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February 2018

MILITARY PERSONNEL

Actions Needed to Better Position the Navy and the Marine Corps to Support Expanding Unmanned Systems Operations

GAO-18-162

GAO Highlights

Highlights of GAO-18-162, a report to congressional committees

February 2018

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Actions Needed to Better Position the Navy and the Marine Corps to Support Expanding Unmanned Systems Operations

Why GAO Did This Study

The Department of the Navy has committed to rapidly grow its unmanned systems portfolio. It currently has at least 24 types of systems and has budgeted nearly $10 billion for their development and procurement for fiscal years 2018-2022. Personnel who launch, navigate, and recover the systems are integral to effective operations. Senate Report 114-255 included a provision for GAO to review the Navy's and the Marine Corps' strategies for unmanned system operators. GAO examined, among other things, the extent to which the Navy and the Marine Corps have (1) evaluated workforce alternatives (such as the use of civilians and contractors) for unmanned system operators and (2) developed and updated personnel requirements and related policies and goals for selected unmanned systems. GAO compared documentation on unmanned systems with DOD policies and conducted discussion groups with unmanned system operators.

What GAO Recommends

GAO is making ten recommendations, including that the Navy and the Marine Corps clarify policies to identify circumstances in which civilians and contractors may serve in operational roles and apply the policies to future evaluations; update personnel requirements for one UAS; and evaluate and update policies and goals to inform future personnel requirements. DOD concurred with eight recommendations and partially concurred with two. As discussed in the report, GAO continues to believe that all ten are warranted.

View GAO-18-162. For more information, contact Brenda S. Farrell at (202) 512-3604 or farrellb@gao.gov.

What GAO Found

The Navy and the Marine Corps are rapidly growing their portfolios of unmanned aerial systems (UAS) and unmanned maritime systems and have opted to use military personnel as operators without evaluating alternatives, such as federal civilian employees and private sector contractors. Service officials stated that civilians or contractors are not viable alternatives and policies are unclear about when and how to use them. However, a June 2016 Department of Defense-commissioned study found that alternative staffing strategies could meet the UAS mission more cost-effectively. Military personnel may be the most appropriate option for unmanned systems, but without clarifying policies to identify circumstances in which civilians and contractors may serve in operational roles, the services could continue to make workforce decisions that do not consider all available resources.

The Navy and the Marine Corps have sufficient personnel requirements or efforts underway to develop personnel requirements for seven unmanned systems that GAO reviewed (see fig.), but requirements for one system (i.e., the RQ-21 Blackjack UAS) have not been updated. That system's requirements have not been updated because service entities disagree about whether they are sufficient. Since 2015, units have deployed with about two to three times the personnel that headquarters and command officials expected they would need. Marine Corps officials stated that the Blackjack's personnel requirements were based on an outdated concept of operations and are insufficient for supporting workloads. Without updating the personnel requirements for the Blackjack UAS, the services will lack current information about the number of personnel needed.

Navy and Marine Corps Personnel Requirements Status for Selected Unmanned Systems

UAS: Unmanned aerial systems
USV: Unmanned surface vehicles
UUV: Unmanned underwater vehicles

Source: GAO analysis of Department of Defense information. | GAO-18-162

The Department of the Navy has taken positive steps but has not fully evaluated and updated aviation policies that affect personnel requirements for certain UAS and lacks clear goals for informing future requirements for all of its UASs. GAO found that the policies do not fully account for differences between UASs of varying sizes and capabilities. These policies require, for example, that the Blackjack UAS be held to the same maintenance standards designed for larger aircraft and UAS, which in turn affects personnel requirements. Until the Department of the Navy evaluates and updates such policies and clarifies related goals, the services will be hampered in developing and updating future requirements as unmanned system inventories grow and operations expand.

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Abbreviations

DOD	Department of Defense
OUSD(P&R)	Office of the Under Secretary of Defense for Personnel and Readiness
USD(P&R)	Under Secretary of Defense for Personnel and Readiness
UAS	unmanned aerial system
USV	unmanned surface vehicle
UUV	unmanned underwater vehicle

U.S. GOVERNMENT ACCOUNTABILITY OFFICE
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February 6, 2018

The Honorable John McCain
Chairman
The Honorable Jack Reed
Ranking Member
Committee on Armed Services
United States Senate

The Honorable Mac Thornberry
Chairman
The Honorable Adam Smith
Ranking Member
Committee on Armed Services
House of Representatives

The Navy's top senior leaders have emphasized the growing importance of unmanned systems to future fleet operations. In 2015, for example, the Secretary of the Navy established a Deputy Assistant Secretary for Unmanned Systems and announced that the F-35 Lightning II will likely be the last manned strike fighter aircraft the Department of the Navy will buy or fly.[1] The Chief of Naval Operations announced in 2017 that the future of the Navy includes unmanned aerial, surface, and underwater systems as an integral part of the future fleet and that these systems must be purchased in large numbers in order to expand the Navy's presence in key areas.[2] To fulfill its commitment to rapidly grow its portfolio of unmanned systems, the Department of the Navy included nearly $10 billion in its budget for fiscal years 2018 through 2022 for unmanned aerial systems (UAS), unmanned surface vehicles (USV), and

[1] Secretary of the Navy Memorandum, *Treat Unmanned as Unmanned* (Nov. 13, 2015); Ray Mabus, then Secretary of the Navy, Address at Sea-Air-Space Exposition (Apr. 15, 2015), available at, http://navylive.dodlive.mil/2015/04/15/secnavs-prepared-remarks-at-sea-air-space-2015/ (last accessed Jan. 25, 2018). The Department of the Navy includes the Navy and the Marine Corps. Marine Corps aviation systems are acquired by the Navy.

[2] Admiral John Richardson, Chief of Naval Operations White Paper, *The Future Navy* (May 17, 2017).

unmanned underwater vehicles (UUV).[3] The Navy also committed to tailoring policies to support expeditious acquisition processes. The Department of the Navy has at least 24 different types of unmanned systems in various stages of development, testing, and fielding to units.

Despite their name, "unmanned" systems require personnel who are integral to performing their missions. Operator personnel are needed to transit, launch, navigate, and recover unmanned systems and control and monitor their payloads (e.g., sensors for identifying terrain or targets); maintainers are needed to perform preventive and corrective maintenance tasks; and other support personnel are needed for post-mission analyses of data the systems gather.[4] According to DOD policy, the initial steps in planning for personnel requirements include determining categories of eligible personnel (i.e., military servicemembers or the other two workforce alternatives of federal civilian employees and private sector contractors) based on whether the activities to be performed are "inherently governmental" or "commercial."[5] The next step involves the identification of the appropriate and cost-effective combination of eligible personnel categories (i.e., workforce mix). Military servicemembers and federal civilians must be considered before the services may consider using private sector contractors as a workforce alternative to perform a function. Following that step are analyses of the numbers of personnel required and the staffing approaches needed to fill personnel requirements.

[3] This amount includes funding for research, development, and procurement purposes for unmanned systems. Department of Defense (DOD) Fiscal Year (FY) 2018 Budget Estimates (May 2017); Secretary of the Navy Memorandum, *Treat Unmanned as Unmanned* (Nov. 13, 2015).

[4] For the purpose of our review, the term "unmanned system operators" includes unmanned aerial system (UAS) operators (which the Navy refers to as air vehicle operators, tactical coordinators, and mission payload operators), unmanned surface vehicle (USV) operators, and unmanned underwater vehicle (UUV) operators. For the Marine Corps' officer and enlisted UAS operators, we distinguish between those positions using the terms "UAS officers" and "UAS operators," respectively.

[5] DOD Instruction 1100.22, *Policy and Procedures for Determining Workforce Mix* (Apr. 12, 2010). According to DOD officials, DOD, including the Navy and the Marine Corps, refers to workforces and personnel categories of workforces as "manpower." An "inherently governmental activity" is a function so intimately related to the public interest as to require performance by federal government personnel. For example, operational control of combat, combat support and combat service support units; armed fighting or use of force deemed necessary for national defense; some aspects of security provided to protect resources and operations in hostile or volatile areas; and intelligence and counterintelligence operations performed in operational environments are inherently governmental activities.

Since 2001, we have identified the strategic management of human capital as a high-risk area across the government in part because of the mission-critical skills gaps within the federal workforce that pose a high risk to the nation by impeding the government from cost-effectively serving the public and achieving results.[6] Related to the UAS workforces, we issued multiple reports from 2014 through 2017 on the Army's and the Air Force's personnel strategies for UAS operators.[7] For example, in January 2017 we reported that neither the Air Force nor the Army had evaluated its UAS operator workforce mix to determine an effective and efficient mix of personnel for meeting mission needs.[8] We recommended that the Air Force and the Army evaluate their workforce mix and the use of federal civilians for UAS pilot positions and conduct cost analyses consistent with Department of Defense (DOD) guidance. DOD concurred with both recommendations but has not yet implemented them. A list of related products is included at the end of this report.

A Senate Armed Services Committee report accompanying a proposed bill for the National Defense Authorization Act for Fiscal Year 2017 includes a provision for us to review the Department of the Navy's personnel strategies for unmanned systems, including UASs, USVs, and UUVs.[9] This report addresses the extent to which the Navy and the Marine Corps have (1) evaluated workforce alternatives for their unmanned system operators, including the use of federal civilian employees and private sector contractors; (2) developed and updated personnel requirements and related policies and goals that affect requirements for operators, maintainers, and other support personnel for selected unmanned systems; and (3) developed approaches for staffing unmanned system operators to meet personnel requirements.

[6] GAO, *High Risk Series: Progress on Many High-Risk Areas, While Substantial Efforts Needed on Others*, GAO-17-317 (Washington, D.C.: Feb. 15, 2017).

[7] GAO, *Air Force: Actions Needed to Strengthen Management of Unmanned Aerial System Pilots*, GAO-14-316 (Washington, D.C.: Apr. 10, 2014); *Unmanned Aerial Systems: Actions Needed to Improve DOD Pilot Training*, GAO-15-461 (Washington, D.C.: May 14, 2015); *Unmanned Aerial Systems: Further Actions Needed to Fully Address Air Force and Army Pilot Workforce Challenges*, GAO-16-527T (Washington, D.C.: Mar. 16, 2016); *Unmanned Aerial Systems: Air Force and Army Should Improve Strategic Human Capital Planning for Pilot Workforces*, GAO-17-53 (Washington, D.C.: Jan. 31, 2017).

[8] GAO-17-53.

[9] S. Rep. No. 114-255, at 154 (2016), accompanying S. 2943, a proposed bill for the National Defense Authorization Act for Fiscal Year 2017.

For these objectives, we used a case study approach to review the Navy's and the Marine Corps' evaluations of workforce alternatives, development and updates of personnel requirements and related policies and goals, and staffing approaches for selected unmanned systems. Of 24 Navy and the Marine Corps unmanned systems in development as programs of record in calendar year 2016, we selected: four UASs—the Navy's MQ-4 Triton, MQ-8 Fire Scout, MQ-25 Stingray, and the Marine Corps' RQ-21 Blackjack; two USVs—the Unmanned Influence Sweep System and the Mine Countermeasures USV—associated with the Navy's littoral combat ships; and two types of Navy UUVs—the MK 18 family of UUV systems and the Snakehead Large Displacement UUV—based on their size and missions.[10] While the UUV case study findings are not generalizable, they provide illustrative examples for each objective. In appendix I, we provide additional information on each of these eight unmanned systems.

For objective one, we compared any Navy and Marine Corps efforts to evaluate workforce alternatives—specifically the use of federal civilian employees and private security contractors—for operators of unmanned systems with two DOD policies: (1) DOD Directive 1100.4, *Guidance for Manpower Management* and (2) DOD Instruction 1100.22, *Policy and Procedures for Determining Workforce Mix*.[11] DOD Directive 1100.4 directs that authorities should consider all available sources when determining workforce mix. DOD Instruction 1100.22 directs the steps that workforce planning authorities must take in planning for personnel requirements. We analyzed documentation on the services' efforts to evaluate alternative workforces for unmanned system operator positions, and interviewed knowledgeable officials about such evaluations and any reasons for not evaluating workforce alternatives. We also compared the services' respective policies on workforce planning with DOD policies and with federal internal controls standards that emphasize the importance of having clear, updated policies that align with an organization's mission

[10] The RQ-21 Blackjack UAS is a single system that is used by both the Navy and the Marine Corps. We did not include the Navy's use of the RQ-21 Blackjack in the scope of our review because the Navy plans to field only three systems. The Unmanned Influence Sweep System and the Mine Countermeasures USV are part of the Navy's littoral combat ship mine countermeasures mission package. In our report, we refer to them as the USVs associated with the Navy's littoral combat ships.

[11] DOD Directive 1100.4, *Guidance for Manpower Management* (Feb. 12, 2005) and DOD Instruction 1100.22, *Policy and Procedures for Determining Workforce Mix* (Apr. 12, 2010). DOD Instruction 1100.22 was updated on December 1, 2017. However, the 2010 version was in use by DOD during the audit period.

and goals.[12] Finally, we reviewed DOD-commissioned workforce mix studies and interviewed officials from the Office of the Under Secretary of Defense for Personnel and Readiness (OUSD(P&R)) to identify benefits and limitations of the different personnel categories as workforce alternatives.[13]

For objective two, we reviewed the Navy's and the Marine Corps' efforts to develop and update personnel requirements for our selected case study systems and interviewed knowledgeable service officials about their perception of the sufficiency of those personnel requirements for supporting training and deployment requirements. We compared requirements documents with DOD Directive 1100.4, which states that personnel requirements should be driven by workload and established at the minimum levels necessary to accomplish mission and performance objectives, and with Navy Instruction 1000.16L. The Navy instruction states that personnel requirements must be validated as program changes dictate and at a minimum annually over a system's lifecycle to determine if a personnel update is required. We also compared the life cycle cost estimate for the RQ-21 Blackjack with DOD Instruction 5000.02, *Operation of the Defense Acquisition System*, and with Office of Management and Budget guidance.[14] DOD Instruction 5000.02 requires that components determine a weapon system program's life cycle cost by planning for the many factors needed to support the system, including personnel. The Office of Management and Budget guidance states that to keep the cost analyses for capital assets, such as weapon systems,

[12] Office of the Chief of Naval Operations (OPNAV) Instruction 1000.16L, *Navy Total Force Manpower Policies and Procedures* (June 24, 2015) (change transmittal 1, April 28, 2016); Marine Corps Order 5311.1E, *Total Force Structure Process* (Nov. 18, 2015); DOD Directive 1100.4; DOD Instruction 1100.22; and GAO, *Standards for Internal Control in the Federal Government*, GAO-14-704G (Washington, D.C.: September 2014).

[13] Institute for Defense Analyses, *Staffing for Unmanned Aircraft Systems (UAS) Operations* (June 2016); and RAND Corporation, U.S. Department of Defense *Experiences with Substituting Government Civilian Employees for Military Personnel* (2016).

[14] DOD Instruction 5000.02, *Operation of the Defense Acquisition System* (Jan. 7, 2015) (incorporating change 3, Aug. 10, 2017); and DOD, *Defense Acquisition Guidebook*, chap. 1, Program Management (July 20, 2017). DOD defines "life cycle" cost as the cost to the government of a program over its full life, including costs for research and development, testing, production, facilities, operations, maintenance, personnel, environmental compliance, and disposal. Office of Management and Budget Circular No. A-11, *Preparation, Submission, and Execution of the Budget*, Capital Programming Guide v3 (2017).

current, accurate, and valid, cost estimating should be continuously updated based on the latest information available as programs mature.

We also reviewed the Navy's policies on operating and maintaining UAS and documentation from the Marine Corps about any effects of those policies on personnel workload, and interviewed service officials about any effects and efforts to review and update policies. We then compared those efforts with DOD policy and with federal internal controls standards that emphasize the importance of having clear, updated policies that align with an organization's mission and goals.[15] Finally, we compared goals established in DOD's *Unmanned Systems Integrated Roadmap*, FY2013-2038 and Department of the Navy strategy documents on unmanned systems with federal internal controls standards that state than an agency's management should define goals clearly to enable the identification of risk.[16]

For objective three, we reviewed the Navy's and the Marine Corps' approaches for selecting, training, and tracking unmanned system operators to identify any challenges. We also reviewed Navy reports and Marine Corps data on operator inventory and retention levels relative to the services' requirements and goals. Specifically, we reviewed Navy reports on the retention of certain aviation personnel to serve as UAS operators for fiscal years 2015 through 2017 because data from earlier years were less relevant given the lower numbers of UAS inventories. We requested data from the Marine Corps on its inventories of and requirements for enlisted UAS operators for fiscal years 2007 through 2017, and on UAS officers for fiscal years 2013 (the first year of available data) through 2017. We requested retention data—actual numbers of personnel who reenlisted versus annual quotas—on enlisted UAS operators for fiscal years 2010 (the earliest year for which data were available) through 2017.

