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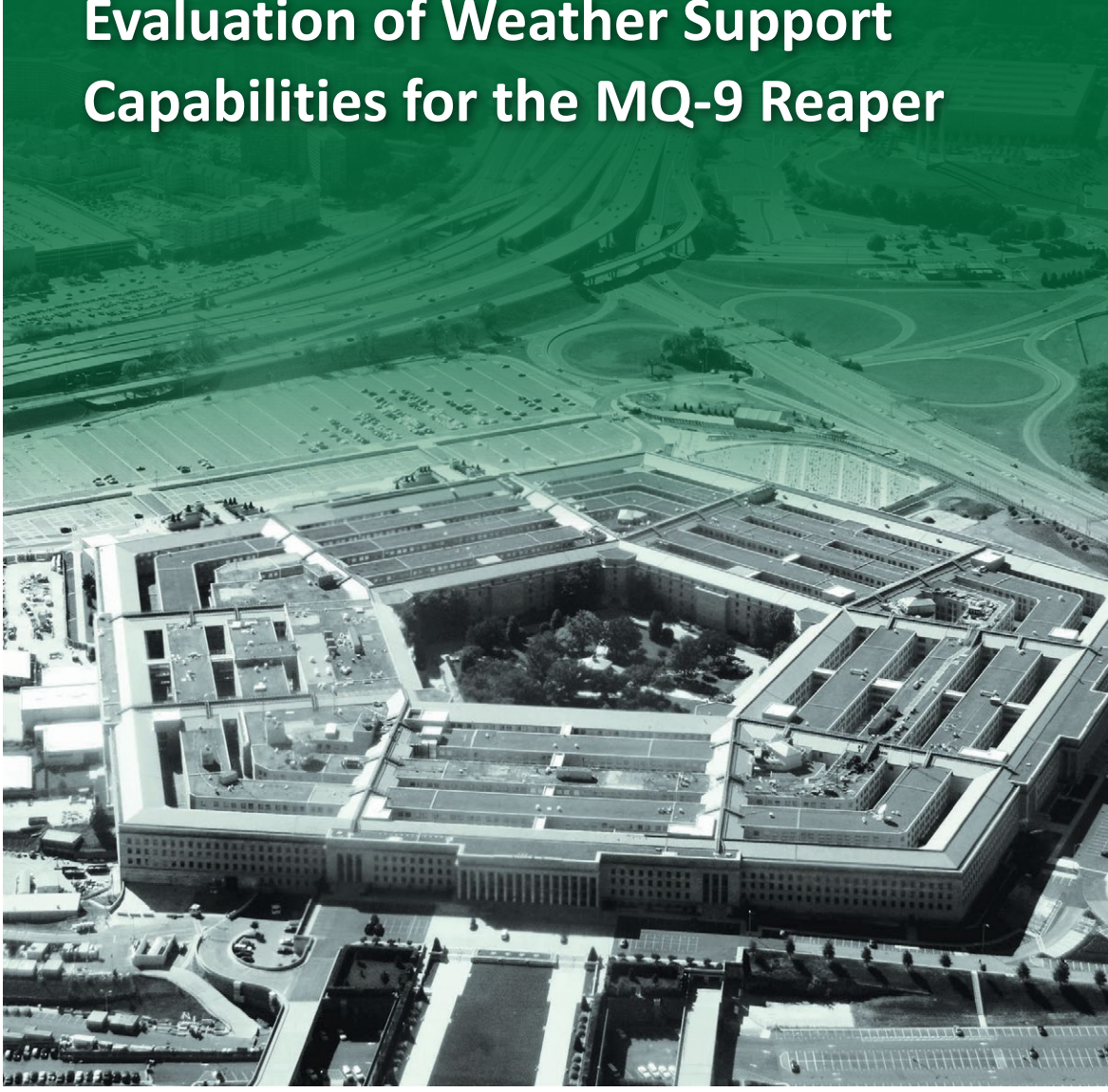
INSPECTOR GENERAL

U.S. Department of Defense

FEBRUARY 5, 2020

Evaluation of Weather Support Capabilities for the MQ-9 Reaper



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Results in Brief

Evaluation of Weather Support Capabilities for the MQ-9 Reaper

February 5, 2020

Objective

The objective of this evaluation was to determine whether the Air Force implemented weather support capabilities on the MQ-9 Reaper unmanned aircraft system (UAS).

Background

UASs provide intelligence, surveillance, and reconnaissance (ISR) capabilities and can serve as strike platforms in support of strategic and tactical military operations. The Air Force manages several UASs, including the MQ-9 Reaper (referred to as the MQ-9), which replaced the MQ-1 Predator (referred to as the MQ-1) in December 2018.

Weather support capabilities are critical to mission planning and execution and command and control of UASs. These capabilities may include providing meteorological data to gauge ice buildup on the wings and generating climatological products merged with preplanned UAS routes and target locations.

Ice and extreme wind can limit UAS operations. Ice accretion is the process by which a layer of ice builds up on solid objects that are exposed to freezing precipitation, fog, or cloud droplets. The effectiveness of the mission and protection of the aircraft require that UAS operations be planned with an accurate understanding of ice accretion.

Background (cont'd)

The MQ-9 was designed and built with limited weather support capabilities, which include analog sensors to measure outside air temperature and wind speed in near real-time, and a sensor calibrated to detect ice buildup (accretion) once the ice exceeds a preset level. The existing sensors were found to be ineffective for in-condition sensing. Therefore, the Air Force funded an MQ-9 trade study to evaluate weather sensors and weather sensor systems for their ability to provide situational awareness for current and impending weather.

~~(FOUO)~~ Costly weather-related mishaps initially drove the need to develop real-time weather support capabilities for UASs. [redacted]. Class A mishaps occur when damages to Government property exceeds $2 million or personnel injury results in a fatality or permanent disability.

Finding

Between FY 2010 and FY 2016, the Air Force spent $17.7 million in Overseas Contingency Operations (OCO) funding to develop enhanced weather support capabilities for the MQ-9 Reaper. However, the Air Force A2I never validated the requirement for the capabilities, which were later determined to not be needed, and the capabilities were never delivered.

This occurred because the Air Force A2/6 and A2I did not follow the normal acquisition process to develop and deliver this capability. Instead, the Air Force A2/6 and A2I used OCO funds to develop a requirement that should have been funded with research, development, test, and evaluation funds. In addition, because this development effort was funded with OCO funding, when OCO funding levels were reduced, the Air Force A2/6 stopped funding the development effort.

Results in Brief

Evaluation of Weather Support Capabilities for the MQ-9 Reaper

Finding (cont'd)

As a result, the Air Force wasted $17.7 million dollars in OCO funding developing a capability that was never delivered. Had the Air Force A2/6 followed appropriate acquisition processes, it could have used the $17.7 million on other Air Force OCO requirements.

