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AIR FORCE TRAINING

Actions Needed to Better Manage and Determine Costs of Virtual Training Efforts

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Why GAO Did This Study

Over the last 20 years, the Air Force has sought ways to expand its approaches to meeting aircrew training requirements, including the increased use of virtual training. In 2012, the Air Force reduced live flying hours, which it estimates will save $1.7 billion in fiscal years 2012 through 2016, as part of its response to the Secretary of Defense's efficiency initiatives. GAO conducted this study in response to House Report 112-78, accompanying a bill for the Fiscal Year 2012 National Defense Authorization Act, which directed GAO to review the status of the military services' virtual training programs. Specifically, GAO assessed (1) how the Air Force determines the mix of live and virtual training to meet training requirements; (2) the extent to which the Air Force has an overarching organizational framework to guide, oversee, and integrate its virtual training efforts; and (3) the extent to which the Air Force considered costs related to virtual training in estimating potential savings from its training efficiency initiative. To do so, GAO analyzed guidance and other documents, visited virtual training facilities, and interviewed officials from the Office of the Secretary of Defense, the Joint Staff, and the Air Force.

What GAO Recommends

GAO recommends that the Air Force designate an entity to integrate its virtual training efforts, develop a strategy to align virtual training initiatives and goals, and develop a methodology to collect virtual training cost data. DOD concurred with GAO's recommendations and identified planned actions.

View GAO-12-727. For more information, contact Sharon Pickup at (202) 512-9619 or pickups@gao.gov.

What GAO Found

The three lead Air Force major commands—Air Mobility Command, Air Force Special Operations Command, and Air Combat Command—all utilize training requirements review boards composed of subject-matter experts to determine training requirements for specific aircraft. These boards determine which training requirements can be completed in live or virtual environments based upon factors such as specific combatant command mission requirements and the capabilities of fielded simulators and networks. All three commands use a combination of live and virtual approaches, but the mix varies by aircraft. For example, Air Combat Command specifies that approximately 25 percent of its training requirements could be met virtually. The other two commands conduct approximately 50 percent of their training virtually.

The Air Force has taken steps to manage its virtual training efforts, but its approach lacks some key elements of an overarching organizational framework needed to fully integrate efforts and address challenges. It has reorganized offices and undertaken various initiatives intended to enhance existing virtual training capabilities, but has not designated an entity to integrate these efforts or developed an overarching strategy to define goals, align efforts, and establish investment priorities. As a result, major commands have developed their own investment plans and standards for acquiring and fielding virtual training systems, which are often not interoperable and require costly, time-consuming work-arounds to allow personnel to train together and with joint and coalition partners. GAO's prior work has found that a designated entity with the necessary authority and resources and an overarching strategy are critical elements of managing organizational transformations and meeting long-term goals and agency missions. In the absence of an approach that establishes clear accountability and a strategy to guide its planning and investment decisions, the Air Force will continue to be challenged to guide the efforts of its commands in planning for and investing in virtual training, ensure these efforts meet the highest priority needs and are synchronized to avoid gaps or future interoperability issues, and maximize available resources.

The Air Force estimated it could save about $1.7 billion in its training program by reducing live flying hours and taking other steps, such as increasing the use of virtual training, but it lacks a methodology for determining the costs of virtual training and therefore did not consider these costs in its estimate. The Air Force estimated savings based solely on reductions in live flying hours without considering expenses such as those incurred for aircrew to travel to simulators, contractor personnel to schedule and operate simulators, and purchase of additional simulators. GAO has found that decision makers need visibility over financial data to meet agency goals and effectively use resources. Identifying virtual training costs is challenging because data is spread across multiple program elements in the Air Force's accounting structure. The Air Force completed an initial study in September 2011 that identified some costs related to virtual training, but it concluded these data might not be complete. In the absence of taking further steps to determine the universe of costs and a means to collect and track data, the Air Force will be limited in its ability to make fully informed investment decisions about the mix of live and virtual training in the future.

_____ **United States Government Accountability Office**

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United States Government Accountability Office
Washington, DC 20548

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Over the past two decades, the Air Force has sought ways to move beyond the use of live flying to meet aircrew training requirements. One alternative it has pursued is to increase its use of virtual training, which utilizes simulators and information networks to bring together geographically separated units in order to conduct training.[1] Virtual training allows personnel to replicate required training interactions and procedures while reducing fuel costs and avoiding other constraints that can affect live training, such as limited access to ranges. Air Force leadership considers virtual training to be the cornerstone of its training transformation efforts, and the Air Force expects to rely even more heavily on virtual training as it fields new aircraft. Further, among the initiatives developed in response to the Secretary of Defense's direction to find cost savings through increased department-wide efficiency, the Air Force reduced its fiscal year 2012 budget for its flying hour program, which funds live training, by $268 million while calling for an increase in the use of virtual training.

H.R. Rep. No. 112-78 (2011), which accompanied a bill for the National Defense Authorization Act for Fiscal Year 2012, directed us to review the status of the military services' training programs and report the results to

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[1]Virtual training uses aircraft simulators that replicate the live environment for aircrew missions and objectives. Aircraft simulators can be stand-alone or linked to information networks. Further details are provided below.

the House and Senate Armed Services Committees.[2] For this review, we assessed (1) how the Air Force determines the mix of live and virtual training to meet training requirementsL(2) the extent to which the Air Force has an overarching organizational framework to guide, oversee, and integrate its virtual training efforts; and (3) the extent to which the Air Force considered costs related to virtual training in estimating potential savings from its training efficiency initiative. We are reporting separately on the other services.

