report to the appropriate congressional committees, the Secretary of Defense; the Secretary of Transportation; the Secretary of the Air Force; the Secretary of the Navy; the Commanders of USTRANSCOM, U.S. European Command, U.S. Indo-Pacific Command; and the Department of Transportation's Maritime Administrator. In addition, the report is available at no charge on the GAO website at https://www.gao.gov.

If you or your staff have any questions about this report or need additional information, please contact me at (202) 512-5431 or russellc@gao.gov. Contact points for our Offices of Congressional Relations and Public

Affairs may be found on the last page of this report. Key contributors to this report are listed in appendix IV.

Cary Russell
Director, Defense Capabilities and Management

List of Committees

The Honorable Jack Reed
Chair
The Honorable James M. Inhofe
Ranking Member
Committee on Armed Services
United States Senate

The Honorable Jon Tester
Chair
The Honorable Richard Shelby
Ranking Member
Subcommittee on Defense
Committee on Appropriations
United States Senate

The Honorable Adam Smith
Chair
The Honorable Mike Rogers
Ranking Member
Committee on Armed Services
House of Representatives

The Honorable Betty McCollum
Chair
The Honorable Ken Calvert
Ranking Member
Subcommittee on Defense
Committee on Appropriations
House of Representatives

Appendix I: Department of Defense (DOD) Studies on Contested Mobility

We identified 11 studies that DOD and its think tanks conducted from 2016 through 2019 for which unclassified information was available. Summary information on these studies is provided in the tables below.

Table 3: Global Mobility Strategic Portfolio Review Final Report

Sponsoring Office	The Secretary of Defense
Study Author	U.S. Transportation Command
Approximate Cost	$896,000, according to the report.
Completion Date	November 2016
Total Recommendations	We did not obtain unclassified information about the recommendations from this report.
Summary of Methodology	We did not obtain unclassified information about the methodology of this report.

Source: GAO analysis of DOD information. | GAO-21-125

Table 4: Final Report of the Defense Science Board (DSB) Task Force on Survivable Logistics

Sponsoring Office	The Under Secretary of Defense for Acquisition, Technology, and Logistics
Study Author	Defense Science Board Task Force on Survivable Logistics
Approximate Cost	GAO did not obtain the cost of this report.
Completion Date	November 2018
Total Recommendations	11
Summary of Methodology	According to the Executive Summary of the Task Force on Survivable Logistics, they examined the threats posed by strategic competitors to U.S. military logistics and provided recommendations for remedying the challenges that could be exploited in a strategic competition. From May 2017 to July 2018, the Survivable Logistics Task Force convened to receive briefings and to collect information about the state of the joint logistics enterprise and adversary threats to military logistics. Experts consulted included active duty logistics professionals from the Army, the Navy, the Air Force, and the Marines; retired senior military leadership; members of the Intelligence Community; scholars; and industry leaders focusing on the development of technologies relevant to the future of the joint logistics enterprise.

Source: GAO analysis of information from the Defense Science Board Task Force on Survivable Logistics Executive Summary. | GAO-21-125

Table 5: Protecting the North Atlantic Sea Lines of Communication

Sponsoring Office	Naval Forces Europe-Africa
Study Author	Center for Naval Analyses
Approximate Cost	$440,000, according to the Center for Naval Analyses.
Completion Date	May 2018
Total Recommendations	15
Summary of Methodology	According to the Center for Naval Analyses, they were asked to study the vulnerabilities to the movement of warfighting materiel along the sea-lines of communication in a European conflict scenario and to determine protective measures to mitigate vulnerabilities. They stated that they conducted a comparative analysis of the threat in 2018 to the threat in the 1980s, and studied the susceptibility of logistics ships to different kinds of modern attack.

Source: GAO analysis of Center for Naval Analyses information. | GAO-21-125

Table 6: USTRANSCOM Wargame 2016: Contested Environment, Final Report

Sponsoring Office	U.S. Transportation Command (USTRANSCOM)
Study Author	Center for Naval Analyses
Approximate Cost	According to the Center for Naval Analyses, the cost for both this study, and the 2017 Wargame in the next table, was $750,000.
Completion Date	February 2017
Total Recommendations	10
Summary of Methodology	According to officials from the Center for Naval Analyses, they worked with USTRANSCOM to develop a wargame to explore USTRANSCOM's challenges associated with contested transportation and logistics. They held focus groups of officers of different levels. They gave each group scenarios and factors that were used to brainstorm potential threats and mitigations. The lists of threats and mitigations were refined through voting and input from the other focus group.