Recommendations

We recommend that the Commander of Air Combat Command share the results of the study conducted for MQ-9 weather tolerance activities with the other Services that use the MQ-9 to ensure efficient use of resources and to prevent duplication of effort.

In addition, we recommend that the Department of the Air Force Auditor General conduct a review of Air Force Components' use of OCO funding to develop innovation projects to ensure these funds are not used to develop capabilities that are not needed or that may be stopped due to shortages in OCO funding without being fully developed.

Furthermore, we recommend that the Air Force Chief of Staff review the actions of personnel in the Air Force Deputy Chief of Staff for Intelligence, Surveillance, Reconnaissance, and Cyber Effects Operations that were responsible for the development and funding of near real-time weather information and weather model forecasting capabilities and determine whether those individuals should be held accountable for wasting resources on capabilities that were being developed without validated requirements and which did not result in the capability being fully developed for DoD use.

Management Comments and Our Response

The Assistant Deputy Chief of Staff for Intelligence, Surveillance, Reconnaissance, and Cyber Effects Operations, responding for the Commander of the Air Combat Command, agreed with the recommendation to share the results of the study conducted for MQ-9 weather tolerance activities with the other Services.

However, the Assistant Deputy Chief of Staff stated that Air Combat Command did not initiate or receive results of the MQ-9 trade study for weather and recommended that Air Force Materiel Command share the results of the study with the other Services. Therefore, we redirected the recommendation to the Commander of the Air Force Materiel Command. We request that the Commander of the Air Force Materiel Command provide comments on this recommendation by February 28, 2020.

The Department of the Air Force Auditor General agreed with the recommendation to conduct a review of Air Force Components' use of Overseas Contingency Operations funding to develop innovation projects and stated that a follow-up audit is expected to be completed on September 30, 2021. Comments from the Air Force Auditor General addressed the recommendation; therefore, the recommendation is resolved but will remain open.

The Assistant Deputy Chief of Staff for Intelligence, Surveillance, Reconnaissance, and Cyber Effects Operations, responding for the Air Force Chief of Staff, did not agree with the accountability recommendation and recommended that the DoD Office of Inspector

Results in Brief

Evaluation of Weather Support Capabilities for the MQ-9 Reaper

Comments (cont'd)

General interview former members of Air Force A2Q and review additional documents.[1] According to the Assistant Deputy Chief of Staff, these documents demonstrate that, even though nothing has been fully developed, capability development continues.

We reviewed the three documents cited by the Assistant Deputy Chief of Staff during our evaluation and reviewed the 17 additional documents provided by the former members of the Air Force A2Q. However, none of the documentation demonstrated a validated requirement as outlined in Air Force Instruction 10-601, which requires the documentation and review of capability requirements, associated capability gaps, risk, validation, and funding throughout the acquisition and fielding process. In addition, the documentation did not demonstrate that the capability is still in use within the DoD.

Therefore, comments from the Assistant Deputy Chief of Staff did not address the specifics of the recommendation. The recommendation is unresolved and will remain open. We request additional comments regarding the determination of accountability for the use of resources from the Air Force Chief of Staff on this recommendation by February 28, 2020.

Please see the Recommendations Table on the next page for the status of the recommendations.

[1] According Air Force A2 personnel Air Force A2Q and Air Force A2I are the same office.

Recommendations Table

Management	Recommendations Unresolved	Recommendations Resolved	Recommendations Closed
Air Force Chief of Staff	3		
Auditor General, Department of the Air Force		2	
Commander, Air Force Materiel Command	1		

Note: The following categories are used to describe agency management's comments to individual recommendations.

- **Unresolved** – Management has not agreed to implement the recommendation or has not proposed actions that will address the recommendation.
- **Resolved** – Management agreed to implement the recommendation or has proposed actions that will address the underlying finding that generated the recommendation.
- **Closed** – OIG verified that the agreed upon corrective actions were implemented.

INSPECTOR GENERAL
DEPARTMENT OF DEFENSE
4800 MARK CENTER DRIVE
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February 5, 2020

MEMORANDUM FOR CHIEF OF STAFF, DEPARTMENT OF THE AIR FORCE
AUDITOR GENERAL, DEPARTMENT OF THE AIR FORCE
COMMANDER, AIR FORCE MATERIEL COMMAND

SUBJECT: Evaluation of Weather Support Capabilities for the MQ-9 Reaper
(Report No. DODIG 2020-059)

This final report provides the results of the DoD Office of Inspector General's evaluation. We previously provided copies of the draft report and requested written comments on the recommendations. We considered management's comments on the draft report when preparing the final report. These comments are included in the report.

This report contains one recommendation that is resolved, but which remains open. The Department of the Air Force Auditor General agreed to conduct a follow-up audit. We will close this recommendation after we review the results of the follow-up audit.

This report also contains two recommendations that are considered unresolved. As a result, of the Office of the Air Force Chief of Staff comments, we redirected the recommendation to share the results of the MQ-9 study to the Air Force Materiel Command. We also request further comments from the Air Force Chief of Staff regarding the determination of accountability for the use of resources. Accordingly, we request further comments to the unresolved recommendations by February 28, 2020.

DoD Instruction 7650.03 requires that all recommendations be resolved promptly. We conducted this evaluation in accordance with the Council of the Inspectors General on Integrity and Efficiency Quality Standards for Inspection and Evaluation.

If you have any questions or would like to meet to discuss the assessment, please contact [redacted] We appreciate the cooperation and assistance received during the evaluation.

Randolph R. Stone
Assistant Inspector General for Evaluations
Space, Intelligence, Engineering, and Oversight

Contents

Introduction

Objective

The objective of this evaluation was to determine whether the Air Force implemented weather support capabilities on the MQ-9 Reaper unmanned aircraft system (UAS).

Background

Weather support capabilities are those capabilities that enhance weather support operations, pilot situational awareness, mission planning and execution, and command and control of UASs. These capabilities include:

- developing ice accretion meteorological products and services for UAS airframes and an accurate four-dimensional (latitude, longitude, altitude, and time) representation of cloud layers and other atmospheric effects;
- providing all meteorological data, products, information, and services in universally accepted digital format;
- integrating meteorological data, products, information, and services with aircraft position, routes, target, and collection locations into a single, fused display on command and control mission planning systems and situational awareness tools;
- relaying all onboard UAS weather data and information, such as air temperature, humidity, wind speed and direction, turbulence, ice accretion, and weather radar reflectivity, in real time; and
- providing climatological products merged with preplanned UAS routes and target locations.