To address these objectives, we met with officials from the Office of the Secretary of Defense, Joint Staff, Office of the Secretary of the Air Force, Headquarters Air Force, and several Air Force major commands, and visited virtual training facilities. Our review focused primarily on virtual training systems for manned aircraft from combat air forces, mobility air forces, and special operations forces. To determine how the Air Force determines the mix of live and virtual training, we analyzed Air Force studies and assessments of virtual training technologies and capabilities. We also interviewed officials from several major commands and obtained and analyzed training-requirement instructions for combat, mobility, and special operations aircraft. To determine the extent to which the Air Force has developed an overarching organizational framework to guide, oversee, and integrate its virtual training efforts, we met with officials from the above organizations as well as officials from Joint and Coalition Warfighting, Joint Training Integration and Evaluation Center, Navy Air Warfare Center, and the four primary centers that facilitate distributed mission operations. To determine the extent to which the Air Force considered costs related to virtual training in estimating potential savings from its training efficiency initiative, we obtained and analyzed the Air Force efficiency calculation and compared it with cost-saving estimating best practices. We also interviewed officials from the Air Force Defense Contracting Management Organization and Headquarters Air Force budget office, as well as officials from the major commands listed above. More-detailed information about our scope and methodology is provided in appendix I.

We conducted this performance audit from August 2011 to July 2012 in accordance with generally accepted government auditing standards.

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[2]H.R. Rep. No. 112-78 (2011), which accompanied H.R. 1540, a bill for the National Defense Authorization Act for Fiscal Year 2012.

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

For each of their aircraft, the Air Force lead commands set training requirements that aircrews must complete on an annual basis in order to maintain combat mission readiness. These training requirements include basic tasks such as take-offs and landings and also more-advanced tasks, such as air-to-air combat and ground-attack missions. To help meet these requirements, the Air Force has developed an approach to training that it terms distributed mission operations. This approach is intended to train units as they expect to fight, maintain readiness, and conduct mission rehearsals in a realistic environment. Distributed mission operations utilizes the integration of virtual (e.g., a person training in a simulator) and constructive (e.g., computer generated) elements to train personnel at geographically separated sites by means of a network. For the purposes of this report, we refer to training that includes a simulator as virtual training.

The Air Force has four primary centers that facilitate distributed mission operations by connecting units and simulators from geographically dispersed areas:[3]

- Distributed Mission Operations Center in Albuquerque, New Mexico, managed by Air Combat Command;

- Distributed Training Operations Center in Des Moines, Iowa, managed by the Air National Guard;

- Warrior Preparation Center in Einsiedlerhof, Germany, managed by U.S. Air Forces Europe; and

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[3]Air Force officials stated that although these are the four primary centers, there are additional centers that conduct distributed mission operations. For example, Air Force Special Operations Command manages a Mission Rehearsal Operations Center at Hurlburt Field, Florida.

- Korean Air Simulation Center in Osan, Republic of Korea, managed by Pacific Air Forces.

The Distributed Mission Operations Center functions as the lead integrator of virtual systems to conduct theater-level exercises and events that include air, land, space, cyber, and maritime virtual assets for Air Force, joint, and coalition partners. These large-scale events, known as virtual flags, are conducted quarterly and last about 2 weeks. In 2011, the Distributed Mission Operations Center trained over 1,400 personnel from the Air Force, Army, Navy, Marines, and coalition forces through this virtual exercise as well as other, small-scale, events.

The Distributed Training Operations Center plans, builds, and manages small-scale events to meet the learning objectives of its customers, mainly Air Combat Command, Air National Guard, and Air Force Reserve Command. These events are short-term, typically lasting 90 minutes. During 2011, the Distributed Training Operations Center conducted over 4,000 events that trained more than 9,500 personnel, of which at least 60 percent were active-duty personnel.

The two overseas virtual training centers provide different capabilities for the commands they support. The Warrior Preparation Center supports training for joint, coalition, and partner-nation forces in the European and African theaters. In addition, the Warrior Preparation Center supports an Air-to-Ground Operations School and three detachments that provide multinational training opportunities. The Korean Air Simulation Center operates constructive simulations that support the air operations in Korea during U.S. Forces Korea operational-level exercises and supports selected exercises for U.S. Forces Japan.

To train its units and personnel, the Air Force conducts distributed mission operations using several different internal Air Force and Department of Defense (DOD) information networks. Some of these key networks, along with their managing organizations, are shown in table 1.

Table 1: Virtual Training Networks

Network	Managed by
Distributed Mission Operations Network	Air Combat Command
Air Reserve Component Network	Air National Guard
Defense Research and Engineering Network	High Performance Computing Modernization Program
Joint Information Operations Range	Deputy Director Joint Force Development
Joint Training Enterprise Network	Deputy Director Joint Force Development
Navy Continuous Training Environment	Navy
Missile Defense Agency Classified Network	Missile Defense Agency
Point-to-Point Connections	Defense Information Systems Agency

Source: Air Combat Command's Distributed Missions Operations Center.

These networks differ according to such factors as security restrictions, bandwidth capacity, data protocols, and support services.

In May 2010, the Secretary of Defense directed DOD to undertake a department-wide efficiency initiative to reduce excess overhead costs and to reinvest the resulting savings in sustaining force structure and modernization. The Air Force identified a number of areas to improve its efficiency, including an initiative, beginning in fiscal year 2012, to decrease training costs by reducing its live flying hour program for its legacy fighter and bomber aircraft by 5 percent and its Air Force Reserve Command F-16 flying hour program by 10 percent.[4] On the basis of this initiative, the Air Force expects to save a total of $1.7 billion from fiscal years 2012 to 2016. The Air Force estimated savings of about $268 million for fiscal year 2012. In discussing the initiative, the Air Force stated that it expected to offset any effect on readiness caused by a reduction in live flying hours by increasing its use of simulators.

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[4]Legacy fighter aircraft are the F-15, F-16, and A-10, and legacy bomber aircraft are the B-1 and B-52.

