UNITED STATES AIR FORCE
AIRCRAFT ACCIDENT INVESTIGATION
BOARD REPORT

MQ-9A, T/N 16-4339

162d ATTACK SQUADRON
178th WING
SPRINGFIELD-BECKLEY AIR NATIONAL GUARD BASE, OHIO

LOCATION: UNITED STATES CENTRAL COMMAND
AREA OF RESPONSIBILITY

DATE OF ACCIDENT: 03 September 2023

BOARD PRESIDENT: COLONEL MICHAEL J. ADAMS

Conducted IAW Air Force Instruction 51-307

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR COMBAT COMMAND

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ACTION OF THE CONVENING AUTHORITY

The report of the accident investigation board conducted under the provisions of Air Force Instruction 51-307, *Aerospace and Ground Accident Investigations*, that investigated the 03 September 2023 mishap in the U.S. Central Command Area of Responsibility, involving an MQ-9A, T/N 16-4339, and operated by the 162d Attack Squadron, complies with applicable regulatory and statutory guidance, and is hereby approved.

MICHAEL G. KOSCHESKI
Lieutenant General, USAF
Deputy Commander

EXECUTIVE SUMMARY
UNITED STATES AIR FORCE
AIRCRAFT ACCIDENT INVESTIGATION

MQ-9A, T/N 16-4339
UNITED STATES CENTRAL COMMAND
AREA OF RESPONSIBILITY
03 September 2023

On 03 September 2023, the mishap aircraft (MA), an MQ-9A, tail number (T/N) 16-4339, ran out of fuel and crashed in undisclosed waters in the U.S. Central Command (CENTCOM) Area of Responsibility (AOR). The MA was operated by the 162d Attack Squadron, Mission Control Element (MCE) located at Springfield-Beckley Air National Guard Base, Ohio. The mishap crew (MC) was comprised of the mishap pilot (MP) and the mishap sensor operator (MS). The mishap resulted in no injuries, loss of life, or damage to civilian property. The MA was destroyed, resulting in loss of government property valued at $26,130,703.00.

The MA launched from a Launch and Recovery Element (LRE) in the U.S. Africa Command AOR and conducted operations under MC control in the CENTCOM AOR. After completing its operational mission, the MA experienced a Starter-Generator (SG) failure, which is an Electrical System Malfunction (ESM) leading to a "land as soon as possible" condition. The MC quickly diagnosed the ESM but executed the checklist slowly and with numerous errors. Additionally, the mishap operations supervisor (MOS) introduced extraneous factors into communications with the LRE Crew (LC), creating doubt within both units about the nature of the ESM, the MA's recoverability, and whether the LC would accept the MA for recovery. The MOS and mishap intelligence coordinator coordinated a forced landing location in vicinity of an undisclosed Forward Operating Base. Shortly after, the MP determined the MA did not have enough battery power for the MC to control a forced landing. The MA was then directed to a ditching location, updated with a new Emergency Mission to ditch near an undisclosed vessel, and set to loiter until it ran out of fuel and crashed in the water several hours later.

The Accident Investigation Board (AIB) President found, by a preponderance of the evidence, the cause of the mishap was pilot error based on the MP's decision to crash-land or ditch the MA. Further, the AIB President found, by a preponderance of the evidence, two factors substantially contributed to the mishap: (1) ineffective operations supervision created and failed to resolve confusion among the MCE and LRE crews about the malfunction; and (2) poor general knowledge created uncertainty in the MP about the impact of the malfunction on the MA and its ability to recover at the LRE.

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MQ-9A, T/N 16-4339
UNITED STATES CENTRAL COMMAND
AREA OF RESPONSIBILITY
03 September 2023

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ACRONYMS AND ABBREVIATIONS

12 ESOS	12th Expeditionary Special Operations Squadron
162 ATKS	162d Attack Squadron
178 WG	178th Wing
ACC	Air Combat Command
AFB	Air Force Base
AFE	Aircrew Flight Equipment
AFI	Air Force Instruction
AFMAN	Air Force Manual
AFRICOM	US Africa Command
AIB	Accident Investigation Board
ANGB	Air National Guard Base
AOR	Area of Responsibility
AT	Additional Training
BP	Board President
BR	Board Recorder
CAOC	Combined Air Operations Center
CFACC	Combined Forces Air Component Commander
CLNO	CENTCOM Liaison Officer
Capt	Captain
CENTCOM	US Central Command
Col	Colonel
DG	Dual Generator
DoD	Department of Defense
ELNO	EUCOM/AFRICOM Liaison Officer
EM	Emergency Mission
EPE	Emergency Procedure Evaluation
ESM	Electrical System Malfunction
EUCOM	US European Command
EVAL	Evaluator
FOB	Forward Operating Base
GA	General Atomics
GA-ASI	GA Aeronautical Systems, Inc.
GPS	Global Positioning System
HHD	Head-Down Display
HUD	Head-Up Display
IQT	Initial Qualification Training
IVO	In Vicinity Of
LA	Legal Advisor
LC	LRE Crew
LOS	LRE Operations Supervisor
LNO	Liaison Officer
LP	LRE Pilot
LRE	Launch and Recovery Element
LS	LRE Sensor Operator
Lt Col	Lieutenant Colonel
MA	Mishap Aircraft
Maj	Major
MAJCOM	Major Command
MC	Mishap Crew
MCE	Mission Control Element
MGCS	Mishap Ground Control Station
MIC	Mishap Intelligence Coordinator
MM	Maintenance Member
MOB	Mishap Safety Observer
MOS	Mishap Operations Supervisor
MP	Mishap Pilot
MQT	Mission Qualification Training
MS	Mishap Sensor Operator
MSgt	Master Sergeant
MTS	Multi-mission Targeting System
NM	Nautical Miles
PM	Pilot Member
PMA	Permanent Magnetic Alternator
RPA	Remotely Piloted Aircraft
RTB	Return to Base
SAR	Search and Rescue
SATCOM	Satellite Communications
SG	Starter-Generator
SIDO	Senior Intelligence Duty Officer
SOC	Squadron Operations Center
SSgt	Staff Sergeant
TCTO	Time Compliance Technical Order
TO	Technical Order
T/N	Tail Number
UHF	Ultra High Frequency
Z	Zulu