UASs provide intelligence, surveillance, and reconnaissance (ISR) capabilities and can serve as strike platforms in support of strategic and tactical military operations. For that reason, UASs have been called by the Under Secretary of Defense for Acquisition, Technology, and Logistics, "virtually indispensable to combatant commanders."[2] The Air Force manages several UASs, including the MQ-9 Reaper (referred to as the MQ-9), which replaced the MQ-1 Predator (referred to as the MQ-1).[3]

[2] Under Secretary of Defense for Acquisition, Technology, and Logistics, "Annual Industrial Capabilities Report to Congress," October 2013.

[3] The MQ-1 was a technology demonstration aircraft that was modified for military purposes. The Air Force first sought to implement weather support capabilities on the MQ-1 and continued those efforts on the MQ-1's successor, the MQ-9.

MQ-1

The MQ-1 was designed in response to a DoD requirement to provide persistent ISR information combined with a strike capability. The MQ-1 was first used in Albania in July 1995 to conduct ISR missions. The Air Force retired the MQ-1 in December 2018.[4]

MQ-9

The Air Force introduced the MQ-9 in 2006 in response to DoD efforts to support overseas contingency operations (OCOs). The MQ-9 is equipped with both weapon and surveillance systems. General Atomics Aeronautical Systems in Poway, California, is the Air Force contractor that develops and produces the MQ-9.

The Air Force has deployed the MQ-9 since September 2007. The MQ-9 consists of a remotely piloted aircraft, a ground control station, communications equipment, and associated support equipment. The aircraft has a wingspan of 66 feet and is 36 feet long. It is capable of flying up to a maximum altitude of 45,000 feet and at a cruise speed of around 230 miles per hour.

The MQ-9 is larger and more powerful than the MQ-1 and was designed to destroy or disable time-sensitive targets with persistence and precision. The MQ-9 can fly higher and faster, with increased weapons capacity, than the MQ-1. The MQ-9 was designed and built with limited weather support capabilities, which include analog sensors to measure outside air temperature and wind speed in near real-time, and a sensor calibrated to detect ice accretion once the ice exceeds a preset level. The figure below shows an MQ-9 Reaper in flight.

Figure. MQ-9 Reaper
Source: Air Force News.

[4] The Air Force transferred all combat missions from the MQ-1 to the MQ-9. The MQ-1 fleet is in use by other Services but is not available for commercial use.

Weather Impacts on UASs

Airborne ISR mission-cancellation, reduced mission effectiveness, or mission failure can occur in the absence of accurate and immediate situational awareness of the weather environment. When weather forecasts are inaccurate or outdated, Air Force ISR operations may be disrupted. According to A2I, a subordinate command within the Air Force responsible for ISR innovations, the Air Force needed a way to deal with adverse weather conditions in near- or real-time for safe flight operations and mission effectiveness because UASs do not have a pilot onboard to detect adverse weather conditions in real time.

Ice and extreme wind limit UAS operations. Ice accretion is the process by which a layer of ice builds up on solid objects that are exposed to freezing precipitation or to super-cooled fog or cloud droplets. Specifically, ice buildup on UAS wings reduces lift, increases drag, amplifies vibrations, and jeopardizes stability. Icing on the UAS wing can reduce the UAS performance and its safety of flight.[5] The effectiveness of the mission and protection of the aircraft require that UAS operations be planned with an accurate understanding of ice accretion.

While the MQ-9 has a sensor to detect ice buildup when it reaches a preset level, it does not have a sensor to detect the rates at which ice buildups occur, and it has no system to remove ice. Therefore, MQ-9 operators must avoid or exit icing conditions as soon as possible.

MQ-1 and MQ-9 Weather-Related Class A Mishaps

~~(FOUO)~~ Costly weather-related mishaps initially drove the effort to develop real-time weather support capabilities for UASs. [redacted] A Class A mishap is defined as an unplanned event or series of events that result in damage to DoD property that exceeds $2 million; occupational illness to DoD personnel; injury to on- or off-duty DoD military personnel; injury to on- or off-duty DoD civilian personnel; or damage to public or private property, or injury or illness to non-DoD personnel, caused by DoD activities.[6]

[5] General Atomics Engineering Memorandum FT-18-0383, "MQ-9 Blocks 1 and 5 Weather Tolerance Icing Condition Analysis for Weather Tolerance Activities for MQ-9," April 3, 2019.

[6] DoD Instruction 6055.07, "Mishap Notification, Investigation, Reporting, and Record Keeping," June 6, 2011.

~~(FOUO)~~ [redacted]

Air Force Deputy Chief of Staff for ISR and Cyber Effects Operations Is Responsible for Managing ISR Aircraft Activities

The Air Force Deputy Chief of Staff for Intelligence, Surveillance, Reconnaissance, and Cyber Effects Operations (Air Force A2/6) coordinates with the Secretary of the Air Force, other Secretariat offices, and the Chief of Staff to carry out the ISR mission of the Air Force. The Air Force A2/6 coordinates with the Deputy Chief of Staff of the Air Force for Operations, Plans, and Requirements (Air Force A3) to develop and manage manned and unmanned ISR aircraft activities. Additionally, the Air Force A2/6 serves as the office of primary responsibility for Air Force ISR, including planning, programming, policy, guidance, intelligence force development, and oversight. The Air Force A2I, a subordinate directorate of the Air Force A2/6, innovates, explores, develops, and evaluates near-term ISR concepts, technologies, and practices for potential applicability to the Air Force ISR enterprise.

Air Combat Command Is the Lead Command for the MQ-1 and MQ-9 Aircraft and the Air Force Weather Weapon System

The Air Combat Command (ACC) organizes, trains, and equips combat-ready air, space, cyber, and intelligence forces (including weather forces). As the lead command for the MQ-1 and MQ-9 and the Air Force Weather Weapon System, ACC also identifies, prioritizes, and validates current and future requirements for MQ-1, MQ-9, and weather capability development.

Air Force Director of Weather Manages Weather Services and Support for the Air Force and Army

ACC works in close coordination with the Air Force Director of Weather (Air Force A3W). The Air Force A3W, a subordinate directorate office of the Air Force A3, organizes and manages weather services and support for the Air Force and Army. The Air Force A3W staff oversees organizing, training, and equipping of Air Force-wide weather organizations. This includes developing doctrine, policy, and standards for weather support to the Air Force, Army, designated unified commands, national programs, and emergency response operations.

Air Force Audit Agency Report in 2018 Identified Potential Violations of the Antideficiency Act

In FY 2010, the Air Force A2I contracted with a single-source vendor for the development of a weather sensor and software.[7] These technologies provide near- or real-time weather information and weather model forecasting for use during MQ-1 and MQ-9 missions.

