UNITED STATES AIR FORCE
ABBREVIATED AIRCRAFT ACCIDENT INVESTIGATION
BOARD REPORT

MQ-9A, T/N 13-4226

432d Wing
Creech Air Force Base, Nevada

LOCATION: UNITED STATES AFRICA COMMAND
AREA OF RESPONSIBILITY
DATE OF ACCIDENT: 29 November 2023

BOARD PRESIDENT: LIEUTENANT COLONEL TOBY J. MILLER

Abbreviated Accident Investigation, conducted pursuant to
Chapter 12 of Air Force Instruction 51-307

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR COMBAT COMMAND

OFFICE OF THE DEPUTY COMMANDER
205 DODD BOULEVARD, SUITE 203
JOINT BASE LANGLEY-EUSTIS VA 23665

11 APR 2025

ACTION OF THE CONVENING AUTHORITY

The report of the abbreviated accident investigation board conducted under the provisions of Air Force Instruction 51-307, *Aerospace and Ground Accident Investigations*, that investigated the 29 November 2023 mishap in the U.S. Africa Command Area of Responsibility, involving an MQ-9A, T/N 13-4226, and operated by the 12th Expeditionary Special Operations 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
ABBREVIATED AIRCRAFT ACCIDENT INVESTIGATION

MQ-9A, T/N 13-4226
UNITED STATES AFRICA COMMAND AREA OF RESPONSIBILITY
29 NOVEMBER 2023

On 29 November 2023 at 20:09 Zulu Time (z) an unmanned MQ-9A, tail number (T/N) 13-4226, experienced an in-flight propulsion system anomaly after takeoff that resulted in the mishap crew (MC) performing a forced landing of the mishap aircraft (MA). The MA impacted the ground at an undisclosed location within the United States Africa Command (AFRICOM) Area of Responsibility (AOR) resulting in a complete loss of the MA. The MA was operated remotely by a Launch and Recovery Element (LRE) that was comprised of the mishap pilot (MP) and mishap sensor operator (MSO) deployed with the 12th Expeditionary Special Operation Squadron (ESOS) assigned to Air Force Special Operations Command (AFSOC). There was no reported damage to civilian property, no injuries, and no fatalities. The loss of government property was valued at $21,500,000.

14 seconds after takeoff, an internal mechanical failure within the Fuel Control Unit (FCU) caused a sudden decrease in fuel flow to the MA's engine which led to an immediate decrease in engine torque. The substantial loss of engine torque caused the loss of altitude and stabilization for the MA. The MA, 44 seconds after takeoff and approximately 30 seconds after initial loss of torque indication, impacted the ground several miles east of the runway. Due to the time, location, and loss of maneuverability after takeoff, the MP assessed there to be no suitable recovery element or alternate airfield within range for the MA's safe recovery resulting in the forced landing. The MA's parts were not available for further evaluation due to loss of the MA at the forced landing site.

The Abbreviated Accident Investigation Board President found, by a preponderance of the evidence, that the cause of the mishap was an undetermined mechanical failure within the FCU that caused a sudden decrease in fuel flow to the MA's engine leading to a loss of torque. Through re-creation testing, the MA manufacturer narrowed the possible origins of the mechanical failure within the FCU to two possibilities: a pressure failure in the P3 line or a torque motor failure. Despite extensive review of maintenance records, and due to the unavailability of wreckage for further analysis, the exact cause could not be established by a preponderance of the evidence.

SUMMARY OF FACTS AND STATEMENT OF OPINION
MQ-9A, T/N 13-4226
UNITED STATES AFRICA COMMAND AREA OF RESPONSIBILITY
29 November 2023

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ACRONYMS AND ABBREVIATIONS

AFI	Air Force Instruction	Maj	Major
AIB	Accident Investigation Board	MAJCOM	Major Command
ATC	Air Traffic Control	MP	Mishap Pilot
Capt	Captain	MSO	Mishap Sensor Operator
Col	Colonel	NOTAMs	Notices to Airmen
FLCS	Flight Control System	SAR	Search and Rescue
HUD	Heads-Up Display	TCTO	Time Compliance Technical Order
IAW	In Accordance With	T/N	Tail Number
LRE	Launch and Recovery Element	TOD	Technical Order Data
Lt Col	Lieutenant Colonel	Z	Zulu
MA	Mishap Aircraft		