SUMMARY OF FACTS

1. AUTHORITY AND PURPOSE

a. Authority

On 08 February 2024, the Air Combat Command (ACC) Deputy Commander appointed Colonel Michael J. Adams as President of the Accident Investigation Board (AIB) for the mishap that occurred on 03 September 2023 involving an MQ-9A in the United States Central Command (CENTCOM) Area of Responsibility (AOR) (Tab Y-2). Other board members included a Captain (Capt) Legal Advisor, a Capt Pilot Member, a Master Sergeant (MSgt) Maintenance Member, and a Staff Sergeant (SSgt) Recorder (Tab Y-2). The AIB conducted its investigation in accordance with Air Force Instruction (AFI) 51-307, *Aerospace and Ground Accident Investigations*, remotely from 20 February 2024 to 18 April 2024 (Tab Y-4).

b. Purpose

In accordance with AFI 51-307, *Aerospace and Ground Accident Investigations*, this AIB conducted a legal investigation to inquire into all the facts and circumstances surrounding this Air Force aerospace accident, prepare a publicly releasable report, and obtain and preserve all available evidence for use in litigation, claims, disciplinary action, and adverse administrative action.

2. ACCIDENT SUMMARY

On 03 September 2023, the mishap aircraft (MA), an MQ-9A, tail number (T/N) 16-4339, completed operations in an undisclosed location within the CENTCOM AOR and turned towards its Launch and Recovery Element (LRE) within the United States Africa Command (AFRICOM) AOR (Tabs K-3, V-4.21, V-11.4, and DD-8). The MA was operated by the 162d Attack Squadron (162 ATKS), Mission Control Element (MCE) located at Springfield-Beckley Air National Guard Base, Ohio (Tabs K-2, V-21 and V-14.1). The LRE was operated by the 12th Expeditionary Special Operations Squadron (12 ESOS) at an undisclosed location within the AFRICOM AOR (Tabs BB-3 and DD-4). Shortly after turning towards the LRE, the MA experienced malfunctions within the electrical system consistent with a Starter-Generator (SG) failure (Tab J-3). The mishap pilot (MP) initiated the Electrical System Malfunction (ESM) checklist and identified the SG failure (Tabs BB-6, DD-6, and DD-11 to DD-12). The mishap operations supervisor (MOS) initiated communications with the LRE and, after several consultations between both the MCE and the LRE, the MP and MOS became uncertain about: 1) the SG failure diagnosis; 2) whether the MA could recover to the LRE location; and 3) whether the LRE would accept the MA for recovery (Tabs V-1.8 to V-1.9, V-1.15 to V-1.16, V-3.3 to V-3.6, V-3.24, V-7.25, and DD-4). The MP elected to crash-land the aircraft instead of attempting LRE recovery (Tab V-1.15, V-1.17, and V-3.23). The MP initially turned the MA away from the LRE toward an ad hoc crash-landing site in the CENTCOM AOR (Tabs V-1.16 to V-1.17, V-4.22, and DD-21 to 22). The MP then reoriented the MA to a ditching site in waters within the CENTCOM AOR and matched the MA Emergency Mission (EM) to the ditching location (Tab DD-30 to DD-32). Sixty-nine minutes

after the malfunction occurred, the MCE lost satellite communication (SATCOM) with, and control over, the MA (Tab DD-3 and DD-40). The MA continued to follow its programmed EM for two hours and forty-six minutes until it ran out of fuel and crashed in the water at 2303Z (Tabs J-3 and DD-3. The mishap resulted in no injuries, loss of life, or damage to civilian property (Tab P-2). The MA crashed at sea and was destroyed, resulting in loss of government property valued at $26,130,703.00 (Tab P-2).

3. BACKGROUND

a. Air Combat Command (ACC)

Headquartered at Joint Base Langley-Eustis, Virginia, ACC is one of ten major commands (MAJCOMs) in the United States Air Force (Tab CC-2). ACC is the primary provider of combat air forces to America's warfighting commanders (Tab CC-2). ACC organizes, trains, and equips Airmen who fight in and from multiple domains to control the air, space, and cyberspace (Tab CC-2). As the lead command for fighter, command and control, intelligence, surveillance and reconnaissance, personnel recovery, persistent attack and reconnaissance, electronic warfare, and cyber operations, ACC is responsible for providing combat air, space, and cyber power and the combat support that assures mission success to America's warfighting commands (Tab CC-2).

b. 178th Wing (178 WG)

The 178 WG, located at Springfield-Beckley Air National Guard Base (ANGB), Ohio, operates Remotely Piloted Aircraft (RPA), transitioning from MQ-1B Predators to MQ-9A Reapers on December 6, 2017 (Tab CC-4 and CC-8). The 178 WG's mission is to provide ready units to conduct Intelligence, Surveillance and Reconnaissance and Operations Support to execute federal and state missions while maintaining an active involvement with the local community (Tab CC-5).

c. 162d Attack Squadron (162 ATKS)

Located at Springfield-Beckley ANGB, the 162 ATKS's mission is to provide a diverse organization maximizing the MQ-9 Reaper's combat capabilities and training opportunities to support Global and Domestic Operations (Tab CC-7 to CC-8). The squadron vision is a cohesive combat unit striving for superior tactical prowess across the full spectrum of RPA Operations with exceptional integration of combat execution and combat training (Tab CC-7).

d. MQ-9A - Reaper

The MQ-9A Reaper is an armed, multi-mission, medium-altitude, long-endurance RPA that is employed primarily against dynamic execution targets and secondarily as an intelligence collection asset. (Tab CC-6). Given its significant loiter time, wide-range sensors, multi-mode communications suite, and precision weapons, it provides a unique capability to perform strike, coordination, and reconnaissance against high-value, fleeting, and time sensitive targets (Tab CC-6). Reapers can also perform the following missions and tasks: intelligence, surveillance, and reconnaissance; close air support; combat search and rescue; precision strike; buddy-lase; convoy and raid overwatch; route clearance; target development; and terminal air guidance (Tab CC-6). The MQ-9A's capabilities make it uniquely qualified to conduct irregular warfare operations in support of combatant commander objectives (Tab CC-6)