We assessed the reliability of the Marine Corps' data by administering questionnaires to obtain information on the quality control measures in place to ensure that the data systems record, track, and report reliable data, and by interviewing knowledgeable officials and manually testing the data for errors and omissions. We found the data to be sufficiently reliable for our purposes of describing personnel inventory trends and the

[15] GAO-14-704G.

[16] DOD, *Unmanned Systems Integrated Roadmap, FY2013-2038*.

sufficiency of operator personnel to meet requirements. We found that the retention data are of undetermined reliability but are reporting them because they are the data of record used by Marine Corps planning officials.

We also compared Navy and Marine Corps financial incentives for retaining personnel as UAS operators with DOD's 2012 *Eleventh Quadrennial Review of Military Compensation*, which established that organizations should assess civilian supply and demand and civilian wages to determine the most cost-effective special and incentive pay strategies.[17] We compared any Marine Corps efforts to address workforce challenges specific to the Marine Corps' UAS operator career field with a key principle of strategic human capital planning from our prior work, which states that agencies should ensure that "flexibilities" are part of their overall human capital strategy.[18] We interviewed Marine Corps UAS leaders and conducted discussion groups with UAS operators and officers from one squadron, selected because of its experience level, to learn their views about UAS personnel requirements and staffing approaches and career satisfaction. We provide further details on our scope and methodology in appendix II.

We conducted this performance audit from September 2016 to February 2018 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.

[17] DOD, *Eleventh Quadrennial Review of Military Compensation* (June 2012).

[18] GAO, *Human Capital: Key Principles for Effective Strategic Workforce Planning*, GAO-04-39, (Washington, D.C.: Dec. 11, 2003). "Human capital flexibilities" are the policies and practices that an agency has the authority to implement in managing its workforce to accomplish the missions and achieve goals. Flexibilities include actions related to recruitment, retention, compensation, position classification, incentive awards and recognition, training and development, performance management and appraisals, and work-life policies.

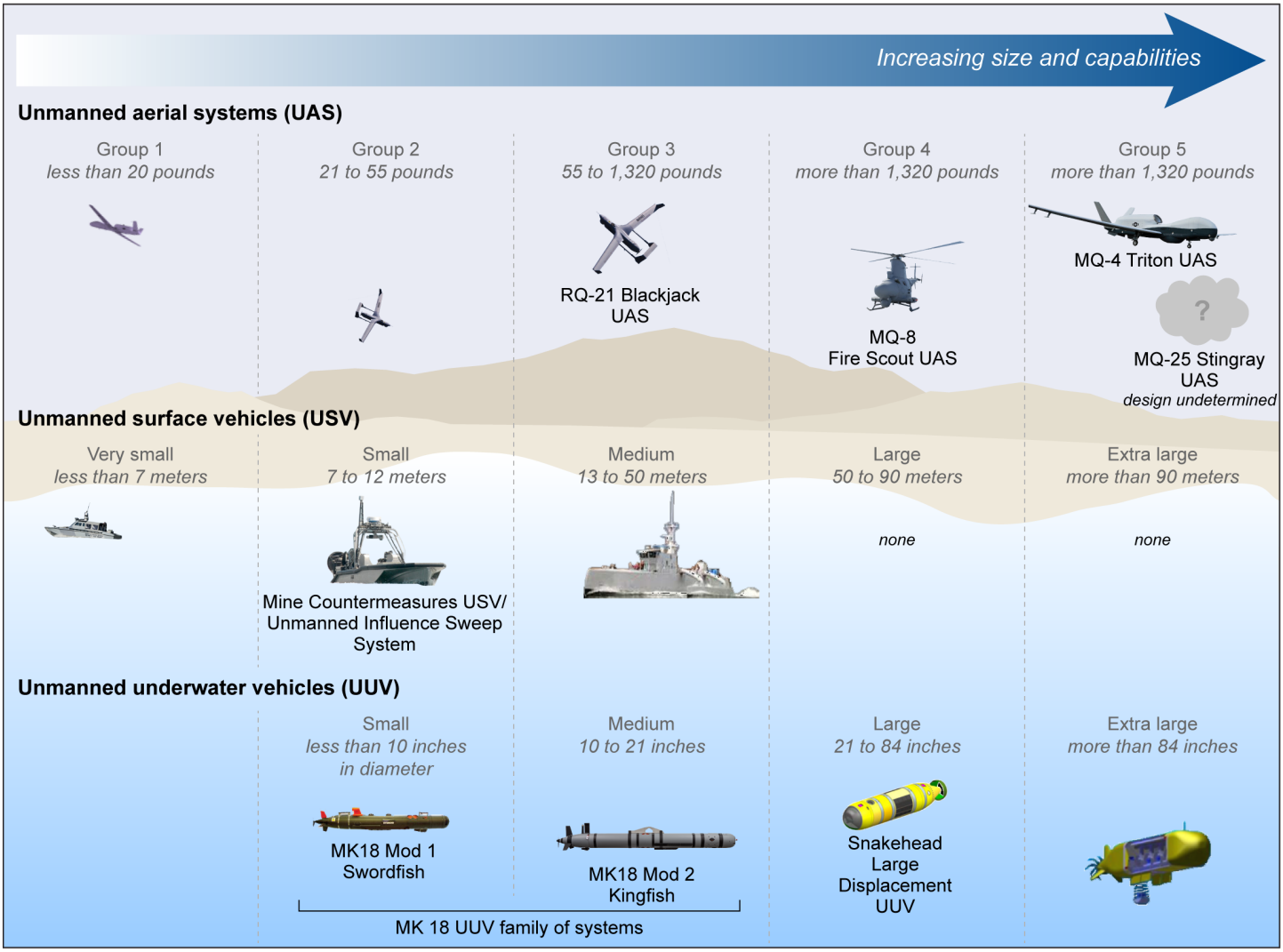
Background

Unmanned Systems

Unmanned systems provide DOD with capabilities for conducting a range of military operations, including environmental sensing and battlespace awareness; chemical, biological, radiological, and nuclear detection; counter-improvised explosive device capabilities; port security; precision targeting; and precision strike. DOD's unmanned systems operate in different warfighting "domains" ranging from air, land, and maritime environments.[19] As shown in figure 1, DOD categorizes its unmanned systems into five groups by domain (i.e., aerial and maritime, including surface and underwater) and other attributes of size and capability.

[19] DOD, *Unmanned Systems Integrated Roadmap, FY2013-2038*. Unmanned maritime systems include both USVs and UUVs for surface and underwater operations.

Figure 1: Department of Defense's Categorization of Selected Navy and Marine Corps Unmanned Aerial and Maritime Systems



Source: GAO analysis of Navy data and information. | GAO-18-162

Notes: The unnamed systems above represent the existence of one or more of that category and type of system in the Navy or the Marine Corps. UASs in groups 1, 2, and 3 exist in both the Navy and the Marine Corps, and the other unmanned systems depicted are specific to the Navy. The named systems in the figure are those we selected as case studies.

Group 1 UASs weigh fewer than 20 pounds and operate below 1,200 feet in altitude, whereas group 5 UASs weigh more than 1,320 pounds and operate above 18,000 feet. Similarly, USVs are categorized in five groups, increasing in size and capability from very small to extra-large,

and UUVs are categorized in four groups—small, medium, large, and extra-large.

Organizational Roles and Responsibilities for Evaluating Workforces

Various offices within the Office of the Secretary of Defense and the Department of the Navy have roles and responsibilities for evaluating the appropriate mix of personnel for the Navy's and the Marine Corps' total workforces.

According to Section 129a of Title 10 of the U.S. Code, which governs DOD's general policy for total force management, the Secretary of Defense is required to establish policies and procedures for determining the most appropriate and cost efficient mix of military, federal civilian, and contractor personnel to perform the missions of the department. Section 2463 of Title 10 mandates the Under Secretary of Defense for Personnel and Readiness (USD(P&R)) to devise and implement guidelines and procedures to ensure consideration is given to using DOD civilian employees to perform new functions and functions that are performed by contractors and could be performed by civilian employees.

DOD policies also establish roles and responsibilities for the USD(P&R):

- DOD Directive 1100.4 establishes departmental policy concerning workforce management, including multiple responsibilities for the USD(P&R) (e.g., reviewing the workforce management guidelines and practices of DOD components for compliance with established policies and guidance).[20]
- DOD Instruction 1100.22 implements policy set forth under DOD Directive 1100.4; assigns responsibilities; and prescribes procedures for determining the appropriate mix of military, federal civilian, and contractor personnel. The instruction assigns to the USD(P&R) the responsibility for overseeing the instruction's implementation and working with component heads to ensure that they establish policies and procedures consistent with this instruction.
- DOD Instruction 7041.04 states that DOD's USD(P&R), the Comptroller, and the Director of Cost Assessment and Program

[20] DOD Directive 1100.4 defines "DOD components" as the Office of the Secretary of Defense, the military departments, the Chairman of the Joint Chiefs of Staff, the combatant commands, the Office of the Inspector General of the Department of Defense, the defense agencies, the DOD field activities, and all other organizational entities in DOD.

Evaluation are responsible for developing a DOD-wide cost model for estimating and comparing the full costs of DOD workforce and contract support.[21]

Section 129a of title 10 of the U.S. Code directs the Secretary of Defense to delegate responsibility for the implementation of policies and procedures established by the Secretary to the Secretaries of the military departments. In accordance with this delegation, the Secretary of the Navy has overall responsibility for requirements determination, planning, programming, and budgeting for policies and procedures for determining the appropriate and cost-effective mix of personnel.

DOD policies establish the following roles and responsibilities for the military department Secretaries, including the Secretary of the Navy and heads of other DOD components:

- DOD Directive 1100.4 requires the component heads to designate an individual with full authority for workforce management, to include responsibility for, among other things, developing annual personnel requests to Congress considering the advantages of converting from one form of support (active or reserve military servicemembers, federal civilians, or private sector contractors) to another for the performance of a specified function, consistent with section 129a of the U.S. Code.
- DOD Instruction 1100.22 establishes that the component heads should require that their designated workforce authority issue implementing guidance requiring the use of the instruction when determining workforce mix for current, new, or expanded missions.

Secretary of the Navy Instruction 5430.7R assigns authority for workforce management in the Department of the Navy, including workforce mix

[21] DOD Instruction 7041.04, *Estimating and Comparing the Full Costs of Civilian and Active Duty Military Manpower and Contract Support* (July 3, 2013). According to a senior-level official from the Office of the Under Secretary of Defense for Personnel and Readiness (OUSD(P&R)), the responsibility for developing a cost model has been fulfilled. We reported in September 2013 that DOD Instruction 7041.04 reflects improvements to DOD's methodology for estimating and comparing the full cost to the taxpayer of work performed by military and civilian personnel and contractor support since the initial issuance of the guidance. However, we also reported that DOD's instruction is limited in certain areas by providing limited guidance on estimating overhead costs and on adjusting advertising and recruiting and training costs. GAO, *Human Capital: Opportunities Exist to Further Improve DOD's Methodology for Estimating the Cost of Its Workforces*, GAO-13-792 (Washington, D.C.: Sept. 25, 2013).

issues, to the Assistant Secretary of the Navy for Manpower and Reserve Affairs.[22]

Navy and Marine Corps Processes for Determining and Staffing Personnel Requirements

Concurrently with a weapon system's development through DOD's acquisition process, the Navy and the Marine Corps determine the numbers and types of personnel and skills required for their unmanned systems. The personnel requirements development process generally begins with the program manager from a Navy systems command (e.g., Naval Air Systems Command for Navy and Marine Corps aircraft and Naval Sea Systems Command for ships and submarines) that is responsible for supervising the management of assigned acquisition programs. The program manager and systems command utilize Navy policies and other inputs to formulate initial requirements. In doing so, the program manager coordinates any Navy personnel requirements with the Office of the Chief of Naval Operations and other entities such as the Navy Personnel Command and commands that will operate and maintain the systems, such as the U.S. Fleet Forces Command and the Commander, Naval Air Forces. For Marine Corps aircraft systems, the program manager from the Naval Air Systems Command coordinates with Marine Corps headquarters entities, such as the Deputy Commandant for Aviation and the Deputy Commandant for Combat Development and Integration. The program manager and systems command calculate the cost of personnel as part of a system's total life cycle cost. The program manager validates personnel requirements as program changes dictate and at a minimum annually, over a system's lifecycle.

The Navy and the Marine Corps staff the units that will operate and maintain their unmanned systems by filling the required positions to the extent possible based on the number of positions funded and the number of trained and qualified personnel available to fill them. This staffing process is managed by the Navy Personnel Command and in the Marine Corps by the Deputy Commandant for Manpower and Reserve Affairs.

[22] Secretary of the Navy Instruction (SECNAVINST) 5430.7R, *Assignment of Responsibilities and Authorities in the Office of the Secretary of the Navy* (May 2, 2017).

The Navy and the Marine Corps Have Not Evaluated Using Federal Civilian Employees and Private Sector Contractors as Workforce Alternatives for Unmanned System Operators

The Navy and the Marine Corps are in the process of rapidly growing their portfolios of unmanned systems, but have not evaluated the use of alternative workforces—specifically the use of federal civilian employees and private sector contractors as unmanned system operators. DOD Directive 1100.4 states that authorities should consider all available sources when determining workforce mix, including federal civilians and contractors, and personnel shall be designated as federal civilians except in enumerated circumstances.[23] According to DOD Instruction 1100.22, the initial steps in planning for personnel requirements include determining categories of eligible personnel (e.g., military servicemembers, federal civilian employees, or private sector contractors). These determinations are based on whether activities to be performed are "military essential" (the activity must be performed by a military servicemember), "inherently governmental" (the activity could be performed by a military servicemember or a federal civilian employee), or "commercial" (the activity could be performed by military servicemembers, federal civilians, or private sector contractors). Military servicemembers and federal civilians must be considered before the services may consider using contractors to perform a function.

In the absence of workforce alternative analyses, the services have decided to rely solely on military servicemembers as operator workforces for all of their unmanned systems, including the eight systems we reviewed in detail. For all eight case studies, Navy and Marine Corps officials told us that their decisions to rely on servicemembers as operators were based on the pre-existing force structure made up of personnel who were already trained in related mission areas. For seven of the eight selected systems, the officials stated that they did not evaluate the use of federal civilians or contractors in their determinations for using military personnel for their operator workforces. In the case of an eighth system, the MQ-4 Triton UAS, the Navy evaluated using contractor personnel, but did so without first considering the use of federal civilian employees as DOD policy requires. In a 2009 analysis for the Triton, the Navy concluded that comparisons between the cost-effectiveness of using military personnel and federal civilian employees were beyond the

[23] These circumstances enumerated in DOD Directive 1100.04 include the following: when military incumbency is required for reasons of law, command and control of crisis situations, combat readiness, or esprit de corps; when unusual working conditions are not conducive to civilian employment; or when military-unique knowledge and skills are required for the successful performance of the duties.

expertise of the working group that performed the analysis. Ultimately, the Navy decided to use military personnel as Triton operators.[24]

According to senior-level officials from OUSD(P&R), there are concerns within the department about the level of consideration the military services have applied to workforce mix alternatives for unmanned system operators. As a result, OUSD(P&R) and other entities from the Office of the Secretary of Defense commissioned the Institute for Defense Analyses to conduct a study, which was published in June 2016, on alternative staffing strategies to enable DOD to accomplish UAS-related missions more cost-effectively.[25] The study found that staffing alternatives exist for each service and could produce cost savings. According to the Institute for Defense Analyses' report, the use of enlisted personnel for a portion of the Navy's and the Air Forces' UAS operator workforces offers the potential for savings, as could the use of limited duty officers or warrant officers. The Institute for Defense Analyses also reported that federal civilian employees of DOD could generate the most substantial savings of the options studied if they were used in combination with military servicemembers as UAS operators responsible for the launch and recovery of air vehicles. OUSD(P&R) officials stated that this latter approach would free up military servicemembers to fill key positions for supporting military readiness in other areas of operations that are military personnel essential, and better leverage the services' limited military personnel end strengths.[26]

In September 2016, OUSD(P&R) issued a proposal for an additional study of UAS staffing options that stated that the Department of the Navy's workforce mix determination (i.e., relying on military servicemembers as operators) is "immature and infeasible" and that any recommended approaches should also be applied to unmanned maritime systems.[27] OUSD(P&R) has also commissioned a study to clarify circumstances in which military servicemembers should be considered

[24] Naval Air Systems Command, *Broad Area Maritime Surveillance (BAMS) Unmanned Aircraft System (UAS) Manpower Business Case Analysis* (2009).