SUMMARY OF FACTS

1. AUTHORITY AND PURPOSE

a. Authority

On 17 July 2024, the Deputy Commander, Air Combat Command (ACC), appointed Lieutenant Colonel Toby J. Miller as the Abbreviated Accident Investigation Board (AAIB) President to investigate a mishap that occurred on 29 November 2023 involving an MQ-9A aircraft in the United States Africa Command (AFRICOM) Area of Responsibility (AOR) (Tab Y-3 to Y-4). The AAIB was conducted virtually in accordance with (IAW) the ACC Supplement to Air Force Instruction (AFI) 51-307, *Aerospace and Ground Accident Investigations*, Chapter 12, from 29 July 2024 to 20 December 2024 (Tab Y-3 to Y-9). Additional 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-3).

b. Purpose

In accordance with AFI 51-307, *Aerospace and Ground Accident Investigations*, this Abbreviated Accident Investigation Board 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 29 November 2023 at 20:09z, an MQ-9A, Tail Number (T/N) 13-4226, operated by the 12th Expeditionary Special Operations Squadron (ESOS) assigned to Air Force Special Operations Command (AFSOC) in the AFRICOM Area of Responsibility (AOR) experienced loss of torque after take-off. The Mishap Aircraft (MA) consequently crashed. There was no reported damage to civilian property, no injuries, and no fatalities. The loss of government property was valued at $21,500,000.

3. BACKGROUND

a. Air Combat Command (ACC)

Headquartered at Joint Base Langley-Eustis, Virginia, ACC is one of nine major commands (MAJCOMs) in the United States Air Force (Tab CC-11). ACC is the primary provider of combat air forces to America's warfighting commanders (Tab CC-11). ACC organizes, trains, and equips Airmen who fight in and from multiple domains to control the air, space, and cyberspace (Tab CC-11). 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-11).

b. 432nd Wing (432 WG)

The 432 WG is located at Creech Air Force Base, Nevada (Tab CC-5). The 432 WG is the U.S. Air Force's first unmanned (and later remotely piloted) aircraft systems wing (Tab CC-9 to CC-10). The wing's mission is to conduct unmanned precision attack and intelligence, surveillance, and reconnaissance combat missions in support of overseas contingency operations (Tab CC-8).

c. 12th Expeditionary Special Operations Squadron

The mission of the 12th Expeditionary Special Operations Squadron is to launch and recover the MQ-9 Reaper, enabling operational employment by conventional and special operations squadrons (Tab CC-3).

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-13). 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-13). 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-13). The MQ-9A's capabilities make it uniquely qualified to conduct irregular warfare operations in support of combatant commander objectives (Tab CC-13)

4. SEQUENCE OF EVENTS

a. Mission

On 29 November 2023, the MA conducted an operational mission at an undisclosed location within the AFRICOM AOR (Tab V-1.5 to V-1.6).

b. Planning

The MC accomplished all applicable planning steps and procedures to conduct launch and recovery operations on 29 November 2023 (Tab V-1.8). There is no evidence indicating a lack of proper planning to be a factor in this mishap.

c. Preflight

The MC accomplished all applicable checklist steps and procedures correctly to prepare MA for operation (Tab R-16). No evidence indicates that preflight procedures were a factor in this mishap.

d. Summary of Accident

On 29 November 2023, while under the control of the LRE, the MA, tail number (T/N) 13-4226, experienced an in-flight propulsion system anomaly several seconds after takeoff that resulted in the MC performing a forced landing of the MA (Tab J-2). During the event, from initial indications to forced landing, engine torque decreased substantially (Tab J-4).

The MC reported that the start, taxi, and takeoff appeared normal (Tab R-16 and R-29). The MP did not make any erroneous engine commands (Tab J-11). At 20:10:00 Zulu (Z), the MP turned off the autopilot takeoff function and took manual control of the MA (Tab J-6). At 20:10:02Z, the engine torque precipitously dropped, causing an immediate loss of airspeed and ability to climb (Tab J-29). The MA Heads Up Display (HUD) began to display 'Aileron Tip Stall Override' warnings and the MP lowered the nose slightly to alleviate the stall condition (Tab J-30). The MP notified Air Traffic Control (ATC) the MA would be landing in a ditch before impacting the ground (Tab N-16). The MC did not execute any engine failure or forced landing checklists but was not required to do so given the scenario based on the governing Technical Order (T.O.) (Tab BB-65 and BB-69). The MP did acknowledge that the "trash pile" straight ahead was the safest place to attempt a forced landing (Tab R-18).

e. Impact

At the time of impact, the MP controlled the MA, rather than the automated system (Tab J-5). The MP maintained a steady descent rate (Tab J-30).

f. Egress and Aircrew Flight Equipment

Not applicable.

g. Search and Rescue

Not applicable.

h. Recovery of Remains

Not applicable.