4. SEQUENCE OF EVENTS

a. Mission

On 03 September 2023, the MA launched without issue from an LRE in an undisclosed location in the AFRICOM AOR (Tab J-3 to J-4). After launch, the MA was handed off to a mission control element (MCE) crew, who took control and executed an operational mission in the CENTCOM AOR (Tab J-3). During the operational mission, the MCE crew swapped personnel periodically according to unit schedule (Tabs K-3, V-1.20, and V-2.2). The final MCE crew configuration for the mission was the mishap crew (MC) comprised of the MP and the mishap sensor operator (MS) (Tab V-1.3 and V-2.2). It was supported by the MOS and mishap intelligence coordinator (MIC) operating from the Squadron Operations Center (SOC) located immediately adjacent to the Mishap Ground Control Stations (MGCS) (Tab V-1.3 to V-1.5, V-3.3, and V-4.4 to V-4.5). During the mishap, the MC was also supported by an additional sensor operator acting as mishap safety observer (Tab V-3.9 and V-5.2).

b. Planning

During this deployment, mission briefs were given to the main body of the crew on a staggered shift schedule by an operations supervisor and intelligence coordinator with pre-identified members arriving later to retain crew duty day in case the next shift had shortfalls (Tab V-1.20, V-2.19 and V-3.29). On 03 September, the MS arrived at the beginning of the day and was given the brief without the MP (Tab V-1.20, V-2.18 to V-2.19, and V-3.29). The MP arrived slightly later and reviewed the mass brief himself (Tab V-1.20, V-2.18 to V-2.19, and V-3.29). Upon MCE changes of crew during a shift, the MP and MS conducted individual handover briefs with their counterparts, but there was no crew brief conducted between the MP and the MS once they were both in their respective seats (Tab V-1.20 and V-2.19). On this particular shift, the MS had been operating with another pilot for several hours prior to the mishap to gain experience (Tab V-2.20). The MOS and MIC had swapped out with their day shift counterparts when the mishap occurred, but the day shift crews were still operating the MCE (Tab V-3.3 and V-4.2).

c. Preflight

The MCE accomplished all applicable checklist steps and procedures correctly to prepare the MGCS for operation (Tab D-42). The MA was prepared by the LRE in full compliance with all applicable checklist steps and procedures for flight (Tab D-24). No evidence indicates that preflight procedures were a factor in this mishap.

d. Summary of Accident

Upon completion of the operational mission, the MC turned the MA towards the LRE location for return to base (RTB) (Tabs J-3 and DD-8). The MP updated the EM altitude for transit, ensuring the MA would fly itself to a recoverable location if SATCOM connection with the MCE was lost during RTB (Tabs V-1.10 to V-1.11, and DD-8). At 1908Z, shortly after RTB was initiated, the MA experienced malfunctions consistent with an SG failure (Tab J-4). SG failure is one of four main ESMs for the MQ-9, each with different checklist steps and procedures (Tab BB-6). In normal operational environments, an SG failure should be recoverable through proper checklist procedures (Tabs V-6.7 and DD-17). Another ESM is a Dual Generator (DG) failure, and it is the least likely to be recoverable unless an aircraft is close to a suitable airfield (Tabs BB-6, V-11.6, and V-13.8). The MP called the MOS and initiated the ESM checklist (Tabs V-1.3 and DD-9).

The MP immediately verbalized the possibility of SG failure and accomplished ESM checklist steps one through three with the MS (Tabs BB-4 and DD-9). During the initial steps, the MS summarized the warning associated with landing gear which identifies a specific minimum battery power required to drop the gear (Tab DD-9). This warning was misunderstood by the MC and MOS throughout the mishap as relating to just one component power and not the entire electrical system, which draws power from two interconnected systems (Tabs V-4.15 to V-4.16, BB-5, and DD-13). The MQ-9A electrical system has two parallel and largely redundant systems that provide power to aircraft systems (Tab J-7). Most MQ-9A systems, including the landing gear, can be powered by the generators or by batteries in the case of generator failure (Tabs J-7 and BB-12).

The MOS arrived at the MGCS within two minutes of mishap occurrence and confirmed "generator fail" with the MC as they accomplished "load shedding" procedures to power down non-flight essential equipment and preserve backup battery power associated with the failed generator (Tabs BB-7, V-1.6, V-3.3, and DD-10 to DD-11). The MP and MS load shed all non-core aircraft systems, except SATCOM to retain MCE control of the MA and Multi-mission Targeting System (MTS) to maintain a visual search capability (Tabs V-1.16, BB-7, and DD-10).

The MP and MS then accomplished battery calculations, which are directed by the Technical Order (TO) to determine the time remaining for the MCE to control the aircraft via SATCOM during an SG failure (Tabs J-7, V-1.9, V-2.8, V-15.10, BB-7, and BB-12). During a DG failure, the time calculated would represent the amount of time left for any method of aircraft control, including LRE recovery (Tab BB-12). Throughout the mishap, the MP utilized an unofficial spreadsheet-derived digital white board product to accomplish the battery duration calculations and never verbalized the TO note stating the power output capacity of the Permanent Magnetic Alternator (PMA), which could sufficiently power the aircraft during an EM recovery to an LRE (Tabs V-1.10 to V-1.11, V-3.12, V-5.17 to V-5.18, V-14.7, and V-15.10, BB-12, and DD-11). The MOS did not comment on load shedding but reminded the MP to turn direct to the LRE airfield as an

initial emergency action (Tabs V-3.13 and DD-10 to DD-12). The MP subsequently course corrected the MA towards the standard LRE recovery point (Tabs BB-3 and DD-10 to DD-12).

Continuing the checklist, the MP incorrectly determined that a generator reset was warranted and asked the MOS, "is that cool with you?" before executing the procedure (Tabs BB-8 and DD-12). At 1913Z, the MOS departed the MGCS before answering to contact the LRE (Tab DD-12). Three minutes later, after failing to reach the LRE, the MOS called the MP from the SOC and concurred with generator reset, "Go ahead with your reset" (Tab DD-13). Normally, a generator reset would only be attempted if the aircraft was assessed unrecoverable (Tab V-3.15 to V-3.16 and DD-13).