[25] Institute for Defense Analyses, *Staffing for Unmanned Aircraft Systems (UAS) Operations* (June 2016). The study did not evaluate staffing for other types of unmanned systems, such as USVs or UUVs.

[26] A military service's end strength is the authorized number of military personnel at the end of a fiscal year.

[27] At the time of our review OUSD(P&R) officials stated that the proposed study had not been initiated.

essential for certain positions, which is expected to be complete by the end of fiscal year 2018. OUSD(P&R) officials stated that they plan to continue their efforts to expand awareness of these studies and of the available workforce mix alternatives for UAS operators with military service officials.

On the basis of our discussions with Navy and Marine Corps workforce planners, key reasons for not evaluating workforce alternatives for unmanned system operators were that planners did not believe it was necessary, and they did not believe that federal civilian employees or private sector contractors were viable workforce alternatives to military servicemembers for such roles and functions. For example, officials cited concerns that federal civilians cannot serve aboard Navy ships or provide rapid deployment capability. However, officials from OUSD(P&R) told us that these concerns are inaccurate, noting that federal civilian employees have deployed on Navy ships. Further, we note that DOD's Expeditionary Civilian Workforce comprises federal civilian employees across DOD components who are available to deploy within 120 days of notice to meet urgent requirements.[28] DOD officials responsible for the Expeditionary Civilian Workforce program stated that such personnel are intended to be predictable, reliable, and effective so that the military services will source them and the combatant commands can depend upon them.

Further, service workforce planners stated that relevant service-level guidance is unclear on when and how such personnel can and should be considered for performing in operational roles and in deployable positions. The Navy's and the Marine Corps' policies do not provide details about the types of operational roles specific to a service, including those related to unmanned system operators, that could be filled with federal civilians or private sector contractors, nor do the policies provide guidance on the limitations and benefits of using these personnel sources, such as those identified in DOD-commissioned reports and our prior work.[29] For example, military personnel can be the most costly of the three personnel categories and shortages exist in certain functions that have been deemed military essential and are in high demand, such as

[28] Directive-Type Memorandum (DTM)-17-004, *Department of Defense Expeditionary Civilian Workforce* (Jan. 25, 2017). DTM-17-004 also states that it is DOD policy to identify and rely on a mix of capable military members and DOD civilians to meet global national security missions, and to include civilian employees in DOD's Global Force Management allocation process.

[29] OPNAV Instruction 1000.16L and Marine Corps Order 5311.1E.

fighter pilots. On the other hand, federal civilians and private sector contractors can be cost-effective and may augment military servicemembers on a short-term basis if needed (see table 1).

Table 1: Examples of Benefits and Limitations Associated with Staffing Military Servicemembers, Federal Civilian Employees of the Department of Defense (DOD), and Private Sector Contractors as Identified in DOD and Our Prior Reports

Personnel type	Examples of benefits	Examples of limitations
Military servicemembers	• Pre-existing communities with related skills reduce requirements and costs for training • Fewer restrictions on working hours and duties than federal civilian employees of DOD • New positions may enhance career development and available assignment rotations	• Limits on military end strength and on numbers that can be used in conflicts • Retention challenges in some career specialties • Can be less efficient and cost-effective than federal civilians employees of DOD and private sector contractors for non-military essential tasks
Federal civilian employees of DOD	• Provide more continuity of operations and may reduce training requirements relative to military personnel • Total cost may be lower than military servicemembers and private sector contractors • May be hired on a short-term basis	• Potential vulnerability to reductions in operation and maintenance funding and related measures such as hiring freezes • Workday lengths may be constrained • May not serve as combatants; restricted from performing certain missions including weapons deployment and targeting
Private sector contractors	• Can be a cost-effective, flexible solution for meeting short-term capability needs • Supply capabilities and skills where the government may lack sufficient personnel • Can augment existing military or federal civilian capability	• May not serve as a combatant; restricted from performing certain missions including weapons employment and targeting • May be limited to host-nation laws • Potential risks to the government, such as conflicts of interest

Sources: GAO analysis of prior GAO work and DOD-commissioned reports. GAO, *Defense Acquisitions: DOD's Increased Reliance on Service Contractors Exacerbates Long-standing Challenges*, GAO-08-621T (Jan. 23, 2008); *Human Capital: Additional Steps Needed to Help Determine the Right Size and Composition of DOD's Total Workforce*, GAO-13-470 (Washington, D.C.: May 29, 2013); *Military Personnel: Army Needs a Requirement for Capturing Data and Clear Guidance on the Use of Military for Civilian or Contractor Positions*, GAO-15-349 (Washington, D.C.: June 15, 2015); *Unmanned Aerial Systems, Air Force and Army Should Improve Strategic Human Capital Planning for Pilot Workforces*, GAO-17-53 (Washington, D.C.: Jan. 31, 2017); GAO, *Military Compensation: Additional Actions Are Needed to Better Manage Special and Incentive Pay Programs*, GAO-17-39 (Feb. 3, 2017); Institute for Defense Analyses, *Staffing for Unmanned Aircraft Systems* (UAS) Operations (June 2016); RAND Corporation, *U.S. Department of Defense Experiences with Substituting Government Civilian Employees for Military Personnel* (2016). | GAO-18-162

Federal internal controls standards emphasize the importance of having clear, updated policies that align with an organization's mission and goals.[30] Officials from the Office of the Secretary of the Navy for Manpower and Reserve Affairs agreed that the cited service policies do not provide the sort of detail and clarity that could aid planners and decision makers with determining eligible personnel categories for their workforces and weighing the benefits and limitations thereof. Clarifying their respective workforce planning policies could help workforce planners better understand when, where, and how federal civilians or contractors may serve in operational roles (e.g., from shore or from underway naval

[30] GAO-14-704G.

vessels) and what the benefits and limitations are. The use of military servicemembers, and not federal civilians or private sector contractors, as unmanned system operators may indeed be the most appropriate and cost-effective workforce option for the Navy and the Marine Corps. However, the services will not have certainty about the basis for such decisions without first clarifying workforce planning policies and then applying the revised policies to evaluate the use of all personnel resources available to them for future unmanned systems.

The Navy and the Marine Corps Have Not Fully Developed Personnel Requirements for One of Eight Selected Unmanned Systems or Updated Related Policies and Goals

The Navy and the Marine Corps have efforts underway to develop requirements for operators, maintainers, and other support personnel needed for selected unmanned systems. According to Navy information, personnel requirements for three systems are sufficient and the sufficiency of requirements for four other systems is yet undetermined. However, the Navy and the Marine Corps have not updated personnel requirements and the related cost estimate for the RQ-21 Blackjack UAS based on deployment data. Furthermore, the Department of the Navy has not fully evaluated and updated policies or clarified goals that may inform future personnel requirements development and updates to requirements.

The Navy and the Marine Corps Developed Personnel Requirements for Selected Unmanned Systems but Have Not Updated the RQ-21 Blackjack UAS Requirements and Cost Estimate

The Navy and the Marine Corps have efforts underway to develop requirements for operators, maintainers, and other support personnel needed for selected unmanned systems, commensurate with each system's maturity in DOD's acquisition process. The USVs associated with the littoral combat ships, the Snakehead Large Displacement UUV, and the MQ-25 Stingray UAS are in earlier phases of both acquisition and personnel requirements development and, according to Navy information, the precise number of required personnel will be determined and updated as the systems progress through acquisition. On the other hand, the MK 18 UUVs, MQ-8 Fire Scout UAS, MQ-4 Triton UAS, and RQ-21 Blackjack UAS have matured the furthest through DOD's acquisition process. The Navy and the Marine Corps have identified personnel requirements, and service officials told us they have reviewed their sufficiency as units have trained and deployed with the systems. Although future modifications to personnel requirements for the MK 18 UUVs, the MQ-8 Fire Scout, and the MQ-4 Triton may be needed as their inventories and the pace of deployments increase, Navy officials told us the numbers of operators are

appropriate at this time to meet mission objectives based on available deployment data and feedback from operators.

For the RQ-21 Blackjack UAS, however, Navy and Marine Corps headquarters and command entities disagree with unit-level officials about the sufficiency of the personnel requirements. Marine Corps UAS squadrons have identified a requirements shortfall of 13 to 21 personnel per detachment to support each RQ-21 Blackjack UAS.[31] The UAS squadrons have established that a total of 22 personnel are necessary to form a detachment sufficiently sized to support operations with the UAS. Marine Corps unit-level officials told us that this personnel requirement is based on the numbers needed to conduct training and deployments since the first Blackjack system was delivered in 2015, for which 22 to 30 personnel have been needed per detachment to meet mission requirements. In contrast, higher level command and service headquarters entities in the Navy and the Marine Corps have established a requirement of nine Marine Corps personnel per detachment, including three enlisted UAS operators and one UAS officer along with maintenance and support personnel. Squadron officials stated to the Navy and the Marine Corps in their written rebuttal of the 9-person requirement that 13 more personnel are needed to support operations for 10 to 12 hours per day, or up to 24 hours a day for 10-day surges in operations, and to comply with naval aviation maintenance procedures. Marine Corps officials also told us that the squadrons believe these additional personnel are essential for supporting the workload and levels of supervision they believe are necessary to operate and maintain an RQ-21 Blackjack UAS and avoid mishaps and damage to the aircraft during recovery.

DOD policy directs that personnel requirements should be driven by workload and established at the minimum levels necessary to accomplish mission and performance objectives.[32] In addition, according to a Navy instruction, personnel requirements must be validated as program changes dictate and at a minimum annually, over a system's lifecycle to determine if a personnel update is required. The Navy instruction also identifies guidelines for average weekly working hours and personnel availability for different tasks, which are key elements in the calculation of personnel requirements. The instruction states that routinely exceeding

[31] A single RQ-21 Blackjack UAS consists of five air vehicles.

[32] DOD Directive 1100.4.

these guidelines to meet workloads should be avoided because it can adversely affect unit morale, retention and safety.[33]

With respect to the RQ-21 Blackjack UAS, Marine Corps officials stated that the concept of operations has changed for the service's vision of employing the system to support Marine Expeditionary Units and that the 9-person detachment requirement was based on the outdated concept of operations. As a result, Marine Corps officials told us that the personnel requirements for the squadrons that operate them are too low to support the workloads associated with the systems and service headquarters-level decision makers have not yet updated them based on the most current and enduring concept of operations for the system. Marine Corps officials stated that efforts are underway to review the differences in personnel requirements deemed necessary by squadrons and headquarters-level entities as training and deployments continue, which is a positive step. However, according to the program office, the personnel requirements were not changing at the time of this report. Until the Navy and the Marine Corps update the personnel requirements for the RQ-21 Blackjack based on the most current and enduring concept of operations and deployment data, the services will lack current information about the number of operators needed for the squadrons that operate the RQ-21 Blackjack.

In addition, the Navy and the Marine Corps have not updated the life cycle cost estimate for the RQ-21 Blackjack UAS to include additional personnel that Marine Corps squadrons have needed for current operations and expect to need for future operations and deployments. The program office estimated the total Marine Corps personnel cost for the RQ-21 Blackjack based on detachments of 9 personnel each at approximately $371 million over the program's expected 19-year life cycle—nearly 20 percent of the Marine Corps' life cycle cost for the program. However, this estimate may be too low because Marine Corps squadrons have reported that they need up to 21 more personnel per detachment to support the workload associated with the system, as discussed previously.

DOD guidance requires that components determine a weapon system program's life cycle cost by planning for the many factors needed to support the system, including personnel.[34] Decision makers use this

[33] OPNAVINST 1000.16L.

[34] DOD Instruction 5000.02.

information to determine whether a new program is affordable and the program's projected funding and personnel requirements are achievable. In addition, the Office of Management and Budget's Capital Programming Guide indicates that to keep the cost analyses for capital assets, such as weapon systems, current, accurate, and valid, cost estimating should be continuously updated based on the latest information available as programs mature.[35]

The Navy and the Marine Corps have updated the life cycle cost estimate for the RQ-21 Blackjack to account for changing assumptions, such as the expected usage rate of spare parts for system repairs, but not for additional Marine Corps personnel that squadrons have reportedly needed for deployments. Without updating the cost estimate as appropriate after updating personnel requirements, the Navy and the Marine Corps may not have current information about the Marine Corps' RQ-21 Blackjack UAS lifecycle cost and affordability.

The Department of the Navy Has Made Positive Steps but Has Not Fully Evaluated and Updated Policies or Clarified Goals for Informing Future Personnel Requirements

The Navy Has Modified Some UAS Policies but Has Not Fully Evaluated and Updated Policies to Inform Future Personnel Requirements

The Department of the Navy has made some positive steps but has not fully evaluated and updated its aviation policies for operation and maintenance of certain UAS to inform the development of future personnel requirements. According to officials from the Navy Manpower Analysis Center, correctly determining personnel workload and the related numbers of personnel required for operation and maintenance is especially critical for UAS units because of the safety risks associated with operating in shared airspaces and over populated areas. These officials also stated that naval aviation policies—which apply to manned aircraft and UAS—affect the workload of operators and maintenance personnel and the numbers required to achieve a squadron's mission and

[35] Office of Management and Budget Circular No. A-11, *Preparation, Submission, and Execution of the Budget*, Capital Programming Guide v3 (2017).

meet the standards prescribed in the policies. For example, the Naval Air Training and Operating Procedures Standardization manual contains provisions for pilot fatigue and hours they can fly compared with the hours they must rest. Further, the Naval Aviation Maintenance Program instruction prescribes standards for performing and documenting quality assurance steps for maintenance tasks, among other things.[36]

Our review of these selected policies found that some naval aviation standards have been modified to account for UAS separately from manned aircraft, and to some extent between UAS of different sizes and capabilities. The Naval Air Training and Operating Procedures Standardization manual was updated in 2016 with a new chapter for UAS policies and operations. The Naval Aviation Maintenance Program instruction has been updated to specify that UAS of groups 3, 4, and 5 will always be governed by the policy similar to manned aircraft, with a few exceptions, such as compass calibration.

Notwithstanding these updates, Marine Corps headquarters- and unit-level officials told us that the policies have not been fully reviewed and updated to account for differences in UAS of varying sizes and capabilities, especially group 3 UAS, which are those systems weighing 55 to 1,320 pounds. According to these officials, applying certain procedures and standards from these policies equally across different sizes of UAS is problematic for group 3 UAS in particular, which includes the RQ-21 Blackjack. The officials stated that the application of such standards affects workloads and personnel levels in a way that prevents squadrons from accomplishing their missions as efficiently as possible. Specifically, they stated that upholding current naval aviation standards is one key reason—the other being changes to the concept of operations for the RQ-21 Blackjack—for having staffed up to 21 more personnel per RQ-21 Blackjack detachment than the 9-person requirement discussed earlier in this report.

Applying naval aviation operating and maintenance standards equally across different sizes of UAS may not align with the Marine Corps' concept of operations, which states that all UAS are intended to be

[36] Commander, Naval Air Forces M-3710.7, *NATOPS General Flight and Operating Instructions Manual* (May 5, 2016) and Commander, Naval Air Forces Instruction 4790.2C, *The Naval Aviation Maintenance Program (NAMP)* (Jan. 15, 2017).

recovered by landing or capture even though they may be expendable.[37] Each RQ-21 Blackjack system includes five air vehicles, more than one of which could be unavailable for assigned missions at the same time. For example, Marine Corps officials told us that damage to RQ-21 Blackjack air vehicles can be caused by weather, a deficiency with the air vehicle itself, a crash landing, or a combination of factors, and up to three air vehicles could be unavailable at a time. These officials told us that holding the RQ-21 Blackjack to maintenance standards designed for other non-expendable aircraft may not be efficient because their application has a limited effect on mishap rates relative to the additional personnel needed to uphold the standards. Moreover, in discussion groups we held with Marine Corps UAS operator personnel, operators mentioned that mishap investigations performed to existing standards sideline operators from training pending the investigation's outcome. Such standards also apply to the Navy's larger, non-expendable UAS like the MQ-8 Fire Scout and the MQ-4 Triton.