Source: GAO analysis of Center for Naval Analyses information. | GAO-21-125

Table 7: USTRANSCOM Wargame 2017: Final Report

Sponsoring Office	U.S. Transportation Command (USTRANSCOM)
Study Author	Center for Naval Analyses
Approximate Cost	According to the Center for Naval Analysis, the cost for both this study, and the 2016 Wargame in the previous table, was $750,000.
Completion Date	December 2017

Total Recommendations	5
Summary of Methodology	According to the Center for Naval Analyses, to explore opportunities to enhance operational resiliency and identify the potential effects of an adversary's efforts to degrade logistics operations they, in concert with USTRANSCOM, developed and executed USTRANSCOM Wargame 2017 – a classified wargame held on October 16-18, 2017. Concurrently, USTRANSCOM hosted an unclassified Senior Leadership Seminar with representatives from commercial partners to explore the risks associated with executing operations in kinetic and cyber-challenged environments. The wargame analysis considered ground rules, mechanics, and a summary of major movements, summarized the Senior Leadership Seminar and the key discussion topics, and provided insights and recommendations based on the actions and discussions from both the wargame and the Seminar.

Source: GAO analysis of Center for Naval Analyses information. | GAO-21-125

Table 8: Evaluation of Vulnerabilities of Air and Sea Lines of Communication in Contested and Degraded Operating Environments

Sponsoring Office	U.S. Transportation Command
Study Author	RAND National Defense Research Institute
Approximate Cost	$1,300,000. According to USTRANSCOM, this was the cost for a RAND study on attrition underlying this report.
Completion Date	July 2019
Total Recommendations	According to U. S. Transportation Command, information about recommendations from this report is classified.
Summary of Methodology	According to RAND, the authors of this study (1) quantified attrition of sealift assets based on air, surface, and sub-surface attacks, (2) quantified attrition of airlift and air tanker assets based on air and missile kinetic attacks, (3) noted potential impact of attacks on strategic movement, and (4) illustrated potential challenges associated with non-kinetic attacks, such as cyber-attacks. Specifically, the authors used sea combat and air combat models to describe the attrition of strategic lift.

Source: GAO analysis of DOD and RAND information. | GAO-21-125

Table 9: Evaluation of Vulnerabilities and Mitigation Options for Strategic Lift and Tanker Operations within Denied Environments

Sponsoring Office	U.S. Transportation Command and Joint Staff J-4
Study Author	RAND National Defense Research Institute
Approximate Cost	$900,000, according to DOD officials.
Completion Date	July 2019

Total Recommendations	2
Summary of Methodology	According to RAND, the study authors identified vulnerabilities of tanker, airlift forces, and other land-based air forces to ballistic and cruise missile attacks from potential adversaries in the U.S. Indo-Pacific Command and U.S. European Command theaters. They also examined the degree that existing and evolving active and passive defenses might mitigate these vulnerabilities. The analysis further investigated the trade-off between selected war reserve materiel storage postures, costs, and the time to transport materiel from storage to point of use within given constraints and then evaluated the impact of these trade-offs on strategic lift requirements.

Source: GAO analysis of DOD and RAND information. | GAO-21-125

Table 10: Future Deployment and Distribution Assessment FDDA VI, Assumptions and Attritive Effects: The Degradation of Mobility Capabilities in a Contested Environment

Sponsoring Office	U.S. Transportation Command
Study Author	U.S. Transportation Command
Approximate Cost	GAO did not obtain the cost of this report.
Completion Date	February 2018
Total Recommendations	3
Summary of Methodology	According to the study, the study authors considered the degradation of mobility capabilities—and how the potential for that diminution might be expressed in the assumptions made about the global distribution network. The authors reviewed more than 200 assumptions and discovered that many were vulnerable when evaluated within the perspective of the contested environment and its associated impacts. The authors also presented a five-step assumptions and attrition framework for identifying and assessing assumptions made about mobility lift assets and infrastructure.