At 1918Z, the MOS established contact with the LRE operations supervisor (LOS) and reported the MA had an SG ESM, the MA had 45 minutes remaining, and inquired about ditching sites (Tabs V-3.16, V-3.22, V-4.12, V-6.2 to V-6.4, V-6.7, DD-4, and DD-14). The LOS misunderstood the MOS's inclusion of time remaining and inquiry about ditching to signify the MA was experiencing a DG failure (Tab V-6.4). Observing the MTS still operating from the link feed the LOS recommended the MC load shed the MTS and continue running the checklist to completion (Tabs V-3.17, V-6.2, V-6.11, V-7.2, and DD-4). The MOS directed the MP to load shed the MTS in order to preserve battery power, and stated "Hey, kill your MTS" (Tab DD-13). During calls between the MOS and LOS, the LOS was joined on speakerphone by the entire LC, including the LOS, LRE pilot and two LRE sensor operators (LS1 and LS2) (Tab V-3.13 to V-3.14, V-6.2, and V-7.6). LRE maintenance was present during one call but did not contribute to MA ESM diagnosis (Tab V-3.4, V-3.10, V-6.12 to V-6.13, and V-7.6). It should be noted that no recordings of the conversations between the MOS and LC were made at the time (Tab V-3.8).

At 1921Z, the MIC identified that there was a surface vessel of concern in vicinity of (IVO) the MA normal RTB routing (Tabs V-3.5, V-4.2, and DD-14). This vessel was identified as a concern if the LRE failed to take control of the MA during the recovery and it were to crash in its holding location; but the MP had not yet identified any concerns about the MA executing normal EM recovery (Tabs V-4.12, and DD-9 to DD-20). The MIC also informed the MP that MOS and LRE were discussing ditching sites (Tab DD-14).

At 1922Z, the LC messaged the MC directly to ask whether the MA was experiencing an SG or DG failure, to which the MS answered SG failure (Tabs V-6.18, V-7.11, and DD-15). Very soon after, the MOS returned to the MGCS and also confirmed with the MP that the MA was experiencing an SG and not DG failure (Tab DD-15 to DD-16). At 1925Z the MP and MOS reviewed the MA ESM diagnosis, and the MOS assessed that MA could reach the landing site with an SG failure and a functioning PMA, confirming the ESM was not a DG failure (Tab DD-15 to DD-17). The MOS departed the MGCS to call the LRE again (Tab DD-16).

The MC continued running the checklist, reaching step 19 which calls for an assessment of whether or not the aircraft can reach the landing site with Airborne Modem Power on (Tabs BB-8 and DD-17). This assessment is interrupted starting at 1927Z by the MOS and the MIC who call from the SOC asking for MA electrical system readings, travel times, and Heads Down Display (HDD) warnings to relay to the LOS (Tab DD-17 to DD-18). This aircraft data was requested to support a conversation between the MOS and LC which failed to correctly conclude that the MA was experiencing a SG failure and had sufficient power with the PMA to recover via the standard EM

to the LRE airfield (Tabs V-3.21, V-6.7 to V-6.8, and DD-4). As a result of this conversation, the MOS became doubtful about the SG failure diagnosis and whether the LRE would accept the MA for recovery (Tabs V-3.6). At 1933Z the MOS summarized this conversation to the MP saying, "...they are talking about turning around and going to the [undisclosed Forward Operating Base (FOB)] and ditching it there" (Tab DD-18).

At 1934Z, the MOS called the MC from the SOC and asked the MP to compute battery duration if the Airborne Modem was powered off; this corresponds to the ESM checklist step 19 that was previously interrupted (Tabs BB-8 and DD-19). The MP identified that the MA could have as much as 147 minutes of power remaining (Tabs BB-13 and DD-20).

After passing this expected battery duration assessment, the MP computed travel time to the FOB and expressed concern about the distance stating, "Oh, that's up there" (Tab DD-20). Although the mission was planned for an LRE-controlled recovery, the MCE was capable of controlling its own forced landing (Tab BB-9 and DD-20). This prompted the MP to call for a decision at 1937Z whether the MA would continue to recover at the LRE or divert to the FOB for a forced landing (Tab DD-20). Immediately the MIC responded, "turn to FOB" (Tabs V-3.23 and DD-20). The MOS followed up thirty-eight seconds later, "turn to FOB and get ready to ditch in the water", prompting the MP to turn the MA direct to FOB (Tab DD-21). Prior to this direction, the MOS had begun coordinating options to crash-land at the FOB with the CENTCOM Liaison Officer (CLNO) (Tabs V-3.22 to V-3.23, V-10.13, V-12.7, and DD-18).

Shortly after turning away from the LRE, the MOS directed the MP to reassess battery duration and the feasibility of dropping the MA landing gear and sending it lost link to the LRE (Tab DD-21). The MP answered the request, but also proposed an additional option of going direct to LRE airfield instead of flying the standard recovery (Tab DD-21). Both proposals were intended to offer recovery solutions if the MA was in fact experiencing a DG failure (Tabs V-3.5 to 3.6, and DD-21).

The MP then stated, "we're taking a huge chance by assuming that that time is correct by sending home lost link" (Tab DD-23). MP and MOS were now both uncertain whether the MA could safely recover to the LRE under any proposed recovery scenario (Tab DD-23). Additionally, the LC asserted that any non-standard emergency recoveries would require Combined Forces Air Component Commander (CFACC) or other high-level approval (Tab V-1.24, V-3.5, V-3.24, V-4.14, V-7.20, V-13.14). The MOS asked both CLNO and the United States European Command/AFRICOM Liaison Officer (ELNO) to pursue approval for the MA to accomplish non-standard recovery, but also continued coordination with the CLNO for a crash-landing location (Tab V-3.24 and V-4.22)

At 1948Z, the MP changed the MA EM to correspond to the FOB location (Tab DD-25). This is the first moment that the MA would not recover to the LRE upon lost link (Tab J-8). Two minutes later, at 1950Z the MIC announced to the MC, "...we're gonna gear down forced landing on the dirt by FOB, that's the current plan" (Tab DD-26). This decision was relayed to the MIC by the MOS, who had now received concurrence from the CLNO to crash-land at the FOB, if crash-landing was in fact required (Tab V-3.22 to V-3.23, V-4.20 to V-4.21, V-10.13, and V-12.7). It is never stated to, or asked by, the MC or MIC if the higher-level approval to accomplish non-

standard recovery was approved or disapproved (Tabs V-4.21 and DD-8 to DD-48). Shortly after, the MIC relayed from the MOS to the MP to climb the MA and then to drop the landing gear (Tab DD-26). This decision immediately slowed MA airspeed making the forced landing at the FOB impossible (Tabs V-4.16 and DD-6). It should be noted that the MCE and the Combined Air Operations Center (CAOC) understood that crash-landing would protect the wreckage, but not prevent destruction of the MA (Tab V-2.23, V-3.24, and V-4.22).