According to DOD Directive 1100.4, existing policies, procedures, and structures should be periodically evaluated to ensure efficient and effective use of personnel resources. Further, federal internal controls standards emphasize the importance of having clear, updated policies that align with an organization's mission and goals. Such goals could include the Department of the Navy's goal to accelerate the development and fielding of unmanned systems, and the Marine Corps' emphasis on reducing operator workload and providing effective and efficient support to mission execution and decision making. For example, the Marine Corps' UAS concept of operations envisions a future in which one UAS operator will perform multiple functions as opposed to the current approach in which multiple Marines are necessary for a single mission.

We found that the Navy has taken a preliminary step to further evaluate what policy changes may be needed to support unmanned systems by establishing an advisor position for this purpose within the Naval Innovation Advisory Council. The advisor is responsible for making recommendations to the Secretary of the Navy and other senior leaders to streamline policy and remove roadblocks that hinder innovation, among other things. In addition, the program manager for the RQ-21 Blackjack and the Marine Corps' Deputy Commandant for Combat Development and Integration are supporting a research effort through the Naval

[37] U.S. Marine Corps, *Concept of Operations for United States Marine Corps Family of Unmanned Aircraft Systems* (Dec. 5, 2014).

Postgraduate School to improve the efficiency and effectiveness of naval aviation maintenance procedures for group 3 UAS, according to a Marine Corps official who is leading this effort.

While these are positive steps, the time frames for making such policy changes have not been identified. In addition, we did not find evidence that the Navy has taken or planned related steps such as determining whether future reductions to personnel requirements could be accomplished, and any associated cost savings, or benefits to UAS operations if policies were further updated to account for UAS of different sizes and capabilities. The Navy has thus far prioritized the evaluation and modification of acquisition-related policies to expedite the delivery of unmanned systems to units, consistent with a 2015 memorandum from the Secretary of the Navy.[38] Unless the Navy and the Marine Corps prioritize updating policies for operating and maintaining UAS of different sizes and capabilities they may miss opportunities to effectively and efficiently use personnel resources as system inventories grow.

The Department of the Navy Lacks Clear Overarching Goals for Informing Future Unmanned System Personnel Requirements

The Department of the Navy also lacks clear overarching goals for informing future unmanned system personnel requirements and the level of priority that should be assigned to these systems and the units that operate them for the purpose of personnel resourcing decisions. While DOD's *Unmanned Systems Integrated Roadmap, FY2013-2038* stated that the department must strive to reduce the number of personnel required to operate and maintain its unmanned systems, the Department of the Navy has not affirmed this goal or communicated any other personnel goals for its unmanned system development.[39] Department of the Navy documents we reviewed for unmanned systems expressed goals that are less directly related to personnel requirements, to include expanding the range of operations and reducing costs and risks to personnel safety and mission success. As previously mentioned, the Navy has prioritized the evaluation and modification of acquisition-related policies to expedite the delivery of unmanned systems to units, consistent with a 2015 memorandum from the Secretary of the Navy.[40]

Navy and Marine Corps officials we spoke with who are responsible for the RQ-21 Blackjack and other case study systems we reviewed told us

[38] Secretary of the Navy Memorandum, *Treat Unmanned as Unmanned* (Nov. 13, 2015).

[39] DOD, *Unmanned Systems Integrated Roadmap, FY2013-2038*.

[40] Secretary of the Navy Memorandum, *Treat Unmanned as Unmanned* (Nov. 13, 2015).

they did not believe the Department of the Navy has a clear and overarching goal for unmanned system personnel requirements either now or over the long-term. For example, officials stated that they did not know if the Department of the Navy expects that fewer personnel should be needed to operate and support unmanned systems than the numbers of personnel required for other types of systems. Without such clarity about personnel-related goals and priority levels, some officials expressed concern that using the term "unmanned" systems conveys expectations that technological advances can substantially reduce personnel requirements in the near term, and that funding for related personnel resources are a lower priority than those for other system types. For example, a senior Navy personnel official told us that the Navy's past goals and related efforts to reduce personnel required for its ship crews—an initiative referred to as optimal manning—makes them cautious about whether the same goals and efforts will be adopted for unmanned systems and could produce similar, undesirable effects on readiness.[41]

Navy officials at three commands also stated they are concerned that resources for unmanned system personnel over future years may not keep pace with the increasing inventories of the systems if a lower priority is assigned to them in budget decisions in the absence of goals and clarity over priorities. The Navy's Commander, Submarine Forces, identified a personnel shortfall for supporting increased UUV inventories as its second-highest personnel priority for the Navy's fiscal year 2019 budget deliberations to help underscore to headquarters entities the importance of personnel resources for such systems. According to Navy officials, the Navy has since authorized the requested addition of 66 personnel to the command to augment the sole unit that will operate the

[41] The Navy began its optimal manning initiative in 2001 to reduce crew sizes aboard various legacy surface and amphibious ships by gradually reducing the required number of crew members. In a 2010 review of the surface fleet, the Navy found that it had reduced shipboard and shore-based manning to a level that was insufficient to allow the surface fleet to meet minimal standards of material readiness. Between 2010 and 2014, the Navy ended the optimal manning initiative and partially restored crew sizes on its legacy ships. Although the Navy had found that the optimal manning initiative had a detrimental effect on the readiness of legacy ships, it designed its newest surface ship classes to have smaller crews than predecessor ships. The Navy established lower crew size goals for these ships and attempted to reduce their crew sizes by relying to varying degrees on new technologies, automation, and shore support to execute workloads normally completed by larger crews. GAO, *Navy Force Structure: Actions Needed to Ensure Proper Size and Composition of Ship Crews*, GAO-17-413 (Washington, D.C.: May 18, 2017).

Snakehead Large Displacement UUV along with increasing inventories of other types of UUVs.

Federal internal controls standards state that an agency's management should define goals clearly to enable the identification of risk.[42] By applying this standard to the Department of the Navy's acquisition and operations of unmanned systems, such goals could include whether or not unmanned systems should require fewer personnel resources than manned counterparts. Until the Secretary of the Navy clarifies overarching goals for unmanned system personnel requirements and resource priority levels and communicates them to requirements planners and budget decision makers, the services will be hampered in developing future personnel requirements and identifying risks as system inventories grow and operations expand.

The Navy and the Marine Corps Have Developed Staffing Approaches for Unmanned System Operators, but Face Challenges Meeting Personnel Requirements

The Navy and the Marine Corps have developed staffing approaches to select, train, and track unmanned systems operators and to retain some UAS operators by offering special and incentive pays. However, both services face challenges in ensuring that there are sufficient UAS operators to meet personnel requirements. Yet neither service has assessed the commercial drone industry to inform its retention approach for UAS operators. Although Marine Corps UAS operators and officers report low morale and career satisfaction, the Marine Corps has not fully explored the use of human capital flexibilities to address these workforce challenges.

[42] GAO-14-704G.

The Navy and the Marine Corps Have Developed Staffing Approaches to Select, Train, Track, and Retain Unmanned System Operators

In the Navy, unmanned system operations are secondary skills for personnel from related communities. For its UASs in groups 4 and 5, for example, the Navy utilizes personnel from manned aviation communities within the same mission areas, such as MH-60 helicopter pilots and aircrew who are selected and then trained to operate the MQ-8 Fire Scout UAS.[43] Likewise, Navy officials stated that personnel from related communities are selected and trained to operate USVs and UUVs. The Navy is taking steps to track these trained operator personnel by using secondary skill identification codes. According to Navy officials, these identification codes will help personnel managers monitor the inventories of personnel with unmanned system operator qualifications and provide a temporary surge in capability if needed.

In contrast to the Navy's approach, the Marine Corps has a primary career field for operating UAS, including enlisted and officer personnel. The Marine Corps replenishes its UAS operator and officer personnel inventories by selecting from eligible applicant groups. To become UAS operators, enlisted marines must achieve minimum test scores comparable to those required for other high-skill occupations, such as intelligence specialists.[44] Eligible groups include new graduates of recruit training and experienced marines who apply for a lateral transfer from another occupational specialty. UAS officers take a separate test battery and must attain the same minimum scores as other officers who are selected for manned naval aviation training. They are selected from three sources: new graduates of officer training; pilot or flight officer trainees who do not complete their manned aircraft qualification; and experienced officers seeking a transfer from another occupational specialty, including pilots of manned aircraft. Following their selection, enlisted personnel and officers must complete 5 months of Army UAS training courses or 6 months of Air Force UAS training courses, respectively. The Marine Corps then assigns a primary occupation identification code to trained

[43] Only officers who are qualified as manned aircraft pilots serve as Navy air vehicle operators of UAS in groups 4 and 5, although enlisted personnel serve as payload operators or as air vehicle operators of smaller UAS. The other services' approaches for using military personnel as UAS operators differ. The Air Force and the Marine Corps permit both officers and enlisted personnel to serve as UAS air vehicle and mission payload operators. Army UAS air vehicle and mission payload operators are a mix of warrant officers and enlisted personnel.

[44] Department of the Navy, NAVMC 1200.1C, *Military Occupational Specialties Manual*, (Apr. 17, 2017).

personnel, which facilitates tracking their inventory to help meet requirements.

To help retain sufficient numbers of personnel to meet requirements, both the Navy and the Marine Corps have offered special and incentive pays to personnel who operate UASs. Navy personnel who serve as air vehicle operators for the MQ-8 Fire Scout and MQ-4 Triton or as MQ-4 Triton tactical coordinators are eligible for two types of aviation pays based on their qualification as pilots or naval flight officers rather than their UAS assignments—monthly "flight pay" of up to $1,000 and aviation career continuation pay bonuses of $75,000 for a new 5-year contract, as of fiscal year 2017. Marine Corps UAS officers are not offered special and incentive pays, but enlisted operators have been eligible for a selective reenlistment or selective retention bonus since 1998, which ranged from $8,250 up to $19,750 in fiscal year 2017 for qualified marines who committed to an additional 4 years of service.

The Navy and the Marine Corps Face Challenges Meeting UAS Operator Personnel Requirements and Have Not Assessed Commercial Competition to Inform Staffing Approaches

Navy Faces Challenges Meeting UAS Operator Personnel Requirements

Based on our analysis, the Navy faces challenges with meeting personnel requirements for UAS operators although, according to Navy officials, it is too soon to know if personnel shortfalls may arise with unmanned maritime systems because many programs are in early in stages of development.[45] Navy officials told us they have sufficient numbers of personnel to operate the current inventory of UAS, which included 49

[45] The MK 18 unmanned underwater vehicles are an exception among the Navy's unmanned maritime systems because the program is in a later phase of acquisition, with the Navy having attained full operational capability with the first increment of the MK 18 Mod 1 in fiscal year 2007 and initial operational capability expected with the first increment of the MK 18 Mod 2 in fiscal year 2019. According to officials from Navy Expeditionary Combat Command, there have been sufficient numbers of enlisted personnel among the select units that operate the MK 18 UUVs.

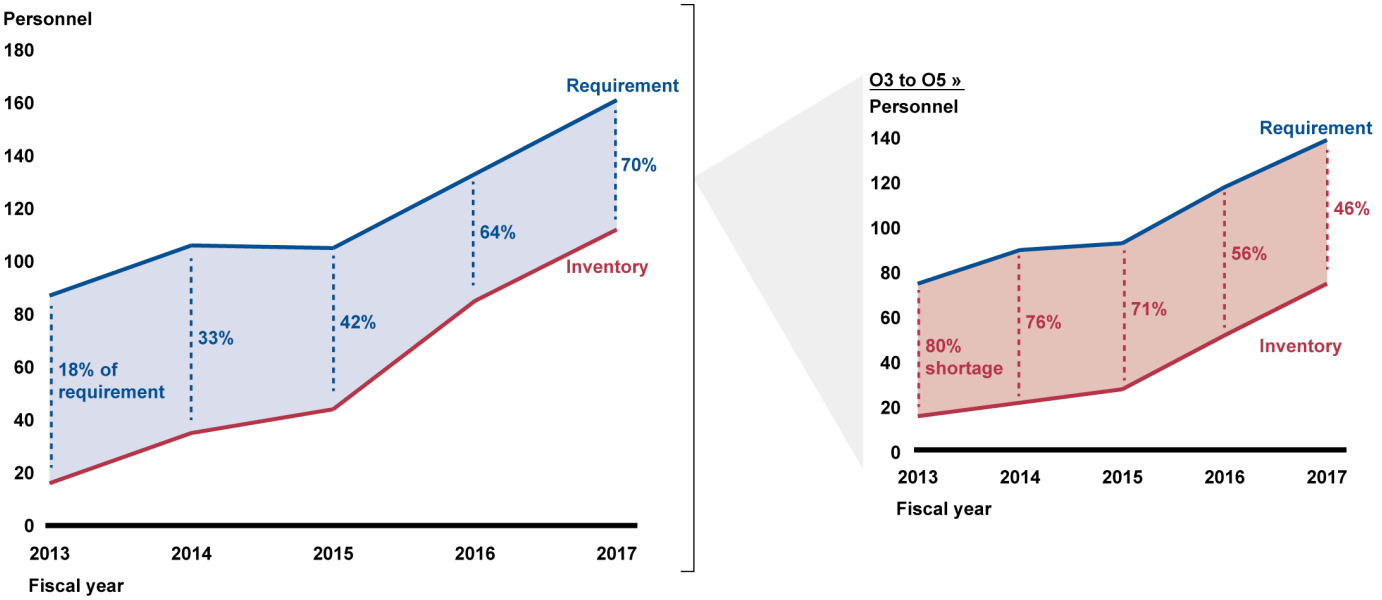
MQ-8 Fire Scouts and 2 MQ-4 Tritons as of September 2017. As UAS inventories increase, the Navy has reported growing retention challenges among its pilots and naval flight officers over the past 3 years as the U.S. economy improves and commercial airline hiring increases. Navy aviation and workforce planning officials told us this could affect the ability to fill both its manned aviation and UAS personnel requirements.

According to Navy proposals for the Navy's aviation retention bonus program, future retention shortfalls are expected in the helicopter, maritime patrol and reconnaissance, and E-2 Hawkeye communities, among others. The first two communities are sources of personnel for the MQ-8 Fire Scout and MQ-4 Triton and, according to Navy officials, the latter community is being considered as a personnel source for the MQ-25 Stingray. In particular, the Navy has reported concerns about the future retention of its maritime patrol and reconnaissance pilots because their experience directly translates to a commercial 737 aircraft. Additionally, the Navy has reported shortages and significant retention issues in meeting requirements for its reserve helicopter and maritime patrol and reconnaissance pilots, communities that the Navy uses to augment its available inventories of active duty pilots who also operate UASs.

The Marine Corps Has Not Met Personnel Requirements for UAS Operators

Based on our analysis, the Marine Corps has experienced past shortfalls of UAS operators through fiscal year 2017. Since the first fiscal year of available data after the inception of the Marine Corps' career specialty for UAS officers in 2012, personnel inventories have increased but fallen short of requirements (see fig. 2).