Source: GAO analysis of DOD information. | GAO-21-125

Table 11: Mobility Capabilities and Requirements Study 2018

Sponsoring Office	[a]
Study Author	U.S. Transportation Command (USTRANSCOM) and the Office of Cost Assessment and Program Evaluation
Approximate Cost	GAO did not obtain the cost of this report.
Completion Date	February 2019
Total Recommendations	The unclassified summary of the Mobility Capabilities and Requirements Study 2018 did not include any recommendations.

Summary of Methodology	According to the unclassified summary of the Mobility Capabilities and Requirements Study 2018, the study authors estimated the number of airlift, tanker aircraft, and sealift ships, to include commercial airlift and sealift assets, needed to meet combatant commander mobility requirements. The authors focused significantly on identifying mobility impacts in contested environments based on credible threat estimates, which focused on the adversary's capabilities and intent to disrupt mobility operations. Finally, the authors measured operational risk based on the Chairman of the Joint Chiefs of Staff risk management classifications.

Source: GAO analysis of DOD information. | GAO-21-125

[a]In January 2019, DOD produced this mobility capabilities requirements study in response to a requirement to do so in the National Defense Authorization Act for Fiscal Year 2018. Pub. L. No. 115-91, § 144(b) (2017). Subsequently, the National Defense Authorization Act for Fiscal Year 2020 required the Commander, USTRANSCOM, in coordination with other DOD officials, to conduct another mobility capabilities requirements study. Pub. L. No. 116-92, § 1712 (2019). USTRANSCOM is to conduct a study of the end-to-end, full-spectrum mobility requirements to fulfill the 2018 National Defense Strategy, including, among other things: (1) an assessment of the ability of airlift, aerial refueling, sealift, and key enablers to meet the integrated mobility requirements within expected strategic environments, as defined by guidance in the 2018 National Defense Strategy; (2) an identification and quantification of associated risk-to-mission required to fulfill such strategy, including risk-to-mission associated with achieving strategic and operational objectives; (3) an identification of capability gaps, shortfalls, overlaps, or excesses; and (4) the articulation of all key assumptions and decisions made with respect to a list of specific elements, including anticipated attrition rates and programmed forces and infrastructure, among others.

Table 12: Options to Enhance Air Mobility in Anti-Access/Area Denial Environments

Sponsoring Office	Air Mobility Command
Study Author	RAND Project Air Force
Approximate Cost	According to Air Mobility Command officials, this report came from a study that resulted in 3 reports. According to the officials, the total cost of the study was $1,658,036.
Completion Date	June 2020. However, according to Air Mobility Command officials, that was the date that the report was "printed," while the report was actually distributed to them in March 2019.
Total Recommendations	9
Summary of Methodology	We did not obtain unclassified information about the methodology of this report.

Source: GAO analysis of DOD information. | GAO-21-125

Table 13: Assessing Survivability Options for Air Refueling Tankers

Sponsoring Office	Air Mobility Command
Study Author	RAND Project Air Force
Approximate Cost	According to Air Mobility Command officials, this report came from a study that resulted in 3 reports. According to the officials, the total cost of the study was $1,658,036.
Completion Date	June 2020. However, according to Air Mobility Command officials, that was the date that the report was “printed,” while the report was actually distributed to them in March 2019.
Total Recommendations	4
Summary of Methodology	We did not obtain unclassified information about the methodology of this report.

Source: GAO analysis of DOD information. | GAO-21-125

Appendix II: Comments from the Department of Defense

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THE JOINT STAFF
WASHINGTON, DC

3 February 2021

Mr. Cary Russell
Director, Defense Capabilities Management, U.S. Government Accountability Office
441 G Street, NW
Washington, DC 20548

Dear Mr. Russell:

This is the Department of Defense (DoD) response to Government Accountability Office (GAO) Draft Report GAO-21-125, "DEFENSE TRANSPORTATION: DOD Can Better Leverage Existing Contested Mobility Studies and Improve Training," December 9, 2020.

DoD appreciates the opportunity to review and comment on the draft report. Our review did not discover any classified or controlled information unsuitable for public release.

DoD partially concurs with recommendation 1, that the Secretary of Defense (SecDef) should ensure the designation of an oversight entity to evaluate the results of contested mobility studies and track the implementation of recommendations deemed appropriate. Detailed comment and rationale are provided in Enclosure A.