The Air Force Audit Agency determined in 2018 that the Air Force A2/6 did not use the correct appropriations to fund innovation projects, which included the weather sensor and software to support the MQ-9.[8] The Air Force Audit Agency, in Report No. F2018-0005-A00900, determined that the misappropriation of funds occurred because A2I personnel did not provide sufficient details in their funding justifications. In addition, although the Air Force A2/6 leadership reviewed funding requests for the operations and maintenance (O&M) execution plan for weather sensor and software development, Air Force A2/6 officials did not have oversight procedures to verify that Air Force A2/6 personnel requested the proper appropriation.[9] More detailed information on the Air Force Audit Agency report is provided in Appendix B.

[7] The aircraft weather sensor and software package was intended to provide real-time information on humidity, visible precipitation, icing, and cloud warnings directly to aircrews. The software was a graphical product that was designed to use algorithms to fuse real-time sensor data with any available weather model data to provide three-dimensional displays of the structure of clouds and the icing threat relative to clouds throughout the domain to ISR aircrews on classified and unclassified systems. For this report, we refer to these technologies as weather sensors and software.

[8] Air Force Audit Agency Report No. F2018-0005-A00900, "Intelligence, Surveillance, and Reconnaissance Innovation Funds," March 23, 2018.

[9] O&M appropriations traditionally finance those things whose benefits are derived for a limited period of time (such as expenses, rather than investments). Examples of costs financed by O&M funds are headquarters operations, civilian salaries and awards, travel, fuel, minor construction projects of less than $2 million, expenses of operational military forces, training and education, recruiting, depot maintenance, purchases from Defense Working Capital Funds (such as spare parts), base operations support, and assets with a system unit cost less than the current expense/investment threshold ($250,000). O&M appropriations are normally available for obligation for 1 fiscal year. O&M appropriations are budgeted using the annual funding policy.

Finding

The Air Force Spent $17.7 Million on Developing Enhanced Weather Support Capabilities for the MQ-9 Without Validating Requirements

Between FY 2010 and FY 2016, the Air Force spent $17.7 million in OCO funding to develop enhanced weather support capabilities for the MQ-9 Reaper. However, the Air Force A2I never validated the requirement for the capabilities, which were later determined to not be needed, and the capabilities were never delivered.

This occurred because the Air Force A2/6 and A2I did not follow the normal acquisition process to develop and deliver this capability. Instead, the Air Force A2/6 and A2I used OCO funds to develop a requirement that should have been funded with research, development, test, and evaluation (RDT&E) funds. In addition, because this development effort was funded with OCO funding, when OCO funding levels were reduced, the Air Force A2/6 stopped funding the development effort.

As a result, the Air Force wasted $17.7 million dollars in OCO funding developing a capability that was never delivered. Had the Air Force A2/6 followed appropriate acquisition processes it could have used the $17.7 million on other Air Force OCO requirements.

The Air Force Spent $17.7 Million on Developing Enhanced Weather Support Capabilities for the MQ-9 Without Validating Requirements

Between FY 2010 and FY 2016, the Air Force spent $17.7 million in OCO funding to develop enhanced weather support capabilities for the MQ-9 Reaper. However, the Air Force A2I never validated the requirement for the capabilities, which were later determined to not be needed, and the capabilities were never delivered.

In FY 2010, the A2I, a subordinate organization within the Air Force responsible for ISR innovations, contracted with a private company for the development of the weather sensors and software to provide near-real-time weather information and weather model forecasting capabilities during MQ-1 and MQ-9 missions. However, the Air Force A2I did not validate the requirements for these capabilities in

accordance with Air Force Instruction 10-601.[10] Air Force Instruction 10-601 requires the documentation and review of capability requirements, associated capability gaps, risk, validation, and funding throughout the acquisition and fielding process.

Air Force A2I Spent 6 Years Developing a Weather Sensor and Software for the MQ-1 and MQ-9

From 2010 to 2016, the Air Force A2I contracted for the development of a weather sensor and software to provide near- or real-time weather information and weather model forecasting during MQ-1 and MQ-9 missions. The development included design and flight testing, which culminated in the sensor capability achieving technology readiness level 7 and a flight to test the capabilities by the Air National Guard.[11] The Air National Guard tested the use of the weather sensor and found the sensor to be "potentially operationally effective." However, the testing was not independently verified by an Air Force testing organization, such as the Air Force Operational Test and Evaluation Center, as required by Air Force Instruction 10-601.

Furthermore, the Air Force A2I did not obtain capability requirements validation and prioritization through ACC and AFLCMC. According to Air Force Instruction 10-601, the process for implementing validated requirements for new capabilities estimated to cost no more than 10 percent of the minimum acquisition category II program dollar amounts for RDT&E and procurement can follow a faster process, the Air Force Form 1067 process.[12] The Air Force Form 1067 can be used to document the submission, review, and approval of requirements for modifications to fielded Air Force systems. The Air Force Form 1067 is typically generated to communicate airframe requirements to AFLCMC after appropriate vetting and validation. The form can also be used to document and secure approval of temporary airframe modifications required for component and system testing purposes with the requirement that the airframe will be returned to its baseline configuration post-test. Air Force Form 1067 modifications costing less than $50 million require lead command approval. However, the Air Force A2I did not use the Air Force Form 1067 process to communicate incremental weather support capability requirements to ACC.

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[10] Air Force Instruction 10-601, "Operational Capabilities Requirements Development," November 6, 2013.

[11] Air Force technology readiness levels range from 1 to 9 and describe a system's readiness for fielding. Technology readiness level 1 means "basic principles are observed and reported." Technology readiness level 2 means a "technology concept and/or application [is] formulated." Technology readiness level 4 indicates "component and/or breadboard validation. Technology readiness level 5 reflects "component and/or breadboard validation in a relevant environment." Technology readiness level 7 indicates system prototype demonstration in an operational environment. Technology readiness level 9 indicates that a system has successfully operated in a mission environment.

[12] Acquisition categories are established to facilitate decentralized decision making and execution and compliance with statutorily imposed requirements. The categories determine the level of review, decision authority, and applicable procedures.

Air Force A3W Identified Concerns With Air Force A2I's Development of Weather Support Capabilities

In 2014, the A3W identified concerns with the manner in which the Air Force A2I sought to develop weather support capabilities for the MQ-1 and the MQ-9. An August 19, 2014, A3W issue paper stated that the A2I initiative lacked a "documented capability gap or requirement approved by the corporate process." Additionally, according to the issue paper, the A2I did not have a transition plan for developing the weather capabilities to a program of record. To transition the weather sensors into UAS programs of record, the A3W advised that the A2I should:

- request that ACC provide a weather representative for participation in operational tests;
- work with ACC to define and quantify capability gaps and requirements within the corporate process; and
- work with the Air Force Weather Agency (and, in the future, ACC as the lead Air Force command for weather) to define completion and transfer of capability to a weather program of record (assuming operational tests show utility, and the Air Force Requirements Oversight Council approves the requirement).[13]

We did not find any evidence to support that A2I took the actions outlined in the issue paper.