Figure 2: Percentages of Personnel Requirements Filled for Marine Corps Unmanned Aerial System Officers and a Subset of Inventory Shortages of Selected Officer Ranks, Fiscal Years 2013 through 2017



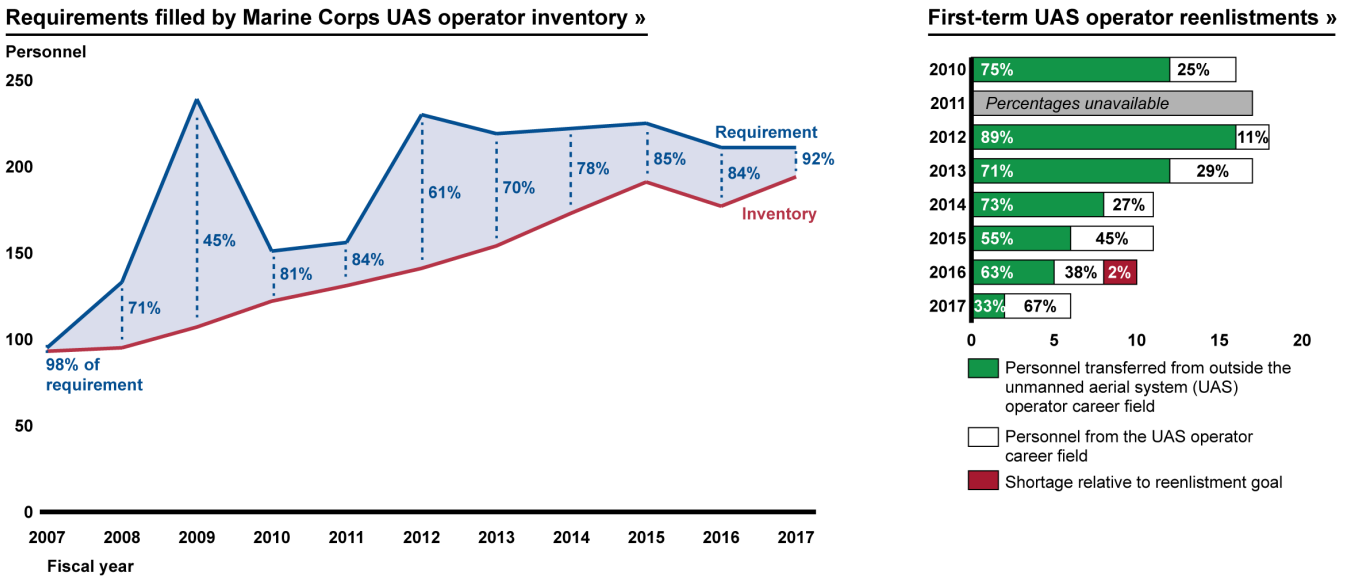
Source: GAO analysis Marine Corps data. | GAO-18-162

Note: Captains, majors, and lieutenant colonels have corresponding pay grades of O3, O4, and O5, respectively. Shortages of these officers were substantial for fiscal years 2013 through 2017.

For fiscal years 2013 through 2017, the Marine Corps was substantially short of captains, majors, and lieutenant colonels (i.e., O3, O4, and O5 pay grades) to serve as UAS officers. Consistent with this trend, the Marine Corps has designated UAS officer inventories as unhealthy since fiscal year 2013. Marine Corps officials told us these shortfalls could be attributable to the annual growth in requirements for this new community. They also stated that they do not currently anticipate retention challenges for UAS officers. However, according to these officials, their predictions about UAS officer retention for future years are based on data from other longer established career fields as proxies until more UAS officer data are available.

For fiscal years 2007 through 2017, inventories of enlisted UAS operators increased in all but one year, but fell short of requirements (see fig. 3) in part due to substantial yearly shortfalls of certain junior enlisted personnel. According to a Marine Corps official, the UAS operator inventory will exceed requirements in fiscal year 2018 because the requirement has decreased by about 60 percent from the previous year.

Figure 3: Percentages of Personnel Requirements Filled for Marine Corps Unmanned Aerial System Operators, Fiscal Years 2007 through 2017, and First-Term Reenlistment as a Subset of Personnel Inventory



Source: GAO analysis of Marine Corps data. | GAO-18-162

Note: Data on types of first-term UAS operator reenlistments for fiscal year 2011 were not available. A Marine Corps official told us they were missing from Marine Corps records.

However, the Marine Corps has leveraged lateral personnel transfers from other occupations to meet approximately 33 to 89 percent of its yearly retention quotas for first-term UAS operator reenlistments since fiscal year 2010 (see fig. 3 above). A Marine Corps personnel planning official told us that personnel transfers have been helpful and necessary for meeting retention quotas. However, other Marine Corps officials told us that heavily leveraging transfers shows that the UAS community is not retaining its own experienced operators—that is, UAS operators who have attained proficiency and advanced skills and been deployed. For more senior enlisted UAS operators eligible for a second reenlistment or beyond, the Marine Corps has fallen short of its retention quotas for fiscal years 2015 through 2017.

The Navy and the Marine Corps Have Not Assessed Commercial Supply, Demand, and Wages to Inform Staffing Approaches for UAS Operator Requirements

Despite the current and future challenges previously discussed, Navy and Marine Corps officials told us that the services have not used information about the commercial drone industry to inform their use of special and incentive pays because they did not believe doing so was needed. Marine Corps officials told us that they have not observed a retention problem for UAS operators and officers and unless they miss retention goals in 3 consecutive years they will not consider changing financial incentives—

i.e., increasing bonuses to enlisted UAS operators or offering special and incentive pays to UAS officers. Until such time, pilots who are selected for the UAS career field are informed by the Marine Corps that their flight pay and aviation continuation pay bonus eligibility will be terminated. Another Marine Corps official with knowledge of the UAS community told us that studying the commercial drone industry and the potential effect on retention is timely because the services must program for the necessary resources for financial incentives 2 years in advance of the budget year. They stated that after 3 years of missing retention goals the problem could persist for another 2 years before additional funds were available to increase retention bonuses given the programming and budget cycle.

Navy workforce planning officials acknowledged that they are concerned about increasing difficulty in providing sufficient numbers of mid-career pilots to meet the Navy's aviation requirements over future years, which includes UAS operator requirements. In addition to competition from commercial airlines, Navy officials told us a growing labor market in the commercial drone industry could exacerbate pilot retention challenges for those with secondary qualifications to operate UAS. However, they added that little is known about the demand and available wages in that industry.

Likewise, Marine Corps officials told us that past challenges in meeting requirements and retaining experienced operators could persist in future years, and hiring in the commercial drone industry could affect retention. These officials stated that the Air Force could also pose a future retention challenge for the Marine Corps' UAS operator community. The Air Force offers the potential for higher pay to its UAS operators than the Marine Corps along with larger and more capable types of UAS. The Air Force reported to Congress in July 2017 that its projections of enlisted UAS operator retention indicate that a bonus may be necessary as soon as 2022.[46] During discussion groups we held with Marine Corps UAS operators, enlisted operators cited the potential for higher pay for their skills outside the Marine Corps as a factor that has influenced reenlistment decisions among them or their peers. Operators in one group told us that three of their five RQ-21 Blackjack instructors were former enlisted operators from their squadron who secured employment with the RQ-21 Blackjack's manufacturer as private sector contractors.

[46] Secretary of the Air Force, *U.S. Air Force RQ-4 Global Hawk Enlisted Pilots Report* (July 2017).

DOD's 2012 *Eleventh Quadrennial Review of Military Compensation* determined that organizations should assess civilian supply and demand and civilian wages to develop the most cost effective special and incentive pay strategies.[47] We reported in February 2017 that conducting such an assessment is a key principle of effective human capital management by which to evaluate DOD's special and incentive pay programs.[48] Our report also found that the services do conduct such assessments for aviation, nuclear propulsion, and cybersecurity occupations.[49] Without assessing the commercial drone industry and using such information to inform retention approaches, including the use of special and incentive pays, the Navy and the Marine Corps may not know if their approaches are effectively tailored to ensure a sufficient number of UAS operators are available to meet future requirements.

Marine Corps UAS Operators and Officers Report Low Morale and Career Satisfaction, but the Marine Corps Has Not Fully Examined Human Capital Flexibilities to Address These Issues

The Marine Corps has experienced workforce challenges with its career field for UAS officers and enlisted operators, including diminished morale and career satisfaction and short periods of time in which operators are trained and available to UAS squadrons before their contract or squadron assignment ends. Results of a 2015 Marine Corps survey of UAS officers showed that about 65 percent of captains and first lieutenants who responded were dissatisfied with their career and about 75 percent of that group cited low job satisfaction as influencing their decision to leave the Marine Corps.[50]

UAS officers and enlisted operators in all eight discussion groups we held told us about factors that enhance their morale, including the

[47] DOD, *The Eleventh Quadrennial Review of Military Compensation* (June 2012).

[48] GAO, *Military Compensation: Additional Actions Are Needed to Better Manage Special and Incentive Pay Programs*, GAO-17-39 (Washington, D.C.: Feb. 3, 2017).

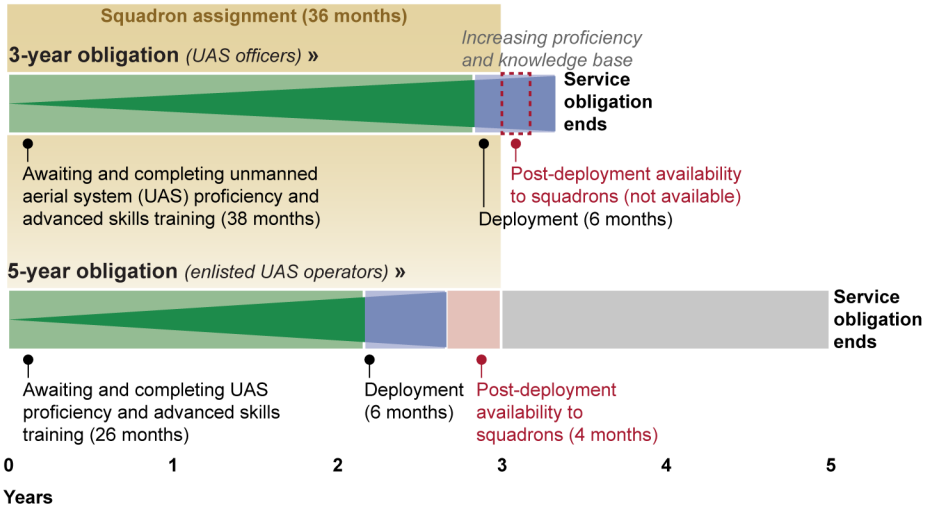
[49] For aviation, in particular, we reported that the Navy fully addressed this principle by specifically identifying comparable salary levels for commercial aviation pilots. Further, we reported that the Air Force and the Marine Corps partially addressed the principle by considering the relationship between the compensation offered to their pilots and to commercial aviation pilots, but they did not specifically identify comparable salary levels and use them to determine retention bonus amounts.

[50] Marine Corps, Deputy Commandant for Aviation, *Information Paper: 2015 Aviator Retention Survey Results* (Nov. 10, 2015). Although officers in ranks of first lieutenant through lieutenant colonel were surveyed, we were unable to include majors and lieutenant colonels in reporting results for UAS officers because the Marine Corps aggregated those officers' responses with those of majors and lieutenant colonels who operate other types of aircraft.

opportunities to learn and to shape their community and their positive deployment experiences, but they also discussed factors that negatively affect their job satisfaction. UAS operators in all enlisted groups cited the frequency of personnel turnover in the squadron as a source of frustration in developing and retaining expertise with the RQ-21 Blackjack. Officers told us they feel like a lower tier priority in Marine Corps aviation for reasons ranging from the lack of a uniform insignia device akin to those awarded to manned aircraft pilots (i.e., pilot “wings”), to confusion over the strategy and missions for Marine Corps UAS now and in future years. UAS officers also told us they desired assignments to positions outside the UAS squadrons that they believed would enhance their leadership ability, but such positions had not consistently been available to them because they were needed to fill squadron billets. For example, the Marine Corps has limited or restricted UAS officers from applying for in-residence professional military education opportunities in past years because they could not be diverted from billets requiring their qualifications due to inventory shortages.

UAS operators and officers spend approximately 2 years or more of their 3-year squadron assignment awaiting and completing training to attain proficiency and advanced skills with the RQ-21 Blackjack UAS. After training and deployment, they may have about 4 months or fewer to impart their knowledge and deployment experience to others in the squadron before they reach the end of their squadron assignment, the end of their service obligation, or both (see fig. 4).

Figure 4: Marine Corps UAS Officers' and Enlisted Operators' Training and Deployment Timelines and Subsequent Availability to Squadrons Before Initial Service Obligations Expire



Source: GAO analysis of Marine Corps information. | GAO-18-162

Notes: The figure illustrates the length of training compared with a typical service obligation and average deployment length. Obligations for certain types of officer commissions may be longer than 3 years. The number of months spent awaiting and completing training assumes that operators attain all advanced skills identified in the Marine Corps' training manual for the RQ-21 Blackjack UAS and within the average amounts of time specified in the manual, except for those associated with instructor qualifications and beyond. In addition, the number of months spent in training includes the approximately 6 months that detachments have spent, or the minimum they should spend, in pre-deployment training, according to a Marine Corps official. For illustrative purposes we approximated the deployment duration at 6 months.

According to Marine Corps officials we spoke with, the loss of experienced UAS operators who do not reenlist and are replaced by lateral transfers from other careers results in diminished UAS expertise among mid-career enlisted members in the squadrons. These officials told us that personnel who transfer to the UAS career to replace experienced operators must spend at least 2 years in training for initial qualification and then proficiency on the RQ-21 Blackjack. Moreover, Marine Corps officials told us that a portion of the UAS operators who reenlist past their first contract must fulfill 3-year special duty assignments outside the UAS community. They stated that this exacerbates the diminished squadron expertise and is the reason that some operators leave rather than reenlist in the Marine Corps.

Although the Marine Corps has taken steps to address challenges with UAS operator inventories by using special and incentive pays for enlisted operators and limiting opportunities that would divert officers away from

squadrons, as previously discussed, it has not fully explored flexibilities for managing its UAS career fields more effectively to help meet requirements. Employing flexibilities to improve job satisfaction could help improve retention of experienced personnel in an already-challenged environment. For example, the Marine Corps has not authorized available aviation special and incentives pays for UAS officers in spite of challenges meeting personnel requirements. As mentioned previously, pilots who are selected for the UAS career field are informed by the Marine Corps that their flight pay and aviation continuation pay bonus eligibility will be terminated. The Marine Corps has incentivized enlisted personnel from certain specialties, such as aircraft maintenance, to both reenlist and to remain in a specified unit as recently as fiscal year 2018, but has not offered this opportunity to UAS operators. By considering longer UAS operator contracts, the Marine Corps could increase the availability of experienced operators to squadrons, where they can pass on their knowledge and skills to junior enlisted personnel.

Our prior work has identified that a key principle for effective strategic human capital planning is that organizations should ensure that flexibilities are part of the overall human capital strategy to ensure effective workforce planning.[51] According to Marine Corps officials, they have not taken additional steps to address workforce challenges in part because inventories of UAS operators and officers have grown and squadrons have generally attained readiness goals and accomplished their deployment missions despite personnel shortages. Further, these officials stated that low morale and career satisfaction could be partially caused by the current transition from the RQ-7 Shadow UAS to the RQ-21 Blackjack, and to the relative newness of the officer career field. Without exploring these or other human capital flexibilities to improve morale and career satisfaction and maximize operators' availability to squadrons, the Marine Corps may face continued challenges in meeting personnel requirements and the growing demands of expanding operations and increasing UAS inventories. Moreover, as the Marine Corps budgets for additional resources to establish its own school for UAS operator training, flexibilities that could improve retention and

[51] "Human capital flexibilities" are the policies and practices that an agency has the authority to implement in managing its workforce to accomplish the missions and achieve goals. "Flexibilities" include actions related to recruitment, retention, compensation, position classification, incentive awards and recognition, training and development, performance management and appraisals, and work-life policies. GAO-04-29.

maximize operator availability could also help ensure the greatest return on its investment in the UAS operator workforce.

Conclusions

For almost 20 years we have identified strategic management of human capital as a high-risk area across government in part because of persistent gaps in mission critical skills. With the Navy's commitment to accelerate the delivery of unmanned systems to the fleet and its budget of nearly $10 billion to develop and procure those systems in fiscal years 2018 through 2022, having sufficient personnel with the appropriate skills at the right time will be critical. To that end, without additional actions to improve their workforce planning the Navy and the Marine Corps may not be positioned to support their expanding unmanned systems operations. Specifically, lacking clear workforce planning policies, decision makers may not know when they should consider using federal civilian employees and private sector contractors as alternatives in determining the most appropriate and cost-effective workforces for their unmanned system operators.

With respect to personnel requirements development, until the Marine Corps' requirements and related cost estimates for the RQ-21 Blackjack UAS are updated, the services will lack current information about the number of operators needed and their affordability. Further, unless the Navy and the Marine Corps prioritize policy updates for operating and maintaining UAS of different sizes and capabilities they may miss opportunities to effectively and efficiently use personnel resources as system inventories grow. Without assessing the commercial drone industry and using that information to inform retention approaches, the Navy and Marine Corps may not know whether special and incentive pays are effectively tailored to ensure a sufficient number of UAS operators are available to meet future requirements. The Marine Corps, in particular, may continue to face challenges in meeting requirements and growing operational demands until it examines additional flexibilities to improve morale and career satisfaction among its UAS operator workforce and maximize the availability of operators serving in its squadrons. Overall, unmanned systems are key to future Navy and Marine Corps operations, but for these systems to be effective the services need to ensure that they take the necessary actions to provide sufficient personnel.