Air Force Major Commands Determine Their Mix of Live and Virtual Training Based on Various Factors

Currently, the three lead Air Force major commands—Air Mobility Command, Air Force Special Operations Command, and Air Combat Command—have similar processes to determine the mix of live and virtual training, but the mix of training differs across the major commands, and among aircraft within the commands. Air Combat Command is responsible for fighters, bombers, and attack aircraft; Air Mobility Command is responsible for transport and tanker aircraft; and Air Force Special Operations Command is responsible for special-operations aircraft. At each command, training-requirement review boards composed of subject-matter experts meet to consider broad sets of training issues and evaluate training requirements for specific aircraft.[5] The boards consider factors such as specific combatant command mission requirements and the capabilities of simulators and networks that have already been fielded, and determine which training requirements can be completed in a virtual environment and which need to be completed in a live environment. The results of their reviews are reflected in updated training guidance for each type of aircraft. In addition, each of the commands also establishes requirements to improve, acquire, or upgrade training devices to meet mission tasks.

While all three lead major commands rely on both live and virtual training to meet aircrews' training requirements, the mix is different for each major command, as discussed below.

Air Mobility Command

For each aircraft type, Air Mobility Command issues a requirement document that specifies the number of times each task or "event" must be completed for a pilot or aircrew to be certified as mission ready. The document also specifies the percentage of events that can be completed in a simulator. For example, the C-130 requirement document specifies that 50 percent of assault landings may be completed in a simulator and 100 percent of instrument approaches in a simulator. Although live and virtual training requirements vary by aircraft, according to Air Mobility Command officials, approximately 50 percent of aircrew training is conducted in simulators, including all training related to takeoffs, landings,

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[5]Air Mobility Command and Air Combat Command refer to their training-requirement review boards as "Realistic Training Review Boards" while Air Force Special Operations Command refers to its board as a "Simulator and Training System Integrated Product Team."

and instrument approaches.[6] Due to limitations in simulator fidelity, however, training for some special qualifications such as aerial refueling, formation flying, airdrops, and assault landings must periodically be conducted live in the actual aircraft. For example, for aerial refueling, currently, there are differences between what the fighter pilots see in their simulators and what air refueling crews see in their simulators. Because the simulators are currently not able to accurately replicate the aerial refueling environment, simulated training cannot yet replace live training. In developing its virtual training program, Air Mobility Command worked with the Federal Aviation Administration to leverage civilian standards, which require simulators to respond like the actual aircraft in order to be certified for training. Air Mobility Command is currently developing a networked distributed training center that would enable more virtual training with combat air forces and coalition partners.

Air Force Special Operations Command

As Air Mobility Command does, for each aircraft type Air Force Special Operations Command issues a requirement document that specifies the number of times each task or "event" must be completed for a pilot or aircrew to be certified as mission ready and the percentage of events that can be completed in a simulator. Air Force Special Operations Command officials stated that the command's goal is to accomplish up to 50 percent of its aircrew training in simulators depending upon the aircraft. For example, aircrew training requirements for the AC-130U, a close air support aircraft, allows aircrew to accomplish 50 percent of their mission tasks in a simulator. Air Force Special Operations Command based its simulator certification program on the standards and metrics used by the Federal Aviation Administration and Air Mobility Command. Air Force Special Operations Command officials stated that simulators provide training that might not be available in the live environment, such as training for specific locations or adverse weather conditions. Air Force Special Operations Command has a stated goal to perform all qualification and continuation training events in the simulator, while increasing both live and simulator mission rehearsal training.

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[6]Officials noted that percentages can vary due not only to differences in aircraft and simulators but also depending on whether the percentages are based on requirements or events. Some complex requirements might only have to be performed once or twice during each training cycle while other events such as takeoffs and landings have to be performed more regularly.

Air Combat Command

Air Combat Command also issues a requirement document for each type of aircraft on an annual basis. Virtual training requirements vary by aircraft, with large aircraft such as bombers generally able to satisfy more of their training requirements in simulators than fighters. Beginning in fiscal year 2012, Air Combat Command's training-requirement review board revised each aircraft's training requirements and specified that approximately 25 percent of training requirements were to be met using virtual training, while the rest of the requirements were to be met using live training. Prior to this, Air Combat Command training guidance specified that virtual training was to be used as a supplement to live training, but it did not set a goal or specific percentage requirement for virtual training. The virtual training that had been done in those years included emergency procedures, instrumentation training, and tactical training rather than mission training. With the availability of more-advanced full mission-training simulators, aircrews are now able to train beyond these basic tasks to more-advanced air-to-air and air-to-ground combat missions, like suppression of enemy air defenses.

According to Air Combat Command officials, the combat air forces face certain challenges that prevent them from conducting the same level of virtual training as forces from the other major commands. Some challenges arise due to differences between unit and simulator locations, difficulties coordinating distributed training events, and a lack of simulator fidelity. For example, officials stated that there are very few simulators collocated with Reserve component units, which means valuable reserve component training time can be lost travelling to and from the simulators. Officials also noted that the software for some aircraft simulators is two or three versions behind the software in the actual aircraft, which could in some cases, affect the performance of aircrews in the actual aircraft. In addition, fighter simulators cannot replicate the extreme physical effects of air combat maneuvers that fighter pilots experience in the actual aircraft. Fighter pilots we interviewed stated that unlike flying other aircraft such as bombers and transports, fighter pilots must effectively make decisions while conducting their missions in a hostile environment and maneuvering the aircraft through high-speed and high-gravity maneuvers that put stress on the human body. We note that the Navy faces similar challenges in conducting virtual training for its fighter aircrews. For example, the crews of the Navy's F/A-18E/F currently conduct 18 percent of their training through virtual training and plan to increase this to 32 percent by 2020.