The Air Force A2/6 Used OCO Funds to Develop a Requirement That Should Have Been Funded With RDT&E Funds

Air Force A2/6 and A2I did not follow the normal acquisition process to develop and deliver this capability. Instead, the Air Force A2/6 and A2I used OCO funds to develop a requirement that should have been funded with RDT&E funds. In addition, because this development effort was funded with OCO funding, when OCO funding levels were reduced, the Air Force A2/6 stopped funding the development effort.

[13] The Air Force Weather Agency, formed in 1997 and headquartered at Offutt Air Force Base, Nebraska, was a field operating agency reporting to the Air Force Director of Weather, Deputy Chief of Staff for Air and Space Operations. In 2015, in accordance with Program Action Directive 14-03, "Realignment of the Air Force Weather Agency," January 5, 2015, the Air Force underwent a reorganization consolidating weather requirements validation and funding for technology development and modification under ACC, which Program Action Directive 14-03 designated as the Air Force Weather Weapon System Lead Command.

Air Force A2/6 Used OCO Funding for Weather Support Capabilities, and A2I Stopped Development When OCO Funding Was No Longer Available

Air Force A2/6 personnel stated that their office approved the development of a weather sensor and software for the MQ-1 and MQ-9 in 2011, without a validated requirement, because OCO funding was available. The Air Force retired the MQ-1 and, in 2016, the A2I stopped developing weather support capabilities for the MQ-9 when OCO funding was no longer available. In 2016, A2/6 sought, but did not receive, ACC sponsorship for further development of enhanced weather support capabilities. The development of a weather sensor and software were never a program of record and had been funded with OCO funds since 2011. As long as there was sufficient OCO funding, the A2/6 approved the continued development. A2/6 resources directorate personnel stated that the Air Force A2/6 authorized the A2I to contract for the development of real-time meteorological situational awareness for the MQ-1 to mitigate weather-related incidents that, according to AFLCMC records, had been a factor in at least 9 Class A mishaps since 2008, representing $57.3 million in losses.

The Air Force A2/6 later discontinued funding for the development of weather support capabilities in 2016 because the Resources Directorate of the Office of the Administrative Assistant to the Secretary of the Air Force distributed less OCO O&M funds to the A2/6. Subsequently, A2/6 could not fund all of the innovation submissions. The A2I continued the contract through 2016 as an unfunded requirement. As a result of discontinued funding, in 2016, the A2I sought major command sponsorship from ACC after the A2/6 discontinued funding. However, according to ACC personnel, A2/6 did not provide specific information related to capability development (for example, data streams and algorithms) to inform the formal Air Force requirements validation and funding processes. Therefore, ACC did not sponsor further development of additional weather capabilities for the MQ-9.

Air Force Determined That Weather-Related Mishaps to the MQ-9 Were a Negligible Risk, Making Weather Support Capability a Lower Priority

According to AFLCMC officials, the impact of weather on the Class A mishaps was negligible and additional weather support capabilities for the MQ9 were not a high priority. Weather-related Class A mishaps originally drove the need to develop real-time weather support capabilities for UASs. Specifically, weather was a factor in at least nine Class A mishaps since 2008, representing $57.3 million in losses.

However, AFLCMC determined that the MQ-1, which was retired in December 2018, accounted for six of the nine weather-related Class A mishaps. According to the AFLCMC Modernization Branch Chief, no MQ-9 sensor would have detected or prevented any of the three MQ-9 mishaps.

The MQ-1 was a technology demonstration aircraft modified for military purposes. The MQ-1 was slower than its successor, the MQ-9. The Air Force halted the configuration of the MQ-1 in September 2011, signaling its intent to transition to the MQ-9 going forward.[14] The Air Force formally retired the MQ-1 in 2018. The MQ-9 was fully integrated and designed to have more power and time aloft than the MQ-1. The MQ-9 is a multi-mission ISR and strike UAS and is significantly larger than the MQ-1. The MQ-9 features a more powerful engine and carries a much greater payload. The MQ-9 is equipped with a multi-spectral targeting system, which has a suite of visual sensors for targeting. The MQ-9 also features multi-mode radar, a multi-mode maritime surveillance radar, and a communications relay. These improvements reduced the compelling need to pursue incremental weather support.

Although the MQ-9 experienced fewer weather-related mishaps than the MQ-1, according to the Remotely Piloted Aircraft Concept of Operations, weather-related mishaps is only one of many factors that should be considered when vetting and funding future weather support capabilities. Other factors include:

- compatibility across all systems;
- proprietary and licensing considerations;
- cost-benefit analysis on the system with respect to competing needs, such as weight impact on flight ranges; and
- higher prioritized funding needs.

Additionally, the Air Force is also studying the weather conditions under which the MQ-9 can safely operate and is using a prioritized process to ensure that future weather support capabilities follow Air Force acquisition policies, are properly vetted, and are correctly funded. One study, "Trade Study Technical Report for Weather Tolerance Activities for the MQ-9A Aircraft" was completed in July 2019. The study researched and identified weather sensors and weather sensor systems for their ability to provide situational awareness for current and impending weather. The information provided by these weather sensors and sensor systems will be used to provide operational weather information and data to the MQ-9 pilot and sensor operator. The study provides guidelines, which can be validated through testing, and can benefit the other Services that operate MQ-9 aircraft.

[14] In a September 15, 2011, memo, the Air Force Requirements Oversight Council approved an ACC recommendation to freeze configuration of the MQ- 1 with the exception of changes based on urgent needs or as directed by the Air Force Chief of Staff.

We are not making any recommendations with regard to validating weather support capabilities for UASs because the Air Force has not moved forward with further development of the weather sensor and software for the MQ-9 since contractual funding ended. In addition, the Air Force has developed a concept of operations incorporating key weather support capability needs for UAS operations. The concept of operations represents the way ahead for UASs, describing the roles and responsibilities of UAS-supporting weather organizations, weather modeling, and environmental characterization capabilities required to enable tactical-level support. It outlines a scalable process to provide integrated weather support to UASs on a global scale. The Air Force is also conducting two MQ-9-related studies to verify what weather-related capability gaps exist and is developing an Air Force-wide weather support capability called the Global Synthetic Weather Radar, which uses artificial intelligence.[15]

The Air Force is taking an enterprise approach to the development and fielding of system modifications, ensuring that systems integrate across platforms and operations. In addition, the Air Force has modified its requirements validation process to help ensure that the appropriate offices review and validate weather-related needs for unmanned aircraft.