5. MAINTENANCE

a. Forms Documentation

A review of the MA's maintenance records leading up to the mishap day revealed no relevant discrepancies, issues, overdue Time Compliance Technical Orders (TCTOs), time change items, or special inspections (Tab D-1620). Prior to takeoff, maintenance supervisors approved the aircraft for flight using a customary Exceptional Release form. (Tab D-1218).

b. Inspections

At the time of the mishap, the MA was not overdue for any inspections (Tab D-1236). All maintenance inspections on the MA were current and complied with appropriate authorities (Tab D-1236). The most recent Pre-Flight was accomplished on 29 November 2023 (Tab D-1218). A 400-hour Engine Inspection was accomplished on 13 October 2023 (Tab D-540). There is no evidence this was a factor in the mishap (Tab D-1620).

c. Maintenance Procedures

There is no evidence incorrect maintenance was a factor in the mishap (Tab D-1620).

d. Maintenance Personnel and Supervision

Records indicate normal maintenance procedures were followed and do not raise any concerns about faulty maintenance—there is no evidence this was a factor in the mishap (Tab D-1620).

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

There is no evidence to suggest fuel was a factor in the mishap (Tab D-1326 to Tab D-1331).

f. Unscheduled Maintenance

Maintenance documentation revealed no significant unscheduled maintenance was performed on the MA engine since completion of the last 400-hour Engine Inspection, accomplished on 13 October 2023 (J-31).

6. AIRFRAME, MISSILE, OR SPACE VEHICLE SYSTEMS

a. Structures and Systems

(1) Digital Electronic Engine Controller

The MQ-9A aircraft is equipped with an engine that powers a propeller (Tab J-8. This engine has a Digital Electronic Engine Controller (DEEC) (Tab J-8). When operating normally, the DEEC controls the throttle and speed functions of the engine via electrical servos (Tab J-8). The throttle servo is set in response to the pilot's throttle commands (Tab-8). It is used only to provide backup engine control in case of DEEC failure and to control propeller pitch (Tab-8). DEEC mode is the

normal engine operating mode (Tab J-8). The DEEC provides functions including engine torque and temperature limiting, engine speed switches, automatic fuel enrichment, and engine fault monitoring (Tab J-8).

(2) Fuel Control Unit

In normal propellor governing operations, the DEEC attempts to maintain a constant engine speed (Tab J-8). To maintain this constant speed, engine power must equal propeller load, which is called torque (Tab J-8). Engine power is regulated by fuel supply, while engine speed is controlled by the propeller governor (Tab J-8). To balance power and load in normal operation, the DEEC controls fuel flow via the Fuel Control Unit (FCU) and blade pitch via the propeller governor (Tab J-8). The FCU meters fuel to the engine to increase or decrease torque (Tab J-8). The DEEC modulates fuel flow through the FCU to increase engine power (Tab-8). In the FCU, fuel flow to the engine is regulated by a metering valve (Tab J-8). Engine compressor discharge air pressure (P3) is supplied to the FCU through a rigid metal line that contains a filter (Tab J-8). A leak in that metal line would reduce pressure and, consequently, fuel flow (Tab J-8).