Recommendations for Executive Action

We are making the following ten recommendations to DOD. The Secretary of the Navy ensures that:

- The Chief of Naval Operations should clarify workforce planning policies to identify circumstances in which federal civilian employees and private sector contractors may serve in operational roles and what the benefits and limitations are of using federal civilians and private sector contractors as alternative workforces. (Recommendation 1)
- The Chief of Naval Operations should, after clarifying workforce planning policies, apply the revised policies to evaluate the use of alternative workforces (including federal civilian employees and private sector contractors) for future unmanned system operators. (Recommendation 2)
- The Commandant of the Marine Corps should clarify workforce planning policies to identify circumstances in which federal civilian employees and private sector contractors may serve in operational roles and what the benefits and limitations are of using federal civilians and private sector contractors as alternative workforces. (Recommendation 3)
- The Commandant of the Marine Corps should, after clarifying workforce planning policies, apply the revised policies to evaluate the use of alternative workforces (including federal civilian employees and private sector contractors) for future unmanned system operators. (Recommendation 4)
- The Commander, Naval Air Systems Command, in coordination with the Deputy Commandant of the Marine Corps for Combat Development and Integration, should update the Marine Corps personnel requirements associated with the RQ-21 Blackjack UAS based on the most current and enduring concept of operations and utilize the updated requirements in planning for UAS squadron personnel requirements. (Recommendation 5)
- The Commander, Naval Air Systems Command, should update the life cycle cost estimate for the RQ-21 Blackjack UAS to make adjustments as appropriate after updating the personnel requirements for the system. (Recommendation 6)
- The Deputy Chief of Naval Operations for Warfare Systems (N9), in coordination with the Deputy Commandant for Aviation, should prioritize continued efforts to fully evaluate policies for operating and maintaining UAS of different sizes and capabilities, such as group 3 UAS—to include establishing completion time frames, determining

whether reductions to personnel requirements could be accomplished, and identifying any associated cost savings and the benefits to the UAS squadrons' ability to complete missions—and update such policies as needed. (Recommendation 7)

- The Secretary of the Navy should clarify overarching goals for unmanned systems' personnel requirements, including related priority levels for resourcing purposes, and communicate them to requirements planners and budget decision makers. (Recommendation 8)
- The Chief of Naval Personnel and the Deputy Commandant for Manpower and Reserve Affairs should assess civilian supply, demand, and wages in the commercial drone industry and use the results to inform retention approaches, including the use of special and incentive pays for UAS operators. (Recommendation 9)
- The Deputy Commandant for Aviation and the Deputy Commandant for Manpower and Reserve Affairs should examine the use of additional human capital flexibilities that could improve the career satisfaction and retention of experienced UAS operators and maximize their availability to squadrons. Such flexibilities could include authorizing available special and incentive pays; permitting UAS operators to extend their enlistments to serve longer within squadrons; ensuring the availability of career- and promotion-enhancing opportunities for professional military education; considering the use of a potential insignia device for operators; or extending UAS operator contract lengths. (Recommendation 10)

Agency Comments and Our Evaluation

We provided a draft of this report to DOD for review and comment. In its written comments, reproduced in appendix III, DOD concurred with eight of our recommendations and partially concurred with two recommendations. DOD also provided technical comments on the draft report, which we incorporated as appropriate.

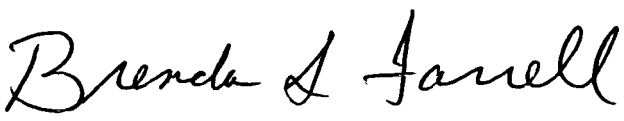
With regard to our recommendation to assess civilian supply, demand, and wages in the commercial drone industry and use the results to inform retention approaches, DOD partially concurred. DOD stated that it will assess competitive markets, both externally and internally, and then analyze the usage of incentive pays for UAS operators when retention rates and inventory levels of personnel display decreasing trends. DOD added that such analysis would be premature if conducted before initial operational capability is attained for each UAS because retention behaviors and air crew dynamics are not yet established. As noted in our

report, the Navy and the Marine Corps have each attained initial operational capability with one UAS (i.e., the MQ-8 Fire Scout B-variant and the RQ-21 Blackjack) and quantities of these and other UAS are expected to increase in future years. Additionally, the Marine Corps has designated UAS officer inventories as unhealthy since fiscal year 2013. Accordingly, we continue to believe that conducting such assessments and using the results are timely and important steps to ensure enough personnel to meet future operator requirements.

DOD partially concurred with our recommendation to examine the use of additional human capital flexibilities that could improve the career satisfaction and retention of experienced UAS operators. DOD stated that human capital flexibilities are constantly under review. Further, DOD stated that the UAS community is still in its infancy, but as it continues to grow and become healthier, assignment opportunities and flexibilities will become more prevalent and special and incentive pays will be examined as retention rates dictate. Such efforts would meet the intent of our recommendation if the opportunities and flexibilities DOD considers include other examples cited in our recommendation. That is, we continue to believe that DOD should also consider permitting UAS operators to extend their enlistments to serve longer within squadrons; ensuring the availability of career- and promotion-enhancing opportunities for professional military education; considering the use of a potential insignia device for operators; and extending UAS operator contract lengths.

We are providing copies of this report to the appropriate congressional committees, the Secretary of Defense, the Secretary of the Navy, and the Commandant of the Marine Corps. In addition, the report is available at no charge on the GAO website at http://www.gao.gov.

If you or your staff have any questions about this report, please contact me at (202) 512-3604 or farrellb@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 key contributions to this report are listed in appendix IV.



Brenda S. Farrell
Director, Defense Capabilities and Management

Appendix I: Characteristics of Selected Navy and Marine Corps Unmanned Systems

Navy MQ-8 Fire Scout Unmanned Aerial System

The Navy's MQ-8 Fire Scout unmanned aerial system (UAS) (B and C variants) is intended to provide real-time imagery and data in support of intelligence, surveillance, and reconnaissance missions for surface, anti-submarine, and mine warfare. The system is part of the surface warfare and mine countermeasures mission packages of the littoral combat ships. The MQ-8 system comprises one or more air vehicles with sensors, a control station, and ship equipment to aid in vertical launch and recovery. According to the program office, the MQ-8C has 90 percent commonality with the previously developed MQ-8B. The primary differences between the two are structural modifications to accommodate the MQ- 8C's larger airframe and fuel system.

The MQ-8 air vehicle is launched and recovered from air-capable ships, including littoral combat ships, and from land (see fig. 5).

Figure 5: The Navy's MQ-8 Fire Scout Unmanned Aerial System

Source: Defense Video and Imagery Distribution System. | GAO-18-162

Planned Quantity	63

Delivery Status and Schedule

The manufacturer has delivered 49 aircraft to the Navy as of September 2017 (including 30 B variants and 19 C variants), and 11 more aircraft (C variants) are scheduled to be delivered by fiscal year 2019.

The Navy attained initial operational capability with the B variant of the Fire Scout in fiscal year 2014, and plans to attain initial operational capability with the C variant in December 2018, depending on the availability of the littoral combat ship from which it deploys.

Operator Personnel Requirements

A composite aviation detachment embarked on a littoral combat ship consists of up to 24 personnel, including operator air crews equipped with one MH-60 helicopter and one MQ-8 Fire Scout UAS. An air crew consists of two personnel: one air vehicle operator and one mission payload operator. There is no additive personnel requirement associated with operators of the MQ-8 Fire Scout because these personnel already reside within existing expeditionary MH-60 helicopter squadron detachments. The littoral combat ships' crew berthing constraints was a key limiting factor in creating the personnel requirements for the number of air crew in a single composite aviation detachment.

Navy officials told us that they believe, based on deployment experiences and available data, that the personnel requirements for the MQ-8 Fire Scout are correct, although they stated that the operational tempo has been very limited to date due to problems with the littoral combat ship that have reduced the number of deployments.

Operator Staffing Approach

MH-60 helicopter pilots and enlisted aircrewmen from expeditionary helicopter squadrons attend 8 and 6 weeks, respectively, of MQ-8 Fire Scout UAS training. During deployments, these personnel serve dual roles as air crew of both the MH-60 and the MQ-8 Fire Scout.

MQ-8 Fire Scout air vehicle operators hold primary career designators as Navy helicopter pilots, and after their UAS training they are identified with an additional qualification designator of DY8. According to a senior Navy official, private sector contractors trained 126 air vehicle operators prior to February 2015, and since then Navy has trained another 91 air vehicle operators as of May 2017.

MQ-8 Fire Scout mission payload operators have an enlisted rating as a helicopter aircrewman, and after their UAS training they are identified with a Navy enlisted classification code of 8367. According to a senior Navy official, private sector contractors trained 148 mission payload operators

through March 2017, and the Navy has trained another 68 mission payload operators since February 2017 (as of May 2017).

According to Navy officials, they do not expect that the approach for staffing MQ-8 Fire Scout aircrew to negatively affect accessions or retention in the helicopter community, even when operational tempo increases, but they are continuing to monitor feedback from deployments.

Navy MQ-4 Triton UAS

The Navy's MQ-4 Triton UAS is intended to provide persistent maritime intelligence, surveillance, and reconnaissance data collection and dissemination capability in an operating area of a 2,000 nautical miles radius. Based on the Air Force's RQ-4B Global Hawk air vehicle, the MQ-4 Triton was formerly known as the Broad Area Maritime Surveillance UAS. Triton UAS sensors can provide detection, classification, tracking, and identification of maritime targets. Additionally, the MQ-4 Triton is designed with a communications relay capability that can link dispersed forces in the theater of operation. The system will cue other Navy assets for further situational investigation and/or attack, and will also provide a battle damage assessment of the area of interest. Tactical-level data analysis will occur in real-time at shore-based mission control systems via satellite communications.

The MQ-4 Triton is planned to operate from five shore-based sites worldwide as part of the Navy's family of maritime patrol and reconnaissance systems. From these sites, five MQ-4 Triton air vehicles will be airborne concurrently, 24 hours a day and 7 days a week (see fig.6).

Figure 6: The Navy's MQ-4 Triton Unmanned Aerial System

Source: Defense Video and Imagery Distribution System. | GAO-18-162

As a precursor to the MQ-4 Triton, the Navy's RQ-4A Broad Area Maritime Surveillance System-Demonstrator has been continuously deployed to the U.S. Central Command area since January 2009. All four of those planned demonstrator systems have been delivered to the Navy.

Planned Quantity

70

Delivery Status and Schedule

The manufacturer has delivered 2 systems to the Navy as of September 2017 and the Navy expects 10 more systems to be delivered through fiscal year 2021. At the time of this report, no air vehicles had yet been delivered to the Navy's first unmanned patrol squadron; the 2 systems were being utilized for testing.

The Navy has estimated that it will attain initial operational capability with the MQ-4 Triton UAS in 2021.

Operator Personnel Requirements

One of the Navy's two planned unmanned patrol squadrons (referred to as VUPs) will have 30 mission crews, the other squadron will have 20 mission crews, and both squadrons will have additional launch and recovery operators. A MQ-4 Triton mission crew will consist of four

personnel: one air vehicle operator, one tactical coordinator, and two mission payload operators. Future upgrades to the MQ-4 Triton will require a fifth mission crew member to fill a signals intelligence capability operator position. The number of required mission crew members was based in part upon a model that Naval Air Systems Command utilizes to project the number of air crew personnel to support a system.

According to Navy officials, the additional personnel requirements for the Navy associated with the establishment of Triton squadrons are offset by realignments of the Maritime Patrol and Reconnaissance Force, including the retirement of the P-3 Orion aircraft and reduction of associated personnel requirements.

Navy officials told us that they believe, based in part on experience with the Broad Area Maritime Surveillance - Demonstrator, that the personnel requirements for the MQ-4 Triton are adequate, although they stated that they will continue to review and monitor the requirements for sufficiency in future years as the Navy attains steady state operations with the system's five continuous orbits.

Operator Staffing Approach

The Navy's approach for staffing operator aircrew for the MQ-4 Triton is to utilize a portion of its naval aviators, naval flight officers, and enlisted aircrew whose qualification is on a maritime patrol and reconnaissance force aircraft (e.g., the P-8A Poseidon) and assign them to an unmanned patrol squadron following a sea tour with their primary aircraft. According to Navy officials, the career path for all its aviators generally includes a number of shore duty options following a first deployment. The unmanned patrol squadron assignments will be an additional option for aviators' first shore tour. The Navy will provide Triton aircrew members with approximately 3 months of training to qualify on the UAS in connection with their unmanned patrol squadron assignment. Air vehicle operators and tactical coordinators who are trained and qualified on the MQ-4 Triton will be identified with an additional qualification designator of DC5. Trained and qualified mission payload operators will be identified with a Navy enlisted classification of 7828.

According to Navy officials, they do not expect the approach for staffing MQ-4 Triton aircrew to affect accessions or retention in the maritime patrol and reconnaissance community at this time, but it is too soon to be certain. In the meantime, the officials stated that they will continue to monitor personnel feedback and reassure personnel about the career value of experience in a MQ-4 Triton squadron. In addition, the Navy

plans to leverage members of its reserve component to augment the pool of available personnel who can be assigned to its VUP squadrons.

Navy MQ-25 Stingray UAS

The Navy's MQ-25 Stingray UAS will be the first UAS to operate from aircraft carriers. According to Navy officials, the MQ-25 Stingray's primary mission will be to provide a robust refueling capability to extend the range and reach of the carrier air wing and reduce the need for F/A-18E/F Super Hornets to perform refueling missions, freeing them for strike missions, and preserving service life. As a secondary mission, the MQ-25 Stingray will also provide an intelligence, surveillance, and reconnaissance capability. The Navy previously referred to the MQ-25 Stingray as the Carrier Based Aerial Refueling System, a program that followed a restructuring of the former Unmanned Carrier-Launched Airborne Surveillance and Strike program.

Planned Quantity

The Navy's initial plan is to purchase 72 MQ-25 Stingray air vehicles.

Delivery Status and Schedule

No systems have been delivered and a delivery schedule has not been established because the system is still in an early stage of DOD's acquisition process, with a contract award for system development scheduled for the fourth quarter of fiscal year 2018.

The Navy has estimated attaining initial operational capability with the system by the mid-2020s time frame.

Operator Personnel Requirements

According to Navy officials, they plan to either establish new aviation squadrons or utilize existing squadrons in a composite format (i.e., with personnel supporting both an existing manned aircraft and the MQ-25 Stingray). However, these officials told us they have not yet determined the categories of personnel eligible for MQ-25 Stingray air vehicle operator positions and other types of supporting positions, nor have they determined the number of personnel that will be required. The Navy was conducting analyses for such decisions at the time of our review. The precise number of operators per system will be determined and updated as the system progresses through acquisition

Operator Staffing Approach

The Navy has not yet developed a staffing approach for MQ-25 Stingray operators. According to Navy officials involved in establishing plans and requirements for the system, they are considering different options for the systems' operators, including using enlsited personnel or an approach similar to that used for the MQ-8 Fire Scout operators in which a population of aviation personnel, including pilots, would be identified from

a related, existing aircraft community—such as the E-2 Hawkeye aircraft—and provided with UAS qualification training if they were assigned to operate the MQ-25 Stingray in a composite squadron along with their other primary aircraft. According to these officials, at the direction of the Commander of Naval Air Forces, they have considered establishing a new UAS operator career field and surveyed midshipmen at the U.S. Naval Academy to gauge their interest in such a career.

Marine Corps RQ-21 Blackjack UAS

The Marine Corps' RQ-21 Blackjack UAS provides units with a dedicated intelligence, surveillance, and reconnaissance capability for tactical commanders in real time by providing actionable intelligence and communications relay for 12-hour continuous operations per day, with a short surge capability of 24-hours of continuous operations for a 10-day period, during any 30-day cycle.[1]

An RQ-21 Blackjack system consists of five air vehicles, two ground control stations, multi-mission payloads, one launcher, one recovery system, data links, and support systems. Standard payloads include electro-optical and infrared cameras, communications relay payload, and automatic identification system. Future upgraded capabilities may include command and control integration, weapons integration, heavy fuel engine, laser designator, frequency agile communications relay, digital common data link, and cyclic refresh of the electro-optical and infrared cameras.