Air Force Wasted $17.7 Million Developing a UAS Weather Support Capability That Was Never Delivered

The Air Force wasted $17.7 million developing weather support capabilities that were never delivered. Specifically, the Air Force A2I spent $14.5 million developing weather support capabilities that were not properly prioritized or vetted in accordance with Air Force Instruction 10-601 and that will not be used in the DoD. In addition, according to the Air Force response to section 213 of the FY 2019 National Defense Authorization Act, the Air National Guard used $3.2 million of FY 2016 funding for a single MQ-9 to participate in an operational assessment of the weather sensor. However, the weather sensor was not integrated with the aircraft and could not transmit real-time information. Furthermore, sensor data were not verified for accuracy. Based on the data and feedback from that operational assessment, the sensor had operational potential but would not be fully operational in the required timeframe. The Air Force determined that no additional testing was warranted. Had the Air Force A2/6 followed appropriate acquisition processes, it could have used the $17.7 million on other Air Force OCO requirements.

[15] According to an Air Force report, "FY 19 NDAA Current Capabilities That Provide Near/Real-Time Weather Data to Manned or Unmanned Aircraft," July 2019, the Global Synthetic Weather Radar capability fuses information from lightning data, numerical weather prediction, observations, and satellite imagery into an artificial intelligence algorithm.

The Government Accountability Office defines waste as

> the act of using or expending resources carelessly, extravagantly, or to no purpose. Importantly, waste can include activities that do not include abuse and does not necessarily involve a violation of law. Rather, waste relates primarily to mismanagement, inappropriate actions, and inadequate oversight.

The Air Force A2 expended funds to advance a capability that was never proven to be a valid requirement, was never fully developed, and was never delivered.

If the Air Force determines that additional onboard and system weather support capabilities are needed for the MQ-9 in the future, it should follow the requirements validation processes outlined in Air Force Instruction 10-601. The process is designed to facilitate timely development and fielding of optimized, affordable, and sustainable operational systems needed by the warfighter.

Recommendations, Management Comments, and Our Response

Recommendation 1

We recommend that the Commander of the Air Force Materiel Command share the results of the MQ-9 trade study for weather tolerance activities with the other Services that use the MQ-9 to ensure efficient use of resources and to prevent duplication of effort.

Air Force Chief of Staff Comments

The Assistant Deputy Chief of Staff for Intelligence, Surveillance, Reconnaissance, and Cyber Effects Operations, responding for the Commander of the Air Combat Command, agreed with the recommendation. The Assistant Deputy Chief of Staff stated that ACC did not initiate or receive results of the MQ-9 trade study for weather and recommended that the Air Force Materiel Command share the results of the study with the other Services.

Our Response

As a result of the comments from the Assistant Deputy Chief of Staff, we redirected the recommendation to the Commander of the Air Force Materiel Command. We request the Commander of the Air Force Materiel Command provide comments on this recommendation by February 28, 2020.

Recommendation 2

We recommend that the Department of the Air Force Auditor General conduct a review of Air Force Components' use of Overseas Contingency Operations Operations and Maintenance funding to develop innovation projects to ensure these funds are not used to develop capabilities that are not needed or that may be stopped due to shortages in Overseas Contingency Operations funding without being fully developed.

Department of the Air Force Auditor General Comments

The Department of the Air Force Auditor General concurred with the recommendation, stating that the Auditor General would conduct a review of Air Force Components' use of Overseas Contingency Operations funding to develop innovation projects by performing an audit to follow up on actions taken in response to Air Force Audit Agency Report No. F2018-0005-A00900, "Intelligence, Surveillance, and Reconnaissance Innovation Funds," March 23, 2018. The Auditor General stated that the followup audit is expected to be completed on September 30, 2021.

Our Response

Comments from the Department of the Air Force Auditor General addressed the specifics of the recommendation; therefore, the recommendation is resolved but will remain open. We will close this recommendation when the Auditor General provides the results of the followup audit.

Recommendation 3

We recommend that the Air Force Chief of Staff review the actions of personnel in the Air Force Deputy Chief of Staff for Intelligence, Surveillance, Reconnaissance, and Cyber Effects Operations office for the development and funding of near real-time weather information and weather model forecasting capabilities and determine whether individuals should be held accountable for wasting resources on capabilities that were being developed without validated requirements and that were not fully developed for DoD use.

Air Force Chief of Staff Comments

The Assistant Deputy Chief of Staff for Intelligence, Surveillance, Reconnaissance, and Cyber Effects Operations, responding for the Air Force Chief of Staff, did not agree with the recommendation. The Assistant Deputy Chief of Staff cited an October 30, 2015, memorandum from the then-12th Air Force Commander, "Improved Weather Support Capabilities for Remotely Piloted Aircraft Operations";

an Air Force Form 1067 signed in August 2017, "Atmospheric Sensing and Prediction System (ASAPS) Operational Assessment"; and an Air Combat Command Project #17-180R, titled "MQ-9 Atmospheric Sensing and Prediction System and NOWCasting Operational Final Report," stating that these documents demonstrate the continued use of the capabilities by the Air National Guard Air Force Reserve Command Test Center. Additionally, while nothing was fully developed, capability development continues. The Assistant Deputy Chief of Staff recommended that the DoD OIG interview former members of AF/A2Q and review additional documents.

Our Response

Comments from the Assistant Deputy Chief of Staff for Intelligence, Surveillance, Reconnaissance, and Cyber Effects Operations did not address the specifics of the recommendation; therefore, the recommendation is unresolved and will remain open.

During the evaluation we received documents from and interviewed personnel in accordance with their responsibilities outlined in AFI 10-601 and PAD 14-03. This included the three documents cited by the Assistant Deputy Chief of Staff. In addition, we reviewed the 17 additional documents provided by the former members of the AF/A2Q, which we also obtained and reviewed during the evaluation. None of the documentation demonstrated a validated requirement as outlined in Air Force Instruction 10-601, which requires the documentation and review of capability requirements, associated capability gaps, risk, validation, and funding throughout the acquisition and fielding process. The documentation also did not demonstrate that the capability is still in use within the DoD.

The referenced Air Force Form 1067 was also reviewed during the course of this evaluation. However, the Form 1067 explicitly covers the temporary modification of an MQ-9 for test purposes only. The Form 1067 indicated that the MQ-9 was to be reverted to its original form once testing was completed. As stated in the July 2018 ACC Project report #17-180R, the operational assessment of the temporary modification resulted in no additional testing or integration. Additionally, we did not receive documentation to support the transition of this development effort to a program of record, the demonstration of formalized requirements, or the acquisition process, as specified by Air Force A3 in 2014.

Therefore, we request that the Air Force Chief of Staff provide comments on the Air Force's plan to review the actions of personnel in the Air Force Deputy Chief of Staff for Intelligence, Surveillance, Reconnaissance, and Cyber Effects Operations office for the development and funding of near real-time weather information and weather model forecasting capabilities and determine whether individuals should be held accountable for wasting resources on capabilities that were being developed without validated requirements and that were not fully developed for DoD use. We request comments from the Air Force Chief of Staff on this recommendation by February 28, 2020.