The Air Force Has Not Established an Overarching Organizational Framework to Guide, Oversee, and Integrate Virtual Training Efforts

The Air Force has recently taken steps to increase management attention over its virtual training efforts, but its approach to virtual training currently lacks (1) a designated organization with accountability and authority for achieving results and (2) an overarching strategy—key elements of an organizational framework that we have found to be critical for successful transformations in both public and private organizations.[7] In the absence of a framework to structure and guide its virtual training efforts, the Air Force will continue to face challenges in integrating its virtual capabilities and cannot be certain that its efforts align with strategic goals or know whether critical gaps or duplication of efforts exist.

The Air Force Has Increased Management Focus on Virtual Training Efforts, but Oversight Remains Fragmented

According to Air Force leadership, distributed mission operations are the cornerstone of the Air Force training transformation. Additionally, in the *Strategic Plan for the Next Generation of Training*, DOD has emphasized comprehensive training that integrates service and joint capabilities.[8] The Air Force has increased management attention on virtual training efforts by reorganizing and creating new headquarters offices and establishing working groups, but oversight remains fragmented. For instance, in February 2011, the Air Force Agency for Modeling and Simulation was realigned under Headquarters Air Force Director of Operations (A3O) to serve as the execution arm for integrating and implementing virtual capabilities, resources, and policy. Also, in August 2011, the Air Force established the Headquarters Air Force Director of Operations–Operational Training (A3O-CL) office to provide leadership and support to distributed mission operations users across the Air Force. Additionally, in February 2012, Headquarters Air Force established a working group, composed of subject-matter experts from the Distributed Training Centers and the major commands, to address operational challenges within the virtual training programs. Issues unable to be resolved in this forum are elevated to higher-level working groups including the Headquarters Operations Conference, the Modeling and Simulation Steering

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[7]GAO, *Results-Oriented Cultures: Implementation Steps to Assist Mergers and Organizational Transformations,* GAO-03-669 (Washington, D.C.: July 2, 2003).

[8]Office of the Under Secretary of Defense, Personnel & Readiness, Readiness and Training Policy and Programs, *Strategic Plan for the Next Generation of Training for the Department of Defense* (Sept. 23, 2010).

Committee, and finally the Air Force Modeling and Simulation General Officer's Steering Group.

These organizations and working groups have increased management focus on virtual training efforts, but the Air Force has not designated an organization with accountability and oversight authority necessary to integrate all its virtual training efforts, including developing and acquiring interoperable virtual training systems and establishing and enforcing authoritative standards for simulators, constructive elements, and databases. Rather, oversight of standards development, acquisition, sustainment, and integration of training systems is fragmented among various Air Force organizations, as shown in table 2.

Table 2: Air Force Virtual Training Roles

Office	Roles
Headquarters Air Force Director of Operations–Modeling and Simulation (A3O-CM)	Provide modeling and simulation policy, governance, and processes to achieve full benefit of modeling and simulation across Air Force.
Headquarters Air Force Director of Operations–LVC-Operational Training (A3O-CL)	Provide leadership and support, and ensure capabilities are available for live, virtual, and constructive operational training and distributed mission operations.
Air Force Agency for Modeling and Simulation	Provide implementation and support of Air Force, Joint, and DOD modeling and simulation policy and standards.[a]
Air Force lead major commands	Establish standards, tasks, and formal training requirements for training systems, including systems required for distributed mission operation capabilities.
Air Force Materiel Command	Execute research, development, test and evaluation, and oversee distributed mission operations acquisition, sustainment, and support.
Air Force Research Laboratory–Warfighter Readiness Research Division	Execute the research and development for warfighter training systems.
Aeronautical Systems Center–Simulators Division	Execute the acquisition, development, and sustainment of aircraft simulators.
Electronic Systems Center	Develop and acquire systems that combine computers, radars, information displays, and communication gear.
Air Combat Command Distributed Mission Operations Center	Serve as the lead integrator for theater-level distributed mission operations for the Air Force, joint forces, and coalition partners.
Office of Security, Counterintelligence, and Special Program Oversight (SAF/AAZ)	Serve as accrediting authority for distributed mission operation events and exercises to ensure compliance with special-access program policies and procedures.

Source: GAO.

[a]The Air Force Agency for Modeling and Simulation mission directive is currently being revised to include its reassignment as an organizational element of Headquarters Air Force, with updated roles and responsibilities.

In the absence of an organization to guide virtual training efforts, the lead major commands have developed their own standards and acquired and fielded systems that are not interoperable and often require costly, time-consuming work-arounds to be able to train together in large, complex virtual training exercises. For example, in conducting its quarterly virtual flag exercises, the Distributed Mission Operations Center must integrate simulators and networks that have been developed to different standards. To integrate all the participants into the exercises, the center must implement "gateways" that allow dissimilar simulators to translate data; develop databases to provide a common constructive environment; and link numerous Air Force and DOD networks that have different security restrictions, bandwidth limitations, and data transfer protocols.[9] According to officials, developing and implementing these types of solutions takes up to 9 months, and involves significant reliance on contractor personnel. The network configuration must be certified for each virtual flag event and then it must be disassembled, reconfigured, and recertified for subsequent training events. While the Air Force has been developing these work-around solutions to allow interoperability among its older aircraft simulators, similar solutions will be also be needed for Joint Strike Fighter simulators as they are fielded and integrated into distributed mission operations. According to Joint Strike Fighter program office officials, the programs' operational requirement document specifies that the aircraft and simulators must be interoperable with other aircraft and networks, but interoperability is not scheduled to be achieved until later blocks in the program's development. The Air Force's current Joint Strike Fighter simulators are stand-alone and not integrated into distributed mission operations. Like other aircraft simulators, the Joint Strike Fighter simulators will require complex multilevel security guards and gateways to allow them to operate with other aircraft simulators in a distributed mission environment.[10] Joint Strike Fighter program officials stated that since the types of interoperability challenges that they face are not unique but are similar to those of other programs there should not be any unique technical barriers that would prevent solutions to these challenges. Air

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[9]Gateways are information-technology solutions that translate data between simulators that were developed using different simulation standards.