At 1952Z, the MP initiated the Forced Landing checklist, and shortly after, the MOS returned to the MGCS (Tabs BB-9 and DD-27). During checklist execution, the MOS coached the MP on forced landing at an uncontrolled airfield: reviewing aircraft settings and how to fly the approach (Tabs BB-17 and DD-29 to DD-30). At 1957Z, the MP determined that the MA lacked battery power to execute MCE controlled landing, and the MOS returned to the SOC to coordinate a new plan with the CLNO (Tab DD-30). The MIC and MOS now coordinated with the CLNO to ditch the MA IVO an undisclosed vessel in undisclosed waters near the MA (Tab V-3.6 and V-4.3).

At 1959Z, the MIC relayed from the MOS to the MP to turn towards the undisclosed vessel, communicated the specific location, and relayed direction from the MOS to load shed all remaining aircraft systems except for the Airborne Modem (Tabs BB-7 and DD-32). The MOS returned to the MGCS at 2001Z and coached the MP on ditching considerations: reviewing aircraft settings and how to build the EM to approach the vessel (Tabs V-3.6 and DD-32 to DD-36). At 2007Z, the MP updated the MA EM to match the vessel location but offset to the north to prevent crash-landing into the vessel (Tab DD-35). After one interim update changing the lost link heading, the final EM was sent at 2009Z matching the commanded descent to an altitude that would allow the vessel time to visually acquire the MA before it ditched in the water (Tabs J-5, J-8, V-3.6, DD-35 and DD-36).

At 2014Z, as the MA approached the vessel, the MOS directed the MP to continuously attempt MA generator resets in a last-ditch attempt to regain aircraft power associated with the SG (Tab DD-39). Shortly after, the MOS directed the MP to turn on the aircraft transponder, squawk emergency, and turn on aircraft lights as the MA approached the vessel (Tab DD-39 and DD-40). MIC passed MA configuration to the senior intelligence duty officer who confirmed coordination with the vessel to aid visual acquisition of the MA (Tab DD-40). At 2017Z, the first indication of loss of SATCOM connectivity due to battery depletion was received (Tabs J-5 and DD-40). Any time prior to the lost link indications, the MA could have been safely recovered by resending the original EM for LRE recovery (Tab J-3 to J-4). At 2019Z, the MS initiated the Lost SATCOM checklist (Tabs BB-23 and DD-41). The MA loitered around the last points of the programmed EM at low altitude for two hours and forty-six minutes, operating on PMA-generated power until running out of fuel and uncontrollably ditching at 2303Z (Tabs J-7 to J-8 and DD-3).

e. Impact

The MA impacted undisclosed waters in the CENTCOM AOR at 2303Z after departing controlled flight due to running out of fuel (Tabs J-5 and DD-3).

f. Egress and Aircrew Flight Equipment (AFE)

Not applicable.

g. Search and Rescue (SAR)

The undisclosed vessel recovered pieces of the MA fuselage but was unequipped to retrieve the entire aircraft, which was presumed lost at sea (Tabs J-5 and V-11.14).

h. Recovery of Remains

Not applicable.

5. MAINTENANCE

No evidence indicated the maintenance of the MGCS (forms documentation, inspections, maintenance procedures) was a factor in the mishap (Tab D-42 to D-46). The MA responded to MGCS commands as intended (Tab T-32).

The following pertains to the maintenance on the MA:

a. Forms Documentation

A review of the maintenance records for the MA leading up to the mishap revealed no relevant discrepancies or issues and showed no overdue Time Compliance Technical Orders (TCTO) (Tab D-39). All Basic Post-Flight/Pre-Flight, Thru-Flight inspections, and release procedures were followed (Tab D-24 to D-25).

b. Inspections

All maintenance inspections on the MA were current and complied with by appropriate authorities (Tab D-24 to D-36). The most recent Thru-Flight was accomplished on 03 September 2023 (Tab D-24). A 400-hour Engine Inspection was accomplished on 29 August 2023 (Tab D-4).

c. Maintenance Procedures

Maintenance personnel conducted procedures IAW applicable TOs and guidance (Tab T-32).

d. Maintenance Personnel and Supervision

Without the inspection of MA parts, it is undetermined if maintenance personnel and supervision were a factor in this mishap (Tab T-32).

e. Fuel, Hydraulic, Oil, and Oxygen Inspection Analyses

There is no evidence to suggest fuel, hydraulic, oil, or oxygen were a factor in the mishap (Tab J-3 to J-4). The MA ran out of fuel causing it to impact the water (Tab J-4).

f. Unscheduled Maintenance

A review of the maintenance history of the MA engine revealed that the engine experienced an "Engine over-temp" on 08 August 2022 (Tab D-2). The engine was received by the LRE unit

maintenance on 31 August 2022 (Tab D-2). Engine was installed on MA on 27 January 2023 (Tab D-2).

Maintenance documentation revealed no significant unscheduled maintenance was performed on the MA engine since completion of the last 400-hour Engine Inspection, accomplished on 29 August 2023 (Tab D-4).

6. AIRFRAME, MISSILE, OR SPACE VEHICLE SYSTEMS

a. Structures and Systems

The MQ-9A electrical power system consists of two independent electrical systems (Tabs J-7 and BB-12). One is normally powered by the SG while the other is normally powered by the PMA (Tab J-7). In the event of a generator failure, the PMA will continue to supply power, which supports flight critical avionics (Tab J-7). With the SG offline, any equipment that is normally powered by the first system will be powered by Ni-Cad batteries (Tab J-7). While the flight critical avionics are supported by the PMA, the MTS and SATCOM systems are supported only by the other power system (Tab J-7). As battery capacity is drained, the available battery voltage decreases (Tab J-7). When the available battery voltage is below the minimum required to run the MTS-B and/or SATCOM systems, those systems will shut down (Tab J-7). However, flight can be continued in lost link mode as long as the other system remains powered (Tabs J-7). When in range of an LRE datalink, the aircraft can be landed manually (Tab J-7).