Appendix A

Scope and Methodology

We conducted this evaluation from February 2019 through October 2019 in accordance with the "Quality Standards for Inspection and Evaluation," published in January 2012 by the Council of Inspectors General on Integrity and Efficiency. Those standards require that we adequately plan the evaluation to ensure that objectives are met and that we perform the evaluation to obtain sufficient, competent, and relevant evidence to support the findings, conclusions, and recommendations. We believe that the evidence obtained was sufficient, competent, and relevant to lead a reasonable person to sustain the findings, conclusions, and recommendations.

We received an overview of weather support capabilities for the MQ-9, reviewed existing criteria, and determined the extent to which the integration of policies governing both weather support capabilities and the MQ-9 program and goals were either congruent or divergent. Specifically, we reviewed the following criteria and policies.

- DoD Instruction 6055.07
- Air Force Instruction 10-601
- Air Force Instruction 65-608
- Program Action Directive 14-03

We reviewed the mechanisms for identifying capability gaps, requirements prioritization and validation, technical solutions, technology development and maturation, and life cycle management.

To obtain additional information, we conducted data calls and interviews with Air Force weather stakeholders to determine whether existing policies were successfully implemented. We interviewed and obtained information from personnel at the following organizations.

- Deputy Chief of Staff for Intelligence, Surveillance, Reconnaissance, and Cyber Effects Operations/Air Force A2/A2I/A26OR
- Deputy Chief of Staff for Operations/Air Force A3/Air Force Director of Weather (A3W)
- Air Combat Command/A5W (lead command for weather)
- Air Force Materiel Command/Assistant Secretary of the Air Force for Acquisition, Technology, and Logistics/Air Force Life Cycle Management Center (MQ-9 System Program Office)

Computer-Processed Data

We did not use computer-processed data to perform this evaluation.

Prior Coverage

During the last 5 years, the DoD Office of Inspector General (OIG) and the Air Force Audit Agency issued two reports related to the MQ-9 Reaper. Unrestricted DoD OIG reports can be accessed at http://www.dodig.mil/reports.html/. Unrestricted Air Force Audit Agency reports can be accessed from www.afaa.af.mil by clicking on Freedom of Information Act Reading Room and then selecting Audit.

DoD OIG

Report No. DODIG-2018-146, "Hotline Allegations Regarding the Acceptance and Testing of the MQ-9 Reaper Aircraft," August 16, 2018

In response to a Defense Hotline complaint, the OIG evaluated the MQ-9's average lifetime Class A mishap rate to determine whether the mishap rate was consistent with similar DoD unmanned aircraft vehicles. The OIG determined that the MQ-9's average lifetime Class A mishap rate had significantly improved from its predecessor, the MQ-1.

Air Force

Report No. F2018-0005-A00900, "Intelligence, Surveillance, and Reconnaissance Innovation Funds," March 23, 2018

> Air Force A2 personnel did not comply with established acquisition procedures for innovation projects, nor did Air Force A2 personnel use the correct appropriations to fund innovation projects, which increased the risk of Antideficiency Act violations. Specifically, OCO O&M funds were incorrectly used for 14 RDT&E projects. Also, Air Force A2 personnel did not adhere to established contracting procedures for innovation projects. Specifically, personnel executed interagency acquisitions without approval from the Air Force District of Washington Contracting Office.

Appendix B

Air Force Audit Agency Report

On March 23, 2018, the Air Force Audit Agency published Report No. F2018-0005-A00900, "Intelligence, Surveillance, and Reconnaissance Innovation Funds," in response to an Air Force A2 request to determine whether personnel complied with established acquisition procedures for ISR innovation projects. The Air Force Audit Agency concluded that the Air Force A2 did not comply with established acquisition procedures for innovation projects.

The report stated that Air Force A2 personnel did not use the correct appropriations to fund innovation projects. Specifically, from FY 2013 through FY 2016, Air Force A2 personnel improperly used $37 million in OCO O&M funds, instead of RDT&E funds, for 14 (74 percent) of 19 projects reviewed. Personnel improperly used OCO O&M funds to finance RDT&E efforts. One of the 14 projects was:

- Contract number W911QY-13-D-100 (Delivery Orders 0010, 0018, 0028, and 0054), valued at $10.6 million. This multi-year project to develop a new services-oriented distribution system for theater weather data was started in FY 2010. The project included tasks such as requirements analysis, operational concept development, research and development to further system capabilities, and demonstration of prototype.

This occurred because A2I personnel did not provide sufficient details in funding request justifications. Air Force A2 personnel approved requests for O&M Execution Plan funding even though insufficient funding request justifications did not allow for an accurate funding determination. Although the Air Force A2 leadership reviewed funding requests for the O&M Execution Plan, Air Force A2 officials had no oversight procedure to verify that Air Force A2 personnel requested the proper appropriation.

In accordance with Air Force Instruction 65-608, and as noted in the Air Force Audit Agency report, appropriately funding innovation projects ensures proper use of Air Force funds and avoids the risk of Antideficiency Act (ADA) violations.[16] Federal employees who violate the ADA are subject to administrative sanctions, criminal penalties, or both, including administrative discipline, suspension from duty without pay, removal from office, fines, or imprisonment.

[16] Air Force Instruction 65-608, "Antideficiency Act Violations," December 29, 2015, states that ADA violations may be caused by violating statutory limitations in the use of funds as it relates to an appropriation's purpose, period of availability, or amount. The Air Force A2 expended $14.523 million of OCO O&M funding, instead of the appropriate RDT&E funding, to conduct sensor research, testing, and development. Therefore, the use of O&M funds for RDT&E purposes is a potential ADA violation.

In addition, Air Force A2 personnel did not adhere to established contracting procedures for innovation projects. Specifically, the Air Force Audit Agency audit of 17 FY 2013 through FY 2016 interagency acquisitions disclosed that Air Force A2 personnel released Military Interdepartmental Purchase Request packages to other agencies for acceptance without warranted contracting officer review. This occurred because:

- Air Force A2 personnel misinterpreted a Contract Action Lead Time Memorandum as a waiver to bypass codified procedures. To illustrate, the Contract Action Lead Time Memorandum provided guidance on the minimum documentation required in an acquisition package as well as estimated number of calendar months required to award a contract or task order. The memorandum stated that packages received outside of the Contract Action Lead Time would be reviewed on a case-by-case basis but did not indicate that contract review requirements were waived.
- Air Force A2 personnel submitted the Military Interdepartmental Purchase Request packages without obtaining required documentation or a valid waiver.
- Air Force A2 officials had no oversight procedures to verify that Air Force A2 personnel submitted the required documentation for interagency acquisitions.