[10]A multilevel security guard is a computer software program that allows a system to process information with different security classifications, permits access to users with different security clearances, and prevents users from obtaining access to information for which they lack authorization.

Combat Command is also currently assessing the technologies needed to integrate live and virtual training for the Joint Strike Fighter.

Our prior work has found that designating an integration team, vested with the necessary authority and resources, is a critical element of managing the transformation of an organization.[11] We note that the Army and the Navy have each designated an organization with centralized oversight over standards development, acquisition, sustainment, and integration of virtual training systems.[12] Further, the Navy has established guiding principles and investment priorities to assist decision makers in selecting the proper simulator solution for specific training requirements and gaps, and to help avoid interoperability issues. One of the principles states that simulators intended to interface with other simulators must be compatible with the Navy Continuous Training Environment network. A Navy training instruction elaborates on this guiding principle by further stating, "Interoperability is a key objective for Fleet simulators. Translator development is expensive and time consuming, translation slows things down (introduces latency), and translation is never perfect. To reduce the need for translators to overcome interoperability challenges, Navy Continuous Training Environment network technical standards have been adopted Fleet-wide and are mandatory for new simulators that will integrate into Fleet synthetic training."

DOD has called for an approach to training investments that eliminates "after-the-fact" interoperability solutions for training capabilities and the breaking down of stovepipes to achieve an efficient yet realistic training environment.[13] Also, in 2011 the Air Force Agency for Modeling and Simulation developed an Initial Capabilities Document that has been approved by the Joint Requirements Oversight Council and that called for an organization with contracting oversight that could provide specific requirements supporting improved interoperability across the virtual

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[11]GAO, *Results-Oriented Cultures: Implementation Steps to Assist Mergers and Organizational Transformations*, GAO-03-669 (Washington, D.C.: July 2, 2003).

[12]The Program Executive Office—Simulation, Training and Instrumentation (PEO-STRI) is the acquisition and contracting center for live, virtual, and constructive training aids, devices, simulations and simulators for the Army. The Naval Air Warfare Center is the principal Navy center for research, development, test and evaluation, acquisition and product support of training systems.

[13]Office of the Under Secretary of Defense, *Strategic Plan for the Next Generation of Training for Department of Defense* (Sept. 23, 2010).

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training environment.[14] However, the Air Force has not yet identified an organization to perform this oversight. Without a dedicated organization with responsibility and accountability to integrate virtual training efforts, the Air Force may continue to face challenges in managing and integrating its virtual training efforts, including interoperability issues that lead to diminished training quality, fewer training opportunities due to lengthy preparation times, and increased costs.

Individual Air Force Initiatives to Enhance Virtual Training Capabilities Are Not Yet Guided by an Overarching Strategy

The Air Force is currently pursuing a number of individual initiatives to enhance its virtual training capabilities. Among these initiatives are the following:

- Air Mobility Command is planning to create and staff a Distributed Training Center at Scott Air Force Base in December 2012. The training center is initially planned to provide the integration capability needed for transport aircraft simulators to conduct distributed mission operations on a daily, consistent basis and will also provide the ability for these simulators to participate in Distributed Mission Operations Center events. Air Mobility Command also has plans to expand the center's capability to include integration of tanker simulators to train air refueling virtually.

- The Distributed Training Operations Center has increased its capabilities in response to increased user requirements and mission requests by adding personnel and expanding event availability. Additionally, the Distributed Training Operations Center plans to work with the major commands to establish remote capability sites that would be networked to the center to increase distributed mission operations availability across the Air Force. According to Distributed Training Operations Center officials, remote-capability sites have already been established for the Air National Guard in South Dakota and Pacific Air Forces in Alaska.

- Air Combat Command is in the process of establishing a Distributed Training Center at Langley Air Force Base. The training center is intended to provide a focal point for scheduling of combat air forces

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[14]United States Air Force Agency for Modeling and Simulation, *Initial Capabilities Report for Integrating Architecture for Air & Space Live, Virtual, and Constructive Environments (IA-ASLVCE)* (Sept. 12, 2011).

events not involving the Distributed Training Operations Center or Distributed Mission Operations Center. It is also intended to provide scenario development, focused on training gaps, desired unit missions, operational plan missions, and other tactics, techniques, and procedures. The training center is expected to be fully operational in September 2012.

- Air Force Special Operations Command is in the process of establishing a Distributed Training Center at Cannon Air Force Base that will focus on virtual training activities for initial and mission qualification training and unit-level mission essential tasks.

Our prior work has found that strategic planning is a key element of an overarching organizational framework. For example, a leading practice derived from principles established under the Government Performance and Results Act of 1993 is to improve the management of federal agencies by developing comprehensive strategies to address management challenges that threaten their ability to meet long-term goals.[15] We have previously reported that these types of strategies should contain results-oriented goals, performance measures, and expectations with clear linkages to organizational, unit, and individual performance goals to promote accountability and should also be clearly linked to key resource decisions.[16] While the Air Force currently has numerous individual initiatives underway to enhance its virtual training capabilities and is planning to make additional investments, it has not yet developed an overall strategy to guide and integrate these efforts. For example, the Air Force has not outlined overall goals for its virtual training efforts, resource needs, and investment priorities. In the absence of a strategy, the Air Force cannot be certain that its individual initiatives are synchronized and will address its highest priority needs.

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[15]Pub. L. No. 103-62 (1993), as amended by Pub. L. No. 111-352 (2011).