The RQ-21 Blackjack can be launched and recovered from land or from air-capable ships, including L-class ships (e.g., amphibious transport docks) (see fig. 7).

[1] The RQ-21 Blackjack unmanned aerial system (UAS) is part of a combined Navy and Marine Corps program formerly known as the Small Tactical Unmanned Aircraft System. The Navy is fielding a smaller number of Blackjack UAS than the Marine Corps (3 systems), which units from Naval Special Warfare will operate.

Figure 7: The Marine Corps' RQ-21 Blackjack Unmanned Aerial System

Source: Defense Video and Imagery Distribution System. | GAO-18-162

Planned Quantity

32

Delivery Status and Schedule

The manufacturer has delivered 11 systems to the Marine Corps as of September 2017 and the Marine Corps expects the other 21 planned systems to be delivered through 2022.

The Marine Corps attained initial operational capability with the RQ-21 Blackjack in 2016.

Operator Personnel Requirements

The Marine Corps has three active duty unmanned aerial vehicle squadrons (VMU 1, 2, and 3) and one reserve VMU squadron (VMU 4) that will operate the RQ-21 Blackjack UAS. Each active duty VMU will contain nine detachments and each detachment will comprise 9 personnel—including 1 UAS officer and 3 enlisted UAS operators—and one RQ-21 Blackjack UAS. The Marine Corps Reserve's VMU 4 will contain three detachments.

The Marine Corps' does not distinguish between requirements for air vehicle operators and mission payload operators for the RQ-21 Blackjack because those functions are performed by the same operator.

Operator Staffing Approach

The Marine Corps has a primary career field for operating UAS, including enlisted UAS operators and UAS officers. The Marine Corps replenishes its UAS operator and officer personnel inventories by selecting from eligible applicant groups. For enlisted UAS operators, eligible groups include new graduates of recruit training and experienced marines who apply for a lateral transfer from another occupational specialty. UAS officers are selected from three sources: new graduates of officer training; pilot or flight officer trainees who do not complete their manned aircraft qualification; and experienced officers seeking a transfer from another occupational specialty, including pilots of manned aircraft.

The Marine Corps requires certain minimum test scores before marines can be selected for UAS training. Enlisted marines must achieve minimum test scores comparable to those required for other high-skill occupations, such as intelligence specialists.[2] Officers take a separate test battery and must attain the same minimum scores as other officers who are selected for manned naval aviation training. Following their selection for UAS training, enlisted personnel must complete 5 months of Army UAS training courses to attain their military occupational specialty as a UAS operator. Officers attend 6 months of Air Force training courses to attain their occupational specialty. The Marine Corps then assigns a primary occupation identification code to trained personnel, which is 7314 for enlisted UAS operators or 7315 for UAS officers.

The Marine Corps assigns enlisted personnel and officers to one of its UAS squadrons after they attain their occupational specialty, where they continue their UAS training to attain and maintain proficiency and advanced qualifications. As discussed earlier in this report, Marine Corps UAS squadrons believe that an RQ-21 Blackjack detachment requirement of 9 personnel is not sufficient to meet their workloads. Since 2015, squadrons have staffed their deploying detachments with up to 30 personnel each to support the workload and levels of supervision they believe are necessary to operate and maintain an RQ-21 Blackjack UAS and avoid mishaps and damage to the aircraft during recovery to meet operating and maintenance standards, among other reasons.

[2] Department of the Navy, NAVMC 1200.1C, *Military Occupational Specialties Manual*, (Apr. 17, 2017).

Navy Mine Countermeasures Unmanned Surface Vehicle and Unmanned Influence Sweep System

The Navy's Mine Countermeasures Unmanned Surface Vehicle (USV) and Unmanned Influence Sweep System will be part of the mine countermeasures mission package of the Navy's littoral combat ships (see fig. 8).

Figure 8: The Navy's Mine Countermeasures Unmanned Surface Vehicle and Unmanned Influence Sweep System

Source: Naval Sea Systems Command. | GAO-18-162

The Mine Countermeasures USV will tow a sonar payload for mine hunting. The Unmanned Influence Sweep System will use the same USV platform to tow an acoustic and magnetic influence sweep payload to clear bottom and moored mines. Both systems will be launched and recovered from littoral combat ships.

Planned Quantity

For the Mine Countermeasures USV, the projected inventory is 2 systems per mine countermeasures mission package for a total of 48 systems, in addition to systems needed for training.

For the Unmanned Influence Sweep System, the projected inventory is 1 per mine countermeasures mission package for a total of 24 payloads, in addition to payloads for training.

Delivery Status and Schedule

As of September 2017, two Mine Countermeasures USVs were under construction, but neither had been delivered to the Navy. The Navy plans to attain initial operational capability with the Mine Countermeasures USVs in fiscal year 2021.

As of September 2017, one Unmanned Influence Sweep System had been constructed and the Navy expects it to be delivered for testing by fiscal year 2018. The Navy plans to attain initial operational capability with the Unmanned Influence Sweep System in fiscal year 2019.

Operator Personnel Requirements

The Mine Countermeasures USV and Unmanned Influence Sweep System will be operated by littoral combat ship mine countermeasures mission package crews of 20 personnel each. The precise number of operators per system will be determined and updated as the systems progress through acquisition.

Operator Staffing Approach

According to Navy officials, USV operators associated with the littoral combat ships' mine countermeasures mission package crews will not be directly accessed and recruited to such positions. Instead, these officials stated that enlisted sailors from related primary career ratings will be assigned to the crews and trained on the USVs along with other systems as part of a longer training pipeline. Upon their completion of training, the Navy plans to identify them with a Navy enlisted classification code of 1206, Littoral Combat Ship Mine Warfare Mission Package Specialist.

Navy MK 18 Unmanned Underwater Vehicle Family of Systems

The Navy's MK 18 Unmanned Underwater Vehicle (UUV) family of systems consists of the MK 18 "Mod 1" Swordfish UUV and the MK 18 "Mod 2" Kingfish UUV. The MK 18 Mod 1 Swordfish is a man-portable system that performs autonomous, low-visibility exploration and reconnaissance missions in support of amphibious landings and mine countermeasures operations, among other things. The MK 18 Mod 2 Kingfish UUV is a larger vehicle with increased endurance and depth, and more advanced sensors to improve mine countermeasures capabilities. The Mod 1 Swordfish and the Mod 2 Kingfish operate in very shallow water and shallow water zones, and will be tactically integrated to enable detection of moored and bottom mines at increased standoff and reduced risk to operators and systems that would otherwise be operating in the minefield.

The MK 18 systems can be launched and recovered from shore, from rigid hull inflatable boats or from ships (see fig. 9).

Figure 9: The Navy's MK 18 Mod 1 and Mod 2 Unmanned Underwater Vehicles

Source: Naval Sea Systems Command. | GAO-18-162

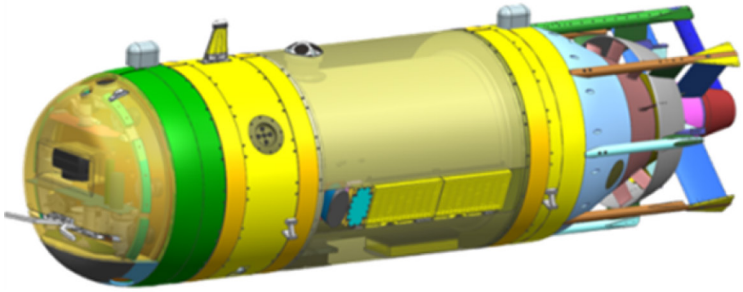
Planned Quantity	41 (25 Mod 1 Swordfish and 16 Mod 2 Kingfish)
Delivery Status and Schedule	The manufacturer has delivered 33 systems (21 Mod 1 Swordfish and 12 Mod 2 Kingfish) to the Navy as of fiscal year 2017. The Navy attained full operational capability with the first increment of the Mod 1 Swordfish in fiscal year 2007 and expects to attain initial operational capability with the first increment of the Mod 2 Kingfish in fiscal year 2019.
Operator Personnel Requirements	MK 18 UUVs are operated by platoons within three different Navy units: Explosive Ordinance Disposal Mobile Unit One, Mobile Diving and Salvage Unit Two, and the Naval Oceanography Mine Warfare Center. According to Navy officials, the establishment of such platoons did not generate an additive personnel requirement to those units. The minimal personnel requirement for MK 18 operations includes three UUV operators and a UUV supervisor, along with an officer-in-charge, a boat coxswain, and a boat engineer.
Operator Staffing Approach	According to Navy officials, the Navy does not directly access or recruit personnel to fill its requirements for operators of the MK 18 UUVs. These officials stated that, instead, enlisted sailors from related primary career ratings, including special warfare boat operator and aerographer's mate ratings, can be assigned to a unit that operates the UUVs either on their first tour or later in their career on a subsequent assignment. Navy officials also stated that Navy Expeditionary Combat Command is

coordinating with the Commander, Submarine Forces, to potentially utilize the Navy enlisted classification code of 9550 for its UUV operators.

Navy Snakehead Large Displacement UUV

The Navy's Snakehead Large Displacement UUV will be a long-endurance, off-board system that will conduct reconnaissance and surveillance missions in denied areas and in waters too shallow or otherwise inaccessible for conventional platforms (see fig. 10).

Figure 10: The Navy's Snakehead Large Displacement Unmanned Underwater Vehicle



Source: Naval Sea Systems Command. | GAO-18-162

The Snakehead Large Displacement UUV will be launched and recovered from submarines and surface ships.

Planned Quantity

14

Delivery Status and Schedule

No systems have been delivered to the Navy. The Navy is planning for the first 2 systems to be delivered in fiscal year 2020 and for another 2 systems to be delivered in fiscal year 2023. The Navy will attain initial operational capability with the first phase systems when two of them are delivered and tested on a host platform, a life-cycle sustainment plan is in place, and personnel are trained and equipped to operate and maintain the system from a host platform.

Operator Personnel Requirements

The Navy plans to field the Snakehead Large Displacement UUVs to UUV Squadron 1. According to Navy officials, the squadron is also testing or operating more than 10 other types of UUVs and expects to receive 2 or more other new types of UUVs through approximately fiscal year 2020, along with the Snakehead. Although Navy officials told us that it is too soon to analyze and determine the numbers of personnel required for the system at the time of this report, they plan to utilize forward-deployed operators to launch and recover the vehicle, an operator to control the

vehicle from an operations center on land, and a mission payload operator as needed depending on the mission. The precise number of operators per system will be determined and updated as the systems progress through acquisition.

Operator Staffing Approach

In staffing personnel to meet requirements for UUV Squadron 1, Navy officials stated that they do not directly access or recruit personnel to fill such positions. Instead, these officials told us that enlisted sailors from related career ratings within the submarine community, such as sonar technicians, are assigned to the squadron generally after they have completed at least one previous assignment and have approximately 5 years of experience in the Navy. According to the officials, once personnel are assigned to the squadron, they receive UUV training to qualify on the systems they will operate, and they will be identified with a Navy enlisted classification code of 9550 for UUV operators.

Appendix II: Objectives, Scope, and Methodology

This report addresses the extent to which the Navy and the Marine Corps have (1) evaluated workforce alternatives for their unmanned system operators, including the use of federal civilian employees and private sector contractors; (2) developed and updated personnel requirements and related policies and goals that affect requirements for operators, maintainers, and other support personnel for selected unmanned systems; and (3) developed approaches for staffing unmanned system operators to meet personnel requirements and have met those requirements.

To address these objectives, we included in the scope of our review the Navy's and the Marine Corps' unmanned aerial systems (UAS), unmanned surface vehicles (USV), and unmanned underwater vehicles (UUV) that were programs of record in calendar year 2016. On the basis of Department of the Navy documentation and interviews with knowledgeable officials, we identified 24 such systems. To provide illustrative examples for our first and third objectives and to address the entirety of our second objective, we further narrowed our scope to those systems that had progressed far enough through DOD's acquisition process to be part of a program of record within the purview of the services' system commands. Additionally, we narrowed our scope for UASs, in particular, to those categorized as group 3 or above.[1] We omitted smaller group 1 UASs because service officials told us that those systems are fielded in larger numbers as additional capabilities for existing units in accomplishing their missions and entail a small workload for operating and maintaining them relative to UASs of group 3 and above. Group 2 UASs that the Navy and the Marine Corps utilize are contractor-owned and operated, which was outside the scope of our review.

From the remaining unmanned systems in our scope, we selected eight case studies to review the services' evaluations of workforce alternatives, development and updates of personnel requirements and related policies and goals, and staffing approaches: four UASs—the Navy's MQ-4 Triton, MQ-8 Fire Scout, MQ-25 Stingray, and the Marine Corps' RQ-21 Blackjack; the two USVs—the Unmanned Influence Sweep System and the Mine Countermeasures USV—associated with the Navy's littoral

[1] DOD classifies its unmanned aerial systems (UAS) into five groups on the basis of their size and capabilities, including airspeed and operating altitude. For example, group 1 UAS weigh fewer than 20 pounds and operate below 1,200 feet in altitude, whereas group 5 UAS weigh more than 1,320 pounds and operate above 18,000 feet.

combat ships; and two types of the Navy's UUVs—the MK 18 family of UUV systems and the Snakehead Large Displacement UUV—based on their size and missions.[2] Although the results of the UUV case studies cannot be generalized to all UUVs across the Navy, they illustrate different characteristics of and approaches used for workforce mix, requirements, and staffing for such systems.

To address our first objective, we compared any Navy and Marine Corps efforts to evaluate federal civilian employees and private sector contractors as workforce alternatives for operators of all of their unmanned systems, including those from our case study sample, with criteria from (1) DOD Directive 1100.4, G*uidance for Manpower Management*, which directs, among other things, that authorities consider all available sources when determining workforce mix, and that workforces be designated as federal civilians except in certain circumstances, and (2) DOD Instruction 1100.22, *Policy and Procedures for Determining Workforce Mix*, which establishes the workforce mix decision process and directs that workforce planning authorities consider all available personnel when determining the workforce mix—that is, the combination of military servicemembers, federal civilians, and private sector contractors.[3] Specifically, we analyzed available documentation for the selected case study systems on any evaluations the services performed of alternative workforces and the related decisions made about eligible personnel categories, and interviewed knowledgeable service officials about factors that informed those evaluations and decisions and any reasons for not evaluating workforce alternatives.

We also interviewed officials from the Navy and OUSD(P&R) who are responsible for reviewing workforce and personnel planning documents for Navy and Marine Corps programs to understand any broader DOD or service workforce planning efforts for unmanned systems, and reasons for omitting certain personnel categories from consideration for systems that are in development. We reviewed our prior reports on workforce mix and DOD-commissioned workforce mix studies and interviewed officials

[2] The RQ-21 Blackjack UAS is a single system that is used by both the Navy and the Marine Corps. We did not include the Navy's use of the RQ-21 Blackjack in the scope of our review because the Navy plans to field only three systems.

[3] DOD Directive 1100.4, *Guidance for Manpower Management* (Feb. 12, 2005); DOD Instruction 1100.22, *Policy and Procedures for Determining Workforce Mix* (Apr. 12, 2010). DOD Instruction 1100.22 was updated on December 1, 2017. However, the 2010 version was in use by DOD during the audit period.

from OUSD(P&R) to identify limitations and benefits associated with different categories of personnel, including military servicemembers, federal civilian employees of DOD, and private sector contractors.[4] We reviewed the Navy's and the Marine Corps' policies on workforce planning to determine whether those policies provide more detailed guidance or criteria relative to those available in DOD's policies on circumstances for which alternative personnel sources should be considered or on the limitations and benefits associated with different workforce mix options.[5] We also compared these service-level workforce planning policies with federal internal controls standards that emphasize the importance of having clear, updated policies that align with an organization's mission and goals.[6]

To address our second objective, we reviewed the Navy's and the Marine Corps' efforts to develop and update personnel requirements for our selected case study systems, including documentation of steps taken to analyze and determine personnel requirements levels. We interviewed service officials about their views of the sufficiency of those personnel requirements for supporting training and deployment requirements for the selected systems. For any systems that service officials were concerned about the sufficiency of related personnel requirements, we compared documentation of the requirements with DOD Directive 1100.4 and with a Navy instruction.[7] The DOD policy states that personnel requirements should be driven by workload and established at the minimum levels necessary to accomplish mission and performance objectives. Navy Instruction 1000.16L states that personnel requirements must be

[4] GAO, Military Compensation: Additional Actions are Needed to Better Manage Special and Incentive Pay Programs, GAO-17-39 (Feb. 3, 2017); *Unmanned Aerial Systems: Air Force and Army Should Improve Human Capital Planning for Pilot Workforces*, GAO-17-53 (Washington, D.C.: Jan. 31, 2017); *Human Capital: Additional Steps Needed to Help Determine the Right Size and Composition of DOD's Total Workforce*, GAO-13-470 (Washington, D.C.: May 29, 2013); *Military Personnel: Army Needs a Requirement for Capturing Data and Clear Guidance on the Use of Military for Civilian or Contractor Positions*, GAO-15-349 (Washington, D.C.: June 15, 2015); Institute for Defense Analyses, *Staffing for Unmanned Aircraft Systems (UAS) Operations* (June 2016); and RAND Corporation, U.S. Department of Defense *Experiences with Substituting Government Civilian Employees for Military Personnel* (Santa Monica, CA: 2016).