DoD concurs with recommendation 2, that the SecDef, in coordination with the Chairman of the Joint Chiefs of Staff, should ensure that the Secretary of the Navy (SecNav) and the Commander of U.S. Transportation Command, in coordination with the Department of Transportation's Maritime Administrator, evaluate surge sealift crew training and related guidance to ensure it reflects the skills and competencies that might be required of sealift crews in a contested environment. Detailed comment is provided in Enclosure A.

DoD concurs with recommendation 3, that the Secretary of Transportation should ensure that the Maritime Administrator, in coordination with the SecNav and the Commander, U.S. Transportation Command, updates surge sealift crew training, as appropriate and feasible, to reflect the results of the training evaluation conducted by DoD. Detailed comment is provided in Enclosure A.

Technical comments intended to provide context and improve the accuracy, clarity, and consistency of the draft report are also included in Enclosure B.

Sincerely,

WILLIAM D. BYRNE, JR., RADM, USN
Vice Director, Joint Staff

Enclosures:
As stated

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GAO DRAFT REPORT DATED JANUARY 1, 2021
GAO-21-125

"DEFENSE TRANSPORTATION: DOD Can Better Leverage Existing Contested Mobility Studies and Improve Training"

DEPARTMENT OF DEFENSE COMMENTS TO THE GAO RECOMMENDATION

Recommendation 1: The Secretary of Defense (SecDef) should ensure the designation of an oversight entity to evaluate the results of contested mobility studies and track the implementation of recommendations deemed appropriate.

DoD Response: The Department of Defense (DoD) partially concurs with this recommendation. The DoD proposes to designate an oversight entity to coordinate the results of contested mobility studies and monitor the implementation of recommendations deemed appropriate by the study sponsor. Study recommendations are not, in and of themselves, requirements. Sponsoring entities such as Combatant Commands (CCMDs) or Services conduct these studies to answer very specific analytic questions. The sponsors then use results/recommendations to inform the development of CCMD Integrated Priority Lists, Service Program Objective Memorandums (POMs) and/or other Joint Capability Integrated Development System processes, as appropriate. Inherent to these processes is the need to balance risk with available resources. Once a study recommendation has passed through this rigorous process and becomes a requirement, it is appropriately prioritized by the responsible CCMD or Service. Commander, U.S. Transportation Command (CDRUSTRANSCOM), as the Joint Deployment and Distribution Coordinator (JDDC), is well positioned to establish a central repository of contested mobility studies, results, and recommendations. As the study sponsoring organization deems requirements arising out of these studies appropriate, and implements them accordingly, the JDDC can track within the Joint Deployment and Distribution Enterprise (JDDE) governance structure and coordinate between JDDE stakeholders to ensure efforts to mitigate contested mobility challenges remain synchronized across the enterprise.

Recommendation 2: The SecDef, in coordination with the Chairman of the Joint Chiefs of Staff, should ensure that the Secretary of the Navy (SecNav) and the CDRUSTRANSCOM, in coordination with the Department of Transportation's Maritime Administrator, evaluate surge sealift crew training and related guidance to ensure it reflects the skills and competencies that might be required of sealift crews in a contested environment.

DoD Response: The DoD concurs with this recommendation. USTRANSCOM, through the Military Sealift Command (MSC), utilizes Strategic Sealift Officers (SSOs), Tactical Advisors (TACADs), and mobile secure communications teams to enhance/enable ships that need those specific capabilities, in accordance with Contested Environment assessments. Based on CLASSIFIED-level Operation Plans' (OPLANS') description of the contested environment, USTRANSCOM will continue to update its assessments of threats posed to mobility operations. These assessments assist in informing any future updates to Office of

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the Chief of Naval Operations (OPNAV) OPNAVINST Instruction 3501.119C, "Required Operational Capabilities (ROC) and Projected Operational Environment (POE) for Strategic Sealift Ships," which serves as the basis for defining required sealift crews' training requirements. The Navy (OPNAV N42) is currently working with MSC, Maritime Administrator (MARAD), and USTRANSCOM on the next update to OPNANVINST 3501.199. MSC is responsible for the identification and execution of training, including funding required to meet operational requirements. OPNAV N42, as Resource Sponsor for MSC, is responsible for evaluating funding issues and programming funds necessary to meet operational requirements.