No electrical power system items were recovered; therefore, no items were evaluated post mishap (Tab J-3). The MA electrical system data was transmitted to the MCE and recorded throughout flight until the loss of SATCOM connectivity at 2017Z (Tabs J-3 and DD-8 to DD-40).

b. Evaluation and Analysis

Only data logs and head-up display (HUD) video were sent for technical review by General Atomics Aeronautical Systems, Inc (GA-ASI) (Tab J-2 to J-3). Analysis of the mishap data logs and HUD video indicated that a change in electrical power source from SG to batteries occurred due to a loss of electrical power from the SG (Tab J-3). Without mishap hardware available for inspection, the cause of the loss of SG power could not be determined (Tab J-3). The other power supply continued to work normally and powered all flight critical avionics (Tab J-3). The MA SATCOM equipment, which is only powered on SG-related system, shut down as expected when its voltage decreased below minimum voltage, resulting in a loss of SATCOM datalink (Tab J-7).

7. WEATHER

a. Forecast Weather

The weather forecast at the LRE airfield during the takeoff and landing period was favorable (Tab F-2 and F-3). The temperature for the MA flight was fair between 86 and 93 degrees Fahrenheit (Tab F-2 and F-3). There is no evidence to suggest the overall forecast weather was a factor in the mishap.

b. Observed Weather

There are no available weather observations or in-flight reports (Tab T-33). When asked if weather was an issue in the mission, aircraft performance, or mishap both MCE and LRE personnel did not identify nor recall any specific concerns (Tab V-4.16, V-5.10, V-6.12, and V-7.15).

c. Space Environment

There were no space weather impacts forecasted or reported for the duration of the aircraft's planned sortie time (Tab F-2 to F-3). This includes no impacts to global positioning systems (GPS), ultra-high frequency (UHF) systems, or HF systems (Tab F-2 to F-3).

d. Operations

The operations were conducted, and the MA was flown, within prescribed operational weather limitations (Tab F-2 to F-3).

8. CREW QUALIFICATIONS

a. Mishap Pilot

The MP completed Initial Qualification Training (IQT) at Holloman Air Force Base (AFB), New Mexico on 27 April 2022, culminating in an Initial Instrument/Qualification/Mission evaluation with a grade of Q1 and no downgrades (Tab T-4). The MP completed Mission Qualification Training (MQT) on 10 August 2022 with an overall "Well Below Average" Form 206 grade sheet (Tab T-14). On 16 August 2023, the MP completed an Emergency Procedure Evaluation (EPE) with three discrepancies relevant to the mishap in:

Area 37. Cockpit/Crew Resource Management: Q-. Inadequate CRM degraded crew problem solving and hampered any shift in crew dynamics.
Area 53. Risk Management/Decision Making: Q-. Did not always gather and cross check available data before deciding or provide rationale for decisions.
Area 302. Checklist Usage: Q-. Minor steps omitted that did not affect safety of flight. Communicated with other flight members or crew members (if applicable) with minor exceptions (Tab T-27 to T-28).

The MP was assigned a training plan with one Additional Training (AT) simulation, which was accomplished within a two-day period (Tabs T-27 to T-28 and V-15.2 to V-15.4). The first attempt was instructed by the MOS who graded MP's performance as "Non Effective – Student Non Progression" and noted the MP was slow to recognize and act on emergency management, the MP made multiple errors and omissions to checklists, the MP made frequent incoherent statements, and finally the MP demonstrated scattered skills and below average performance resulting in the recommendation of repeating the AT (Tab T-29 to T-30).

The second attempt was instructed by the Squadron Director of Operations who certified the MP's removal from supervised status (Tab T-27 to T-28).

The MP training currencies were all within Air Force Manual (AFMAN) 11-2MQ-9 Volume-1 (V1) and AFMAN 11-202 V1 limits (Tab T-8 to T-13).

The MP was considered inexperienced at the time of the mishap IAW AFMAN 11-2MQ-9 V1 with 395.9 hours in the MQ-9A and 82.9 hours in the MQ-9A simulator (Tab T-6). Recent flight time is as follows (Tab T-7):

	Hours	Sorties
30 days	15.1	9
60 days	53.8	20
90 days	99.1	33

b. Mishap Sensor Operator

The MS completed IQT at March Air Reserve Base, California on 28 March 2023 culminating in an Initial Qualification/Mission evaluation with a grade of Q1 and no downgrades (Tab T-15). The MS completed MQT on 03 May 2023 with an overall "Effective - Complete" Form 206 grade sheet (Tab T-18). There were no noted deficiencies in the training performance relevant to the mishap (Tab T-33).

The MS training currencies were all within AFMAN 11-2MQ-9 V1 and AFMAN 11-202 V1 limits (Tab T-21 to T-26).

The MS was considered inexperienced at the time of the mishap IAW AFMAN 11-2MQ-9 V1 with 167.9 hours in the MQ-9A and 84.5 hours in the MQ-9 simulator (Tab T-17). Recent flight time is as follows (Tab T-20):

	Hours	Sorties
30 days	36.2	9
60 days	59.1	18
90 days	86.6	32

9. MEDICAL

a. Qualifications

All crew members were physically and medically qualified for the mission (Tab K-2).

b. Health

There was no evidence to indicate any health factors were a factor in the mishap (Tab T-31).

c. Pathology

The blood and urine samples collected post flight revealed no pathological factors for the mishap (Tab G-2 to G-11).

d. Lifestyle

There is no evidence to suggest lifestyle factors were a factor in the mishap (Tab T-31).

e. Crew Rest and Crew Duty Time

Prior to the start of flying duties, the MP and MS signed the 178th Operations Group Risk Assessment form stating each was legally ready to fly as defined in paragraph 3.1, AFMAN 11-202 V3, (Tab K-6).

10. OPERATIONS AND SUPERVISION

a. Operations

No evidence indicates that the MC's operations tempo was a factor in the mishap (Tab V-1.19, V-2.18, V-3.28, and V-4.25).

b. Supervision

The MOS was a direct participant in the analysis, communication, and decision making that led to the MA ditching in the water (Tab DD-8 to DD-40). The MOS was the primary voice of the MCE during all communications with the LC and the CAOC Liaison Officers, which is IAW unit norms (Tab V-1.4, V-2.5, V-3.10, V-4.6, and V-5.4). The MOS handled all coordination from the SOC where voice calls were unrecorded (Tab V-3.10). The MOS provided guidance and, at times, direction to the MC throughout the event and provided instruction on forced landing and ditching procedures during the mishap (Tabs V-4.16, DD-13, DD-16, DD-29, and DD-31 to DD-36). The MIC was also a direct participant in crew communication as a relay between the MOS and the MC and the primary voice of the MCE during all communications with the intelligence community (Tab DD-14, DD-20, DD-25 to DD-26, DD-31 to DD- 32, DD-39).