(3) Propellor Governor

In DEEC mode, engine and propeller speed are controlled by the propeller governor (PG) (Tab J-9). A torque motor in the PG controlled by the DEEC sets the target speed based on pilot or autopilot commands (Tab J-9). The PG meters oil pressure to the propeller to change propeller blade angle, and thus propeller speed (Tab J-9). In normal operation, increased oil pressure results in the propeller blades moving toward finer pitch, and decreased oil pressure results in the propeller blades moving toward feather (Tab J-9). As fuel flow to the engine changes, the PG alters propeller pitch to maintain the commanded speed (Tab J-9).

b. Evaluation and Analysis

MA flight data showed that two seconds after the MP switched from ATLC to direct pilot control, fuel flow to the engine rapidly decreased, decreasing engine speed that eventually leveled out (Tab J-5). The reduced fuel flow initially led to an oscillation in engine speed but ultimately led to the PG decreasing propeller blade pitch to maintain commanded engine speed (Tab J-9). In these same seconds, engine torque substantially decreased to near nothing (Tab J-5). Within 20 seconds after fuel flow decrease, Exhaust Gas Temperature (EGT) too substantially decreased (Tab J-5). However, throttle command, power gauge, and engine speed command remained at full throughout the mishap sequence (Tab J-5). Throughout takeoff and loss of torque, the DEEC functioned normally, and fuel flow rate remained at the constant, substantially reduced rate and engine torque near nothing (Tab J-5). Shortly after fuel flow decrease, the MA began to descend and eventually impacted the ground.

Analysis of the MA flight data indicated that the sudden decrease in torque was caused by a sudden decrease in fuel flow to the engine (Tab J-9). The MA manufacturer's technicians reviewed engine data and surmised six potential causes for loss of fuel flow to the engine (Tab J-10 to J-11). Based on the MA's flight data, four of those potential causes were ruled out during "bench testing" performed by the MA manufacturer that re-created the mishap dynamics (Tab J-10 and J-11).

(1) A total P3 line disconnect was ruled out because a complete loss of P3 pressure would have resulted in much less fuel flow to the engine than was experienced during the mishap (Tab J-10). (2) A manual shutoff valve to the FCU did not become stuck in a restricting position because testing showed fuel flow would stop in a discreet manner, rather than substantially reduced during the mishap (Tab J-10). (3) The propeller governor was functioning properly because the commanded engine speed was maintained throughout the mishap despite actual speed dropping (Tab J-11). (4) There were no indications of erroneous engine commands since the MP's throttle position and the DEEC's power gauge input to the engine were as expected during takeoff (Tab J-11). The reduced fuel flow to the engine occurred two seconds after the switch from ATLC to manual pilot control; however, this was mere coincidence (Tab J-11).

The MA manufacturer's testing narrowed the failure within the FCU to two possibilities: a failure involving P3 pressure in the P3 line or a torque motor failure (Tab J-10). A failure in either P3 pressure or the torque motor could lead to reduced desired control pressure that leads to reduced fuel flow to the engine (Tab J-10). Reduced fuel flow to the engine results in less fuel combustion, less torque, and reduced speed (Tab J-9). No MA parts were available for further evaluation (Tab J-11).

7. WEATHER

a. Forecast Weather

The weather forecast at the LRE airfield during the takeoff and landing period was favorable (Tab F-3). The temperature for the MA flight was 81 degrees Fahrenheit (Tab F-3). There is no evidence to suggest weather was a factor in the mishap.

b. Observed Weather

There are no available in-flight reports. Ground-based observations showed favorable conditions for flight (Tab F-18).

c. Space Environment

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

d. Operations

The operations were conducted, and the MA was flown, within prescribed operational weather limitations (Tabs BB-22 and Tab F-3).

8. CREW QUALIFICATIONS

a. Mishap Pilot

The MP was current and qualified to conduct LRE duties in the MQ-9 at the time of the mishap (Tab G-3). In total, MP had 852.8 hours of pilot-in-command flight time in the MQ-9 and 92.5 hours of MQ-9 simulator time (Tab G-12). MP also had 209.2 MQ-9 instructor hours (Tab G-12).

Flight time for the months preceding the mishap was as follows (Tab G-13):

	Hours	Sorties
Last 30 days	5.6	17
Last 60 days	11	28
Last 75 days	16.9	36

b. Mishap Sensor Operator

The MSO was current and qualified to conduct LRE duties in the MQ-9 at the time of the mishap (Tab G-325). In total, MSO had 119.1 hours of primary flight time in the MQ-9 and 85.2 hours of MQ-9 simulator time (Tab G-609).