[5] Office of the Chief of Naval Operations (OPNAV), Instruction 1000.16L, *Navy Total Force Manpower Policies and Procedures* (June 24, 2015) (Change transmittal 1, April 28, 2016); Marine Corps Order 5311.1E, *Total Force Structure Process* (Nov. 18, 2015).

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

[7] OPNAV Instruction 1000.16L.

validated as program changes dictate and at a minimum annually over a system's lifecycle to determine if a personnel update is required. Further, we reviewed documentation of the life cycle cost estimate for the number of Marine Corps personnel required to operate and maintain the RQ-21 Blackjack, and of UAS squadrons' position on the sufficiency of those personnel requirements, and compared those documents with DOD guidance requiring that components determine a weapon system program's life cycle costs by planning for the many factors needed to support the system, including personnel, and with Office of Management and Budget guidance that states that to keep the cost analyses for capital assets, such as weapon systems, current, accurate, and valid, cost estimating should be continuously updated based on the latest information available as programs mature.[8]

In addition, we reviewed Navy policies on operating and maintaining UAS and documentation from the Marine Corps about the effect of those policies on UAS squadron personnel workload, and interviewed Navy and Marine Corps headquarters- and unit-level officials about those effects and any efforts underway to review and update policies.[9] We then compared those efforts to review and update policies with DOD Directive 1100.4 stating that existing policies, procedures, and structures should be periodically evaluated to ensure efficient and effective use of personnel resources, and with federal internal controls standards that emphasize the importance of having clear, updated policies that align with an organization's mission and goals.[10] Finally, we compared goals established in DOD's *Unmanned Systems Integrated Roadmap, FY2013-2038* and Department of the Navy strategy documents on unmanned systems with federal internal controls standards that state than an agency's management should define objectives clearly to enable the identification of risk.[11]

[8] DOD Instruction 5000.02, *Operation of the Defense Acquisition System* (Jan. 7, 2015) (incorporating change 3, Aug. 10, 2017); DOD, *Defense Acquisition Guidebook*, chap.1, Program Management (2017); Office of Management and Budget Circular No. A-11, *Preparation, Submission, and Execution of the Budget*, Capital Programming Guide (2017).

[9] Commander, Naval Air Forces CMAF M-3710.7, *NATOPS General Flight and Operating Instructions Manual* (May 5, 2016); Commander, Naval Air Forces Instruction 4790.2C, *The Naval Aviation Maintenance Program (NAMP)* (Jan. 15, 2017).

[10] GAO-14-704G.

[11] DOD, *Unmanned Systems Integrated Roadmap, FY2013-2038*.

For our third objective, we reviewed the Navy's and the Marine Corps' steps to select, train, and track unmanned system operators to identify any challenges. We reviewed for the selected systems a combination of manpower estimate reports and personnel and training plan documents to identify approaches for staffing operators. We also reviewed personnel and training manuals describing prerequisites for related military qualifications and occupations. We interviewed command- and unit-level officials from the Navy and the Marine Corps to discuss the effectiveness of current staffing approaches for meeting their training and deployment requirements.

Focusing on challenges with providing enough personnel to serve as UAS operators in particular, we also reviewed Navy reports on the retention of certain aviation personnel to serve as UAS operators and we reviewed Marine Corps data on its UAS operator inventory and retention levels relative to its requirements and goals. Specifically, we reviewed Navy reports on retention for fiscal years 2015 through 2017 because data from earlier years were less relevant given the lower numbers of UAS inventories. We requested data from the Marine Corps on its inventories of and requirements for enlisted UAS operators for fiscal years 2007 through 2017 and on UAS officers for fiscal years 2013 (the first year of available data) through 2017. We requested retention data—actual numbers of personnel who reenlisted versus annual quotas—on enlisted UAS operators for fiscal years 2010 (the earliest year for which data were available) through 2017.

We assessed the reliability of these Marine Corps data by administering questionnaires and interviewing relevant personnel responsible for maintaining and overseeing the systems that supplied the data and manually checking the data for errors or omissions. Through these methods, we obtained information on the systems' ability to record, track, and report on these data, as well as on the quality control measures in place. We found the inventory and requirements data to be sufficiently reliable for the purposes of describing personnel inventory trends and the sufficiency of operator personnel to meet requirements. We found that the retention data are of undetermined reliability but are reporting them because they are the data of record used by Marine Corps planning officials. We also reviewed Navy and Marine Corps financial incentives for retaining sufficient personnel to serve as UAS operators and compared those approaches with criteria from DOD's 2012 *Eleventh Quadrennial Review of Military Compensation*, which established that organizations

should assess civilian supply and demand and civilian wages to determine the most cost effective special and incentive pay strategies.[12]

Further, we compared the Marine Corps' efforts to address workforce challenges specific to the Marine Corps' UAS operator career field with a key principle of strategic human capital planning from our prior work, which states that agencies should ensure that flexibilities are part of their overall human capital strategy.[13] In our prior work, we found that strategic human capital planning is an important component of an agency's effort to develop long-term strategies for acquiring, developing, and retaining staff needed for an agency to achieve its goals and of an agency's effort to align human capital activities with the agency's current and emerging mission. Specifically, we have found that an agency's efforts to conduct strategic human capital planning should include, among other things, building the capability needed to address administrative, educational, and other requirements important to supporting workforce strategies by ensuring that flexibilities are part of the overall human capital strategy. We focused on workforce challenges in the Marine Corps, in particular, because it has a long-established career field for UAS operators, and the Navy does not yet have a separate career field for any of its unmanned systems operators.

We identified workforce challenges within the Marine Corps' UAS operator career field by reviewing a 2015 Marine Corps-sponsored survey of its pilot and UAS officer workforce. The survey included questions about satisfaction with career and benefits, and intentions to stay in the Marine Corps and the underlying reasons for these.[14] Although officers in ranks of first lieutenant through lieutenant colonel were surveyed, we were unable to include majors and lieutenant colonels in reporting results for UAS officers because the Marine Corps aggregated those officers' responses with those of majors and lieutenant colonels who operate other

[12] DOD, *Eleventh Quadrennial Review of Military Compensation* (June 2012).

[13] GAO, *Human Capital: Key Principles for Effective Strategic Workforce Planning*, GAO-04-39 (Washington, D.C.: Dec. 11, 2003). "Human capital flexibilities" are the policies and practices that an agency has the authority to implement in managing its workforce to accomplish the missions and achieve goals. Flexibilities include actions related to recruitment, retention, compensation, position classification, incentive awards and recognition, training and development, performance management and appraisals, and work-life policies.

[14] Marine Corps, Deputy Commandant for Aviation, *Information Paper: 2015 Aviator Retention Survey Results* (Nov. 10, 2015).

types of aircraft. By reviewing the survey methodology and interviewing an official involved in administering the survey and analyzing the results, we determined that the survey results were sufficiently reliable for reporting the perceptions about career satisfaction at a single point in time for UAS operators who answered those questions.

In addition, we visited one of three active duty Marine Corps UAS squadrons, which we chose because it had the most deployment experience with the RQ-21 Blackjack UAS. We met with squadron leaders to discuss their views about UAS personnel requirements and staffing approaches. We also conducted eight small group discussions with active duty UAS operators and officers—separately for enlisted personnel and officers—to gain their perspectives on topics such as morale, workload, and career satisfaction. The opinions of Marine Corps UAS operators we obtained during our discussion groups are not generalizable to the population of UAS operators in the Marine Corps.

We interviewed officials and, where appropriate, obtained documentation from the following organizations:

Office of the Secretary of Defense	• Office of the Under Secretary of Defense for Personnel and Readiness
Joint Staff	• J8 Joint Capabilities Division
Navy	• Office of the Assistant Secretary of the Navy for Manpower and Reserve Affairs • Office of the Deputy Assistant Secretary of the Navy for Unmanned Systems • Office of the Deputy Chief of Naval Operations for Manpower, Personnel, Training and Education (N1) • Office of the Deputy Chief of Naval Operations for Warfare Systems (N9) • Program Executive Officer, Unmanned Aviation and Strike Weapons • Commander, Naval Air Systems Command • Commander, Naval Sea Systems Command • Commander, Naval Air Forces

- Commander, Submarine Force U.S. Pacific Fleet
- Navy Expeditionary Combat Command
- Chief of Naval Air Training
- Bureau of Naval Personnel
- Navy Manpower Analysis Center
- Commander, Patrol and Reconnaissance Group
- Helicopter Sea Combat Wing Pacific
- Submarine Development Squadron 5

Marine Corps

- Office of the Deputy Commandant for Aviation
- Office of the Deputy Commandant for Combat Development and Integration
- Office of the Deputy Commandant for Manpower and Reserve Affairs
- Marine Corps Systems Command
- Marine Unmanned Aerial Vehicle Squadron 2

We conducted this performance audit from September 2016 to February 2018 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.

Appendix III: Comments from the Department of Defense

OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE
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MANPOWER AND
RESERVE AFFAIRS

JAN 11 2018

Ms. Brenda Farrell
Director, Defense Capabilities Management
U.S. Government Accountability Office
441 G Street, NW
Washington, DC 20548

Dear Ms. Farrell,

This is the Department of Defense (DoD) response to the GAO Draft Report, GAO-18-162SU, 'MILITARY PERSONNEL: Actions Needed to Better Position the Navy and the Marine Corps to Support Expanding Unmanned Systems Operations,' dated November 21, 2017 (GAO Code 101083).

As the Department seeks to maximize lethality, improve and sustain readiness, grow the force, and increase capability and capacity, we must ensure we have the right manpower and human capital resources in the right places, at the right time, at the right levels, and with the right skills to provide for the Nation's defense, while simultaneously being good stewards of taxpayer dollars. How we determine and meet the manpower demand for remotely operated/piloted platforms is critical to achieving the Secretary's force planning priorities.

The Department has a number of initiatives and efforts underway that will impact the size, structure, composition, and mix of our workforce for remotely operated/piloted platforms. These platforms are an integral part of our force structure and play an increasingly important role in military operations. In order to maximize mission accomplishment, the Department is committed to addressing manpower and training challenges resulting from the increased demand for these capabilities. This can be achieved, in part, through an optimized manpower structure, a right-sized force mix, and training pipelines aligned to produce the capabilities and capacity necessary to most effectively employ remotely operated platforms.

The Department's responses to the specific recommendations are in the enclosure. Should you have any questions, please contact my primary action officer for this engagement, Mr. Thomas Hessel at 703-697-3402 or thomas.j.hessel.civ@mail.mil.

Sincerely,

Rich Robbins
Director, Total Force Manpower &
Resources

Enclosure

GAO Draft Report Dated November 21, 2017
GAO-18-162SU (GAO CODE 101083)

"MILITARY PERSONNEL: ACTIONS NEEDED TO BETTER POSITION THE NAVY AND THE MARINE CORPS TO SUPPORT EXPANDING UNMANNED SYSTEMS OPERATIONS"

DEPARTMENT OF DEFENSE COMMENTS TO THE GAO'S RECOMMENDATIONS

RECOMMENDATION 1: The Chief of Naval Operations should clarify workforce planning policies to identify circumstances in which federal civilian employees and private sector contractors may serve in operational roles and what the benefits and limitations are of using federal civilians and private sector contractors as alternative workforces.

DoD RESPONSE: Concur.

RECOMMENDATION 2: The Chief of Naval Operations should, after clarifying workforce planning policies, apply the revised policies to evaluate the use of alternative workforces (including federal civilian employees and private sector contractors) for future unmanned system operators.

DoD RESPONSE: Concur.

RECOMMENDATION 3: The Commandant of the Marine Corps should clarify workforce planning policies to identify circumstances in which federal civilian employees and private sector contractors may serve in operational roles and what the benefits and limitations are of using federal civilians and private sector contractors as alternative workforces.

DoD RESPONSE: Concur.

RECOMMENDATION 4: The Commandant of the Marine Corps should, after clarifying workforce planning policies, apply the revised policies to evaluate the use of alternative workforces (including federal civilian employees and private sector contractors) for future unmanned system operators.

DoD RESPONSE: Concur.

RECOMMENDATION 5: The Commander, Naval Air Systems Command, in coordination with the Deputy Commandant of the Marine Corps for Combat Development and Integration, should update the Marine Corps personnel requirements associated with the RQ-21 Blackjack UAS based on the most current and enduring concept of operations and utilize the updated requirements in planning for UAS squadron personnel requirements.

DoD RESPONSE: Concur.

RECOMMENDATION 6: The Commander Naval Air Systems Command should update the life cycle cost estimate for RQ-21 Blackjack UAS to make adjustments as appropriate after updating the personnel requirements for the system.

DoD RESPONSE: Concur.

RECOMMENDATION 7: The Commander, Naval Air Forces, in coordination with the Deputy Commandant for Aviation, should prioritize continued efforts to fully evaluate policies for operating and maintaining UAS of different sizes and capabilities, such as group 3 UAS – to include establishing completion timeframes, determining whether reductions to personnel requirements could be accomplished, and identifying any associated cost savings and the benefits to the UAS squadrons' ability to complete missions – and update such policies as needed.

DoD RESPONSE: Concur.

RECOMMENDATION 8: The Secretary of the Navy should clarify overarching goals for unmanned systems' personnel requirements, including related priority levels for resourcing purposes, and communicate them to requirements planners and budget decision makers.

DoD RESPONSE: Concur.

RECOMMENDATION 9: The Chief of Naval Personnel and the Deputy Commandant for Manpower and Reserve Affairs should assess civilian supply, demand, and wages in the commercial drone industry and use the results to inform retention approaches, including the use of special and incentive pays for UAS operators.

DoD RESPONSE: Partially concur. As with all Military Occupational Specialties (MOSs), an assessment of the competitive markets (externally and internally) will be conducted when retention rates and inventory levels show decreasing trends. At that time, the usage of incentive pays for UAS operators will also be analyzed. Furthermore, such analysis would be premature if conducted prior to the Initial Operating Capability (IOC) for each UAS as retention behaviors and aircrew dynamics are not yet established.

RECOMMENDATION 10: The Deputy Commandant for Aviation and the Deputy Commandant for Manpower and Reserve Affairs should examine the use of additional human capital flexibilities that could improve career satisfaction and retention of experienced UAS operators and maximize their availability to squadrons. Such flexibilities could include authorizing available special and incentive pays; permitting UAS operators to extend their enlistments to serve longer within squadrons; ensuring availability of career- and promotion-enhancing opportunities for professional military education; considering the use of a potential insignia device for operators; or extending UAS operator contract lengths.

DoD RESPONSE: Partially concur. Human capital flexibilities are constantly under review. The UAS community is still in its infancy, but as it continues to grow and become healthier, assignment opportunities and flexibilities will become more prevalent. Special and incentive pays will be examined as retention rates dictate.

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Appendix IV: GAO Contact and Staff Acknowledgments

GAO Contact

Brenda S. Farrell, (202) 512-3604 or FarrellB@gao.gov

Staff Acknowledgments

In addition to the contact named above, key contributors to this report were Lori Atkinson, (Assistant Director), Melissa Blanco, Tim Carr, Mae Jones, Amie Lesser, Felicia Lopez, Ben Sclafani, Mike Silver, and Paul Sturm.

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