[16]See, for example, GAO, *Highlights of a GAO Roundtable: The Chief Operating Officer Concept: A Potential Strategy to Address Federal Governance Challenges*, GAO-03-192SP (Washington, D.C.: Oct. 4, 2002); *Highlights of a GAO Forum: Mergers and Transformation: Lessons Learned for a Department of Homeland Security and Other Federal Agencies*, GAO-03-293SP (Washington, D.C.: Nov. 14, 2002); *Defense Business Transformation: Achieving Success Requires a Chief Management Officer to Provide Focus and Sustained Leadership*, GAO-07-1072 (Washington, D.C.: Sept. 5, 2007); and *Unmanned Aircraft Systems: Additional Actions Needed to Improve Management and Integration of DOD Efforts to Support Warfighter Needs*, GAO-09-175 (Washington, D.C.: Nov. 14, 2008).

Air Force officials stated that they are currently developing a Live, Virtual, Constructive Flight Plan to serve as their strategy for virtual training. They told us the Flight Plan will provide direction to the major commands on the handling of operational issues and will establish an internal structure for how issues are to be raised and resolved. Officials expect that the Flight Plan will be completed by July 2012. Officials stated that a separate effort will be undertaken to develop an acquisition strategy for virtual training systems. At this point, it is unclear the extent to which these plans will contain the necessary elements of an overall strategy that the Air Force can use to manage and integrate its planning and acquisition efforts.

Air Force Lacks Cost Data for Virtual Training and Did Not Account for Virtual Training Costs When Determining Savings from Its Flying-Hour Efficiency Initiative

In outlining its efficiency initiative related to training, the Air Force estimated potential cost savings of $268 million for fiscal year 2012, and a total of $1.7 billion for fiscal years 2012 to 2016 by among other things, reducing legacy combat Air Force flying hours across the board by 5 percent.[17] The flying-hour efficiency initiative also called for a concurrent increase in the use of high-fidelity simulators and virtual training to avoid any effect on aircrews' mission readiness from the reduction in live flying. However, in estimating costs, the Air Force included the savings associated with reductions in live training but not the potential costs associated with increases in virtual training that were called for to offset the reduction in live training. On the basis of our prior work, cost savings estimates should include all significant costs in order to have a reasonable basis. Additionally, federal internal control standards state that decision makers need visibility over a program's financial data to determine whether the program is meeting the agencies' goals and effectively using resources.[18]

Air Force officials told us that the cost savings associated with the flying-hour efficiency initiative were estimated by multiplying the reductions in live training flying hours for each aircraft by the cost per flying hour for that aircraft, and then adding the resultant figures for all the aircraft to determine total savings. For example, according to numbers provided by the Air Force, the live training cost of 1 F-15E flight hour is approximately

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[17]Department of Defense, *Department of Defense Efficiency Initiatives, Fiscal Year 2012 Budget Estimates* (Feb. 18, 2011).

[18]GAO, *Standards for Internal Control in the Federal Government*, GAO/AIMD-00-21.3.1 (Washington, D.C.: Nov. 1, 1999)

$17,449 and F-15E flying hours were reduced by 1,782 hours. These amounts were multiplied together to arrive at the Air Force's projected total savings of approximately $31,094,000 for reductions in F-15E flight hours. Similar calculations were made for each of the other aircraft that had their flight hours reduced and the savings for all the aircraft were summed.

The Air Force did not consider any potential costs associated with the increase in virtual training in its estimate of cost savings because it has not developed a methodology to collect and track information on the cost of its virtual training program. According to Air Force officials, some training costs could increase as a result of increases in virtual training. These costs could include expenses for aircrew to travel to simulator locations, additional contractor personnel to schedule and operate simulators, and the purchase of additional simulators to meet increased demand. Furthermore, according to Air Force officials, identifying virtual training costs is challenging because funds to support virtual training and distributed mission operations are currently dispersed across multiple program elements.[19] For example, our analysis identified a portion of virtual training funding, specifically distributed mission operations funding, in a program element titled "Human Effectiveness Applied Research." In another case, distributed mission operations funding was part of a program element titled "International Activities," under an "Armaments Cooperation" subcategory that also included funding for alternative energy among other things. In 2011, the Air Force conducted a onetime study in an attempt to identify the full cost of its virtual efforts.[20] It found that the total investment in virtual capabilities for fiscal year 2012 was at least $1.9 billion. Of that, operational training support accounted for approximately 50 percent of the annual investment, including the largest identified expenditure of $182.3 million for combat air forces distributed mission operations. However, the study noted that its efforts may not have identified all program elements associated with virtual training and therefore further steps would be needed to capture the full value of the Air Force's virtual training investment. As of May 2012, the Air Force had not

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[19]Program elements are primary units of the Future Years Defense Program programming and budgeting system.

[20]Secretary of the Air Force, Office of Information Dominance and Chief Information Officer, Warfighter Systems Integration, *Air Force Modeling and Simulation Enterprise Management Study* (Sept. 12, 2011).

taken any additional steps to develop a methodology for identifying virtual training costs. Without a means to collect or calculate its virtual training costs, the Air Force lacks the information it needs to make informed investment decisions in the future regarding the mix of live and virtual training. Furthermore, the Air Force will be unable to determine the potential costs associated with its flying-hour efficiency initiative.

Conclusions

In an effort to achieve greater efficiencies in its training program while maintaining mission readiness, the Air Force has taken various steps to emphasize and increase the use of virtual training. Among other things, the Air Force has implemented various initiatives and established organizations intended to enhance its virtual training capabilities. However, none of these organizations have the authority necessary to ensure the integration of the Air Force's virtual training efforts, and oversight remains fragmented. Further, the Air Force lacks an overarching organizational framework to guide its current virtual training efforts and the additional investments it plans to make. In the absence of such a framework, the Air Force faces challenges in managing its current inventory of virtual training systems and has experienced delays and costs that stem from the lack of interoperability among its simulators and networks, resulting in workarounds that are required to compensate for these limitations. An overarching management approach, including a single entity responsible for coordinating and integrating all virtual training efforts, as well as a comprehensive strategy that aligns individual efforts with goals and investment priorities, will not be enough if decision makers lack visibility over the potential costs of virtual training—especially as they consider future changes to the mix of live and virtual training. Until the Air Force has a methodology to consistently collect and track its virtual training costs and a management framework to coordinate its efforts, it will continue to face challenges to planning and conducting its virtual training and informing its future investment decisions.