11. HUMAN FACTORS ANALYSIS

a. Introduction

The Department of Defense Human Factors Analysis and Classification System (HFACS) 8.0 lists potential human factors that can play a role in aircraft mishaps and identifies potential areas of assessment during an accident investigation (Tab EE-3). Five human factors were identified as relevant to this mishap: (1) Procedure or Checklist Not Followed Correctly; (2) Inadequate Real-Time Risk Assessment/Action; (3) Ineffective Team Resource Management; (4) Ineffective Supervisory or Command Oversight; and (5) Rank/Position Intimidation.

b. Relevant Factors Identified by AIB

(1) Procedure or Checklist Not Followed Correctly [AE102] is a factor when the mishap individual did not follow correct procedure which resulted in the near-miss or mishap (Tab EE-7). During the mishap, the MP made numerous checklist execution errors, including incorrectly determining the MA could not recover at the LRE airfield (Tabs J-3 to J-4, BB-4 to BB-9, DD-12, DD-13, and DD-26). Additionally, the MOS contacted the LRE, and initiated planning for ditching, well before the MP completed the checklist steps to: a) determine whether the aircraft was recoverable; and b) notify the LRE of the situation (Tabs BB-9, DD-12, and DD-14).

(2) Inadequate Real-Time Risk Assessment/Action [AE201] is a factor when the mishap individual, through inexperience, faulty logic, poor judgment, or insufficient information, selected or proceeded with the wrong course of action based on an ineffective real-time assessment of immediate hazards during execution of a task/mission/activity, which resulted in the mishap (Tab EE-8). The MP and MOS elected to crash-land/ditch the MA instead of resolving uncertainty about the ESM diagnosis (Tabs V-1.16, V-3.6, V-5.13, and DD-22 to DD-25). Additionally, the MP and MOS overweighted the presence of the surface vessel of concern as a planning factor related to the MA handover between the MCE and LRE (Tab V-3.24, V-3.29 to V-3.30, V-4.12, and V-5.10).

(3) Ineffective Team Resource Management [PP101] is a factor when crew/team members failed to actively maintain an accurate and shared understanding of the evolving task, or manage their distribution of tasks, which resulted in a hazardous condition or unsafe act (Tab EE-18). The MOS and LC never achieved a shared, accurate understanding of the MA malfunction (Tab V-1.12, V-3.4 to V-3.6, V-3.16, V-3.21, V-4.13, V-4.15, V-6.4, and V-6.7 to V-6.9). After the decision to crash-land/ditch, the MP and MOS were both entirely focused on forced landing and ditching procedures with neither attempting to resolve uncertainty about the ESM diagnosis and the possibility of LRE recovery (Tab DD-21 to DD-30).

(4) Ineffective Supervisory or Command Oversight [SI001] is a factor when the availability, competency, quality or timeliness of supervisor/leader oversight did not meet task or mission demands, which resulted in hazardous conditions or unsafe acts (Tab EE-22 to EE-23). The MOS introduced extraneous factors into communications with the LC, creating doubt within both units about the nature of the ESM, the MA's recoverability, and whether the LC would accept the MA for recovery (Tabs V-1.16, V-3.6, V-7.25, DD-4, DD-6, and DD-12).

(5) Rank/Position Intimidation [SI009] is a factor when a supervisor caused the task performance capabilities to be degraded by exercising too much or too little of the authority conferred by his or her rank or position (Tab EE-23 to EE-24). The MOS provided excessive advice and direction to the MP, including calls to climb/descend, load shed the MTS, drop the landing gear, attempt a generator restart, crash-land, and then ditch the MA (Tab DD-13, DD-16, DD-21, DD-26, DD-29, and DD-31 to DD-36). The MP and MS never challenged the MOS or LC over the direction to crash-land/ditch the MA or any of the underlying assumptions (DD-8 to DD-30).

12. GOVERNING DIRECTIVES AND PUBLICATIONS

a. Publicly Available Directives and Publications Relevant to the Mishap

Air Force Instruction (AFI) 11-418, *Operations Supervision*
AFI 51-307, *Aerospace and Ground Accident Investigations*
AFI 51-307, *Aerospace and Ground Accident Investigations*, ACC Supplement
AFMAN 11-202 Volume One (V1), *Aircrew Training*
AFMAN 11-202 V2, *Aircrew Standardization and Evaluation Program*
AFMAN 11-202 V3, *Flight Operations*
AFMAN 11-2MQ-9V1, MQ-9, *Aircrew Training*
AFMAN 11-2MQ-9V2, MQ-9, *Aircrew Evaluation Criteria*
AFMAN 11-2MQ-9V3, MQ-9, *Operations Procedures*

NOTICE: All directives and publications listed above are available digitally on the Air Force Departmental Publishing Office website at: https://www.epublishing.af.mil.

b. Other Directives and Publications Relevant to the Mishap

12 ESOS Inflight Guide v10, 12 Apr 2023
12 ESOS MQ-9 LRE-MCE Handover Procedures Standard Operating Procedures, 1 June 2023
AFMAN 11-2MQ-9V3, 12 ESOS Chapter 8, 4 Feb 2023
HFACS 8.0, Human Factors Analysis and Classification System (DoD HFACS) version 8.0

c. Known or Suspected Deviations from Directives or Publications

Battery duration calculations were not accomplished IAW the TO (Tabs BB-12 to BB-16 and DD-11). Instead, a spreadsheet-derived digital white board was utilized to calculate battery duration without referencing the associated TO instructions and notes (Tabs V-3.12, BB-12, DD-18, DD-20, and DD-31). This product did not appear to generate inaccurate data but may have contributed to misunderstanding of the MQ-9A electrical system (Tab V-3.12).