Recommendation 3: The Secretary of Transportation should ensure that the MARAD, in coordination with the SecNav and the CDRUSTRANSCOM, updates surge sealift crew training, as appropriate and feasible, to reflect the results of the training evaluation conducted byDoD.

DoD Response: The DoD concurs with this recommendation. Per the 2009 DoD/Department of Transportation Memorandum of Agreement (para 6.d), MARAD is responsible for updating the required funding to implement the training outlined for them to execute. MARAD's Office of National Coordinator of Maritime Education and Training is responsible for tracking and evaluation of the training. Once these Contested Environment informed requirements have been agreed to and established in Navy and/or MARAD guidance, USTRANSCOM can incorporate them into the Command's training plan and exercises as appropriate.

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Appendix III: Comments from the Department of Transportation

U.S. Department of Transportation
Office of the Secretary of Transportation

Assistant Secretary for Administration

1200 New Jersey Avenue, SE
Washington, DC 20590

January 22, 2021

Cary Russell
Director, Defense Capabilities and Management
U.S. Government Accountability Office (GAO)
441 G Street NW
Washington, DC 20548

Dear Mr. Russell:

The Maritime Administration's (MARAD) top priority is to foster and promote the merchant marine to be sufficient for the Nation's foreign and domestic commerce, and capable of serving as a naval and military auxiliary in time of war or national emergency. Safety is the number one priority for the Department and a safe and reliable Marine Transportation System includes emphasis on a trained workforce. As the Merchant Marine Act of 1936 charges MARAD with supporting the education of licensed merchant mariners, the growing and changing contested environment that sealift ships may operate in the future will require new skills and competencies for the crews assigned to these government ships.

MARAD has been a proponent of change to make the merchant marine more resilient and less susceptible to the effects of a contested environment by:

- Issuing of warnings to mariners for GPS interference through the Maritime Security Communications with Industry process;
- Actively coordinating across the Department of Transportation for assured positioning, navigation, and timing; focus on activities that could affect the electromagnetic spectrum; and supporting the bi-annual revision of the Federal Radionavigation Plan;
- Participating in the Maritime Navigation Steering Group led by the Associate Director for Operations, National Geospatial-Intelligence Agency, and the Navigator of the Navy, established to focus on safety of navigation issues;
- Participating in the Navy's Military Sealift Command's Contested Environment Working Group from inception through its dissolution in February 2019;
- Working with Navy Reserve to establish a billet in December 2020 at MARAD, for greater oversight and coordination with the Strategic Sealift Officer program; and
- Deploying redundant satellite communications systems for Ready Reserve Force vessels activated for DOD missions.

Upon review of GAO's draft report, we partially concur with recommendation three that the "Secretary of Transportation should ensure that the Maritime Administrator, in coordination with the Secretary of the Navy and the Commander of the U.S. Transportation Command, updates surge sealift crew training, as appropriate and feasible, to reflect the results of the training evaluation conducted by the Department of Defense (DOD)." Specifically, we believe that DOD, not MARAD, is best suited to determine the skills and competencies that sealift crews will need in a contested environment, because DOD is responsible for identifying requirements for operating sealift ships through a contested environment. After DOD identifies and documents requirements, and develops and implements a comprehensive, relevant and structured training schema, MARAD will be in a position to determine if updates to surge sealift crew training is feasible and appropriate in terms of the level of resources and coordination required to implement such training.

We appreciate the opportunity to respond to the GAO draft report. Please contact Madeline M. Chulumovich, Director Audit Relations and Program Improvement, at (202) 366-6512 with any questions or if you would like to obtain additional details.

Sincerely,

Deputy Assistant Secretary for Administration

Appendix IV: GAO Contact and Staff Acknowledgments

GAO Contact

Cary Russell, (202) 512-5431 or russellc@gao.gov

Staff Acknowledgments

In addition to the contact named above, Guy LoFaro (Assistant Director), Usman Ahmad (Analyst-in-Charge), Pamela Davidson, David Jones, Mae Jones, Alejandro Oliva, Madhav Panwar, Richard Powelson, Michael Shaughnessy, and McKenna Storey made key contributions to this report.