Recommendations for Executive Action

To develop a fully integrated management approach to guide virtual training efforts and investments, we recommend the Secretary of Defense direct the Secretary of the Air Force to

- designate an entity that is responsible and accountable for integrating all of the Air Force's virtual training efforts, including the development and enforcement of interoperability standards across virtual training systems, and investment planning; and

- develop an overarching strategy to align goals and funding for virtual training efforts across all Air Force major commands. This strategy should at a minimum contain elements such as results-oriented goals, performance measures, and a determination of resources needed to achieve stated goals. In addition, this strategy should show clear linkages between existing and planned initiatives and goals.

To improve decision makers' visibility over the costs related to virtual training, we recommend that the Secretary of Defense direct the Secretary of the Air Force to develop a methodology for collecting and tracking cost data for virtual training and use this cost data to help inform future decisions regarding the mix of live and virtual training.

Agency Comments and Our Evaluation

In written comments on a draft of this report, DOD stated that it concurred with all of our recommendations. In response to our recommendation to designate an entity that is responsible and accountable for integrating all of the Air Force's virtual training efforts, including the development and enforcement of interoperability standards across virtual training systems, and investment planning, DOD stated that the Air Force has taken initial steps to designate its Headquarters, Air Force office, AF/A3/5 (Operations, Plans, and Requirements) as the single entity responsible for integrating the Air Force's virtual training efforts.

In response to our recommendation to develop an overarching strategy to align goals and funding for virtual training efforts across all Air Force major commands, DOD stated that the Air Force is developing an overarching strategy and policy to provide a fully integrated management approach to guide its Live Virtual Constructive-Operational Training efforts and investments. It further stated that operational level guidance will be provided in Air Force Instruction 36-2251, Management of Air Force Training Systems and that investment guidance to link virtual training to "Readiness" was provided in the Air Force's Fiscal Year 2014 Annual Planning and Programming Guidance and Program Objective Memoranda Preparation Instructions.

In response to our recommendation to develop a methodology for collecting and tracking cost data for virtual training and use this cost data to help inform future decisions regarding the mix of live and virtual training, DOD stated that the Air Force is taking actions to improve visibility related to virtual training to inform decisions regarding the mix of live and virtual training. It also stated that the Air Force Instruction regarding Management of Air Force Training Systems will provide major

commands with clear guidance to employ consistent methods to collect and measure virtual training systems data. DOD said the Aviation Resource Management System will be enhanced to provide the capability to capture projected and executed aircraft virtual training and cost data to provide better oversight and management of virtual training funding. Finally, DOD stated that the Air Force is developing a standard methodology of accounting and tracking the programming and execution of program funds through improved visibility into cost categories associated with Live Virtual Constructive-Operational Training. DOD's comments are included in their entirety in appendix II. DOD also provided a number of technical and clarifying comments, which we have incorporated where appropriate.

We are sending copies of this report to appropriate congressional committees, the Secretary of Defense, the Secretary of the Air Force, and the Under Secretary of Defense for Personnel and Readiness. In addition, this report will be available at no charge on our website at http://www.gao.gov.

If you or your staff have any questions about this report, please contact me at (202) 512-9619 or pickups@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made major contributions to this report are listed in appendix III.

Sharon L. Pickup
Director
Defense Capabilities and Management

Appendix I: Scope and Methodology

To address our objectives, we met with officials from the Office of the Secretary of Defense, Joint Staff, Office of the Secretary of the Air Force, Headquarters Air Force, and several Air Force major commands. Our review focused primarily on virtual training systems for manned aircraft from combat air forces, mobility air forces, and special operations forces. Excluded from this review were virtual training programs for unmanned aircraft, space, combat support, and combat service support systems. To determine how the Air Force determines the mix of live and virtual training, we obtained and analyzed training requirement instructions for combat, mobility, and special operations aircraft from each of the three lead major commands—Air Mobility Command, Air Combat Command, and Air Force Special Operations Command. We provided a questionnaire and received written responses from the major commands on the mix of live and virtual training and the benefits, limitations, and challenges of virtual training. We interviewed officials from Air Combat Command, Air Mobility Command, Air Force Special Operations Command, Air National Guard, Air Force Reserve Command, U.S. Air Forces Europe, and Pacific Air Forces.

To determine the extent to which the Air Force has developed an overarching framework to guide, oversee, and integrate its virtual training efforts, we analyzed Air Force studies on virtual training technologies and capabilities. We reviewed relevant Department of Defense (DOD) and Navy training guidance. We also reviewed our ongoing work related to Navy virtual training. We interviewed officials from the Office of the Secretary of the Air Force, Headquarters Air Force, the Joint Staff, the Department of the Navy, Air Force Major Commands, the four primary centers that facilitate distributed mission operations, and joint training officials. We visited Langley Air Force Base, Virginia, to observe F-15 and F-22 simulator operations at the Mission Training Center. We also visited the Distributed Mission Operations Center at Kirtland Air Force Base, New Mexico, to observe a distributed training event and the center's capabilities.

To determine the extent to which the Air Force considered costs related to virtual training in estimating potential savings from its training efficiency initiative, we obtained and analyzed the Air Force efficiency calculation and compared it with cost saving estimating best practices. We analyzed Air Force budget program elements related to virtual training and distributed mission operations. We also analyzed an Air Force study on the cost associated with Air Force modeling and simulation efforts. We interviewed officials from the Air Force Defense Contracting Management

Organization and Headquarters Air Force budget operations office, as well as officials from the major commands listed above.