The MP, with MOS concurrence, attempted to restart the generator long before the MP and MOS had concerns that the MA was not recoverable (Tab DD-13). This checklist step should only be taken if it has been determined that the aircraft cannot be safely recovered with confidence based on the calculated battery duration time as it could result in damage to flight critical components and loss of aircraft (Tabs V-3.15 and BB-8).

The SG failure checklist concludes with two options for LRE recovery; neither were executed (Tab BB-8). It is possible with rapid execution of the ESM checklist, that the MA could have been controlled by the MCE to an LRE handover (Tabs Tab V-6.8 to V-6.10 and BB-8 to BB-9). It is certain that the MP could have set an EM for the MA to autonomously fly to a standard recovery location for LRE handover (Tab V-1.10 to V-1.11 and V-11.6). Instead, the MP, with MOS concurrence, opted to crash-land/ditch the MA (Tab DD-20 to DD-21).

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20 JUNE 2024

MICHAEL J. ADAMS, Colonel, USAF
President, Accident Investigation Board

STATEMENT OF OPINION

MQ-9A, T/N 16-4339
UNITED STATES CENTRAL COMMAND
AREA OF RESPONSIBILITY
3 September 2023

Under 10 U.S.C. § 2254(d) the opinion of the accident investigator as to the cause of, or the factors contributing to, the accident set forth in the accident investigation report, if any, may not be considered as evidence in any civil or criminal proceeding arising from the accident, nor may such information be considered an admission of liability of the United States or by any person referred to in those conclusions or statements.

1. OPINION SUMMARY

On 03 September 2023, the mishap aircraft (MA), an MQ-9A, tail number (T/N) 16-4339, ran out of fuel and crashed in undisclosed waters in the United States Central Command (CENTCOM) Area of Responsibility (AOR). The MA was operated by the 162d Attack Squadron, Mission Control Element (MCE) located at Springfield-Beckley Air National Guard Base, Ohio. The mishap crew (MC) was comprised of the mishap pilot (MP) and the mishap sensor operator (MS). The mishap resulted in no injuries, loss of life or damage to civilian property. The MA was destroyed, resulting in a loss of government property valued at $26,130,703.00.

The MA launched from a Launch and Recovery Element (LRE) in the United States Africa Command AOR and conducted operations under MC control in the CENTCOM AOR. Shortly after completing its operational mission, the MA experienced a Starter-Generator (SG) failure, which is an Electrical System Malfunction (ESM) leading to a "land as soon as possible" condition. The MC quickly and correctly diagnosed the ESM but was slow to complete the checklist and exhibited poor general knowledge of the electrical system. Additionally, the mishap operations supervisor (MOS) introduced extraneous factors into communications with the LRE Crew (LC), creating doubt within both units about the nature of the ESM, the MA's recoverability, and whether the LC would accept the MA for recovery. Furthermore, the MC, MOS, and mishap intelligence coordinator (MIC) prioritized coordinating a sanitized ditching site to protect any MA wreckage over resolving uncertainty about the ESM.

The MOS and MIC coordinated a forced landing location in vicinity of (IVO) an undisclosed Forward Operating Base (FOB). Shortly after, the MP determined the MA did not have enough battery power for the MC to control a forced landing. The MA was then directed toward the ditching location, updated with a new emergency mission (EM) to ditch in close proximity to an undisclosed vessel, and set to loiter until it ran out of fuel and crashed in the water several hours later.

2. CAUSE

As the Accident Investigation Board President, I find, by a preponderance of the evidence, the cause of the mishap was the MP's decision to crash-land or ditch the MA instead of returning to the LRE. This decision was the result of the MP's failure to correctly run the ESM checklist, which should have maintained the unambiguous, original SG diagnosis and resulted in either: a) recovery via EM to the LRE; or b) MCE controlled handoff to the LRE (with EM as a contingency if power was lost). The mishap became unavoidable 40 minutes after the divert decision was made, when the batteries powering the MA satellite communications (SATCOM) were sufficiently depleted that the MCE lost the ability to change the EM back to recover at the LRE.

Review of the MA data files, MCE audio, and witness testimony show, by a preponderance of evidence, that the MP was in command of the MA from the time the decision was made to crash-land or ditch until SATCOM communication with the MA was lost.

3. SUBSTANTIALLY CONTRIBUTING FACTORS

Further, I find, by a preponderance of the evidence, the following two factors substantially contributed to the mishap: (1) ineffective operations supervision created and failed to resolve confusion among the MCE and LRE crews about the malfunction; and (2) poor general knowledge created uncertainty in the MP about the impact of the malfunction on the MA and its ability to recover at the LRE.

a. Ineffective Operations Supervision

The MOS had an outsized impact on the MC's execution during the mishap. The MOS was the only voice to the LRE and the Combined Air Operation Centers and in that role was the source of confusion—about the nature of the ESM, the MA's recoverability, and whether the LC would accept the MA for recovery—that would inform the MP's decision to crash-land/ditch the MA. Additionally, the MOS was an active participant in every consequential decision the MP made during this mishap, voicing either approval or concurrence for the unnecessary and dangerous generator reset, directing the Multi-Spectral Targeting System (MTS) power down, voicing the direction to turn the MA away from the LRE, approving or concurring with direction to drop the landing gear unnecessarily, and defining the final loiter and altitude plan. Ultimately, the MP and MS never challenged the MOS, an evaluator pilot, about any of these matters or the information and assumptions underlying them.

b. Poor General Knowledge

The MP's poor general knowledge of the electrical system and ESM checklist led to constant interaction with the MOS for either advice or counsel. It also resulted in multiple unnecessary decisions (e.g., maintaining MTS and generator reset) and premature actions (e.g., dropping landing gear and crash landing/ditching planning). Most significantly, the MP's poor general knowledge allowed the MOS's ineffective coordination with the LRE, and the resulting confusion,

to lead to a change in the MP's diagnosis of the malfunction which was initially correct and should have been sufficient to guide the MA home.

4. CONCLUSION

I reviewed the data logs, maintenance forms documentation, witness testimony, video evidence, photographic evidence, and technical reports. I find, by a preponderance of evidence the cause of the mishap was pilot error. The MP commanded the MA to ditch after incorrectly determining the aircraft was unrecoverable by the LRE. This decision could have been changed for 40 minutes had the MP revisited the decision or re-examined the underlying assumptions.

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20 JUNE 2024

MICHAEL J. ADAMS, Colonel, USAF
President, Accident Investigation Board

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