As a result, the Air Force incurred $2.4 million in servicing agency fees without first determining whether the interagency acquisitions were the most cost effective.

The Air Force Audit Agency made seven recommendations to improve the management of innovation projects. The Air Force A2 agreed with the recommendations. One open recommendation stated that the Air Force A2 shouldcoordinate with the Headquarters Air Force Financial Management and Comptroller to initiate a preliminary ADA review in accordance with Air Force Instruction 65-608. In August 2018, the Air Force A2 officially requested prior year RDT&E funding from the administrative assistant to the Secretary of the Air Force. As a result, the administrative assistant to the Secretary of the Air Force officially requested Deputy Assistant Secretary for Budget support in October 2018. In April 2019, the administrative assistant to the Secretary of the Air Force advised the Air Force A2 to initiate a financial management suite submission of the requests for prior year upward adjustments to RDT&E. The Air Force A2 initiated a financial management suite submission on April 26, 2019.[17] To date, the Assistant Secretary of the Air Force for Financial Management and Comptroller has not made a final determination regarding all of the upward adjustment requests, and the status of the ADA review is being followed up by the Air Force Audit Agency.

[17] A financial management suite is an online application designed to streamline, track, and automate financial management processes within a standardized structure.

Management Comments

Air Force Chief of Staff and the Commander Air Combat Command

DEPARTMENT OF THE AIR FORCE
WASHINGTON, DC

JAN 1 3 2020

MEMORANDUM FOR DEPARTMENT OF DEFENSE INSPECTOR GENERAL

FROM: HQ AF/A2/6
1700 Air Force Pentagon Suite 4E1070
Washington, DC 20330-1700

SUBJECT: Air Force Response to DoD Office of Inspector General Draft Report, "Evaluation of Weather Support Capabilities for the MQ-9 Reaper" (Project No. D2019-DISPA2-0109.000)

1. This is the Department of the Air Force response to the DoDIG Draft Report, "Evaluation of Weather Support Capabilities for the MQ-9 Reaper" (Project No. D2019-DISPA2-0109.000) The A2/6 non-concurs with comments on the report as written and welcomes the opportunity to implement the recommendations in the report.

2. The AF/A2/6 in coordination with Air Combat Command (ACC) and AF Material Command (AFMC) will correct issues identified in this report, and develop and implement a corrective action plan outlined in the following recommendations:

RECOMMENDATION 1: The DoDIG recommends that the Commander of the Air Combat Command share the results of the MQ-9 trade study for weather tolerance activities with the other services that use MQ-9 to ensure efficient use of resources and to prevent duplication of effort.

AIR FORCE RESPONSE: Air Force concurs with comments. Air Combat Command did not initiate or receive results to a MQ-9 trade study for weather. Recommend AFMC share the results of the study with the Joint Services. **Estimated Completion Date**: 31 July 2020.

RECOMMENDATION 3: The DoDIG recommends that the Air Force Chief of Staff review the actions of personnel in the Air Force Deputy Chief of Staff for Intelligence, Surveillance, Reconnaissance, and Cyber Effects Operations for the development and funding of near real-time weather information and weather model forecasting capabilities and determine whether individuals should be held accountable for wasting resources on capabilities that were being developed without validated requirements and that were not fully developed for DoD use.

AIR FORCE RESPONSE: The Air Force non-concurs. There was a memorandum from the 12 AF/CC signed 30 October 2015 and titled "Improved Weather Support Capabilities for Remotely Piloted Aircraft Operations." Additionally, there are documented requirements outside the scope of the report from FY2010 to FY2016 with a 1067 signed in August of 2017 titled "Atmospheric Sensing and Prediction System (ASAPS) Operational Assessment." Finally, ACC Project #17-180R, titled "MQ-9 Atmospheric Sensing and Prediction System and NOWCasting Operational Assessment Final Report" demonstrates the continued use of the capabilities by the Air National Guard Air Force Reserve Command Test Center. Nothing was fully developed, however, capability development continues outside the scope of this audit. **Recommend**: DoDIG interview former members of AF/A2Q and review additional documents. **Estimated Completion Date**: 30 September 2020.

Air Force Chief of Staff and the Commander Air Combat Command (cont'd)

3. The AF/A2/6 point of contact is [redacted]

PETER J. LAMBERT, Maj Gen, USAF
Assistant Deputy Chief of Staff for Intelligence,
Surveillance, Reconnaissance, and
Cyber Effects Operations

Department of the Air Force Auditor General

DEPARTMENT OF THE AIR FORCE
WASHINGTON, DC

OFFICE OF THE SECRETARY

JAN 0 9 2019

MEMORANDUM FOR DEPARTMENT OF DEFENSE INSPECTOR GENERAL

FROM: SAF/AG
1120 Air Force Pentagon; Suite 4E204
Washington DC 20330-1120

SUBJECT: Air Force Response to DoD Office of Inspector General Draft Report, "Evaluation of Weather Support Capabilities for the MQ-9 Reaper" (Project No. D2019-DISPA2-0109.000)

This is the Secretary of the Air Force Auditor General (SAF/AG) response to the DoDIG Draft Report. The Air Force Audit Agency will conduct a review of issues identified in the report.

RECOMMENDATION 2: The DODIG recommends that the Secretary of the Air Force Auditor General conduct a review of Air Force Components use of Overseas Contingency Operations, Operations and Maintenance funding to develop innovation projects to ensure these funds are not used to develop capabilities that are not needed or that may be stopped due to shortages in overseas contingency operations funding without being fully developed.

AIR FORCE RESPONSE: SAF/AG concurs with comment. AFAA will perform an audit to follow-up on actions taken in reference to the original AFAA Report F2018-0005-A00900, "Intelligence, Surveillance and Reconnaissance Innovation Funds", published 23 March 2018. This report made 7 recommendations to the Deputy Chief of Staff, Intelligence, Surveillance and Reconnaissance (AF/A2), all of which are considered closed by the Air Force. This effort aligns with current AFAA follow-up processes. **Estimated Completion Date**: 30 September 2021.

However, SAF/AG suggests there are established forums, such as the quarterly Service Auditor Generals meeting or the Defense Council on Integrity and Efficiency, to request reviews or audits between DoDIG and service audit agencies. Leveraging these existing structures to request follow-up and audit coverage, rather than issuing separate report recommendations, would expedite execution, address control weakness, and ensure efforts align across the DoD.

The SAF/AG point of contact is [redacted]

Douglas Bennett
Air Force Auditor General

Acronyms and Abbreviations

ACC	Air Combat Command
AFLCMC	Air Force Life Cycle Management Center
ISR	Intelligence, Surveillance, and Reconnaissance
O&M	Operations and Maintenance
OCO	Overseas Contingency Operations
RDT&E	Research, Development, Test, and Evaluation
UAS	Unmanned Aircraft System


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