We conducted this performance audit from August 2011 to July 2012 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.

We interviewed officials, and where appropriate obtained documentation, at the following locations:

- Office of the Secretary of Defense, Office of the Under Secretary of Defense for Personnel and Readiness

- Office of the Under Secretary of the Air Force, Deputy Chief Management Officer

- Joint Staff, J7, Joint and Coalition Warfighting

- Headquarters Air Force, Operations Systems Integration (Live, Virtual, and Constructive–Operational Training)

- Headquarters Air Force, Operations Systems Integration (Air Force Agency for Modeling and Simulation)

- Headquarters Air Force, Operations Integration and Resources

- Headquarters Air Force, Operations Force Management (Force Integration)

- Headquarters Air Force, Air Force Financial Management and Comptroller, Budget Operations Office

- Office of the Secretary of the Air Force, Office of Security, Counterintelligence, and Special Program Oversight

- Air Combat Command, Operations and Training

- Air Mobility Command, Operations and Training

- Air Force Special Operations Command, Operations and Training

- Air National Guard, Operations and Training

- Air Force Reserve Command, Operations and Training

- U.S. Air Forces Europe, Operations and Training

- Pacific Air Forces, Operations and Training

- Air Force Material Command, Aeronautical Systems Center–Simulators Division

- Air Force Space Command, Air Force Network Integration Center, Cross Domain Solutions Office

- Distributed Mission Operations Center

- Distributed Training Operations Center

- Warrior Preparation Center

- Korean Air Simulation Center

- Joint Strike Fighter Program Office

- Joint Training Integration and Evaluation Center

- Navy Naval Air Warfare Center—Training Systems Division

Appendix II: Comments from the Department of Defense

OFFICE OF THE UNDER SECRETARY OF DEFENSE
4000 DEFENSE PENTAGON
WASHINGTON, D.C. 20301-4000

PERSONNEL AND
READINESS

JUL 0 6 2012

Ms. Sharon L. Pickup
Director, Defense Capabilities and Management
U.S. Government Accountability Office
441 G Street, NW
Washington, DC 20548

Dear Ms. Pickup,

This is the Department of Defense (DoD) response to the GAO Report, GAO-12-727, "AIR FORCE TRAINING: Actions Needed to Better Manage and Determine Costs of Virtual Training Efforts," dated June 7, 2012 (GAO Code 351655). Thank you for the opportunity to comment. We concur with the recommendations. Details concerning the recommendations are provided in the enclosure to this letter.

Sincerely,

Laura J. Junor
Deputy Assistant Secretary of Defense
Readiness

GAO DRAFT REPORT DATED JUNE 7, 2012
GAO-12-727 (GAO CODE 351655)

"AIR FORCE TRAINING: ACTIONS NEEDED TO BETTER MANAGE AND
DETERMINE COSTS OF VIRTUAL TRAINING EFFORTS"

DEPARTMENT OF DEFENSE COMMENTS
TO THE GAO RECOMMENDATIONS

RECOMMENDATION 1: To develop a fully integrated management approach to guide virtual training efforts and investments, GAO recommends the Secretary of Defense direct the Secretary of the Air Force to designate an entity that is responsible and accountable for integrating all of the Air Force's virtual training efforts, including the development and enforcement of interoperability standards across virtual training systems, and investment planning.

DoD RESPONSE: Concur. The Air Force has taken initial steps to designate a single entity to develop and enforce interoperability standards across virtual and constructive training communities. AF/A3/5 (Operations, Plans, and Requirements) will be the Air Force's single entity responsible for integrating the Air Force's virtual training efforts.

RECOMMENDATION 2: To develop a fully integrated management approach to guide virtual training efforts and investments, GAO recommends the Secretary of Defense direct the Secretary of the Air Force to develop an overarching strategy to align goals and funding for virtual training efforts across all Air Force major commands. This strategy should at a minimum contain elements such as results-oriented goals, performance measures, and a determination of resources needed to achieve stated goals. In addition, this strategy should show clear linkages between existing and planned initiatives and goals.

DoD RESPONSE: Concur. The Air Force is developing overarching strategy and policy to provide a fully integrated management approach to guide Live Virtual Constructive-Operational Training (LVC-OT) efforts and investments. Operational level guidance, putting the Flight Plan into action, will be provided in Air Force Instruction 36-2251, Management of Air Force Training Systems. In addition, LVC-OT investment guidance was provided in the Air Force's FY14 Annual Planning and Programming Guidance and the POM Preparation Instructions to link virtual training to "Readiness."

RECOMMENDATION 3: To improve decision makers' visibility over the costs related to virtual training, GAO recommends that the Secretary of Defense direct the Secretary of the Air Force to develop a methodology for collecting and tracking cost data for virtual training and use this cost data to help inform future decisions regarding the mix of live and virtual training.

DoD RESPONSE: Concur. The Air Force is taking actions to improve visibility related to virtual training to inform decisions regarding the mix of live and virtual training. The review and update of the Air Force Instruction regarding "Management of Air Force Training Systems" will provide MAJCOMs with clear guidance to employ consistent methods to collect and measure virtual training systems data. In addition, the Aviation Resource Management System will be enhanced to provide the capability to capture projected and executed aircraft virtual training and cost data to provide better oversight and management of virtual training funding. Currently, virtual and constructive training are funded through 35+ program elements. The Air Force is developing a standard methodology of accounting and tracking the programming and execution of the program funds through improved visibility into cost categories associated with LVC-OT.

Appendix III: GAO Contact and Staff Acknowledgments

GAO Contact

Sharon L. Pickup, (202) 512-9619 or pickups@gao.gov

Staff Acknowledgments

In addition to the contact named above, Michael J. Ferren, Assistant Director; Russell M. Bryan; Paige A. Muegenburg; Mathew Sakrekoff; and Erik S. Wilkins-McKee made key contributions to this report.