Flight time for the months preceding the mishap was as follows (Tab G-610):

	Hours	Sorties
Last 30 days	8.7	24
Last 60 days	20.6	50
Last 75 days	26.3	56

9. MEDICAL

There is no evidence that medical issues were a factor in this mishap (Tab AA-5).

a. Qualifications

All crew members were physically and medically qualified for the mission (Tab AA-5).

b. Health

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

c. Pathology

The blood and urine samples collected post flight revealed no pathological factors for the mishap (Tab G-725 to G733).

d. Lifestyle

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

e. Crew Rest and Crew Duty Time

Prior to the start of flying duties, the MP and MSO signed the 12th Expeditionary Special Operations Squadron Risk Assessment form stating each was ready to fly as defined in paragraph 3.1, AFMAN 11-202 V3, *Flight Operations* (Tabs BB-78 and K-31).

10. OPERATIONS AND SUPERVISION

a. Operations

No evidence indicates that the MC's operations tempo was a factor in the mishap (Tab AA-3).

b. Supervision

No evidence indicates that operations supervision was a factor in the mishap (Tab AA-3).

11. HUMAN FACTORS ANALYSIS

Not applicable.

12. GOVERNING DIRECTIVES AND PUBLICATIONS

a. Publicly Available Directives and Publications Relevant to the Mishap

1) AFMAN 11-202V3, *Flight Operations*, updated 10 January 2022.

2) AFMAN 11-2MQ-9V3, *MQ-9 Operations Procedures*, updated 12 Jan 2023.

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

b. Other Directives and Publications Relevant to the Mishap: Technical Order 1Q-9(M)A-1, *Flight Manual*, updated 31 March 2023.

c. Known or Suspected Deviations from Directives or Publications: There is no evidence to suggest that any directive or publication deviations were a factor in this mishap.

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31 MARCH 2025

TOBY J. MILLER, Lt Col, USAF
President, Abbreviated Accident Investigation Board

STATEMENT OF OPINION

MQ-9, T/N 13-4226
AFRICOM Area of Responsibility
29 November 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 29 November 2023 at 20:09 Zulu Time (z) an unmanned MQ-9A, tail number (T/N) 13-4226, experienced an in-flight propulsion system anomaly 14 seconds after takeoff that resulted in the mishap crew (MC) performing a forced landing of the mishap aircraft (MA). The MA impacted the ground at an undisclosed location within the United States Africa Command (AFRICOM) Area of Responsibility (AOR) resulting in a complete loss of the MA. The MA was operated remotely by a Launch and Recovery Element (LRE) that was comprised of the mishap pilot (MP) and mishap sensor operator (MSO) deployed with the 12th Expeditionary Special Operations Squadron (12 ESOS) assigned to Air Force Special Operations Command (AFSOC). There was no reported damage to civilian property, no injuries, and no fatalities. The loss of government property was valued at $21,500,000.

2. CAUSE

As the Abbreviated Accident Investigation Board President, I find, by a preponderance of the evidence, that the cause of the mishap was an undetermined mechanical failure within the Fuel Control Unit (FCU) that caused a sudden decrease in fuel flow to the MA's engine leading to a loss of torque. The substantial loss of engine torque caused the loss of both altitude and stabilization for the MA. The MA, 44 seconds after takeoff and approximately 30 seconds after initial loss of torque indication, impacted the ground. Recovery of the MA was not accomplished, and inspection of the engine post-mishap was not possible.

Through re-creation testing, the MA's manufacturer considered six potential causes, eliminating four, but was unable to determine a single root cause between a possible P3 line or torque motor failure. A failure in either P3 pressure in the P3 line or the torque motor could lead to reduced desired control pressure that leads to reduced fuel flow to the engine. Reduced fuel flow to the engine results in less fuel combustion, less torque, and reduced speed.

Without a post-mishap inspection of the MA, it was not possible for technicians or the Board to determine a specific mechanical malfunction within the MA's FCU. Despite extensive review of maintenance records, and due to the unavailability of wreckage for further analysis, the Board could not establish the exact cause for the mechanical failure within the FCU by a preponderance of the evidence.

3. CONCLUSION

I have reviewed the data logs, aircraft maintenance forms documentation, witness testimony, video evidence, and technical reports. I find, by a preponderance of the evidence, the cause of the mishap was an undetermined mechanical failure within the FCU that caused a sudden decrease in fuel flow to the MA's engine leading to a loss of torque. As the MA was not recovered, it was not possible to conduct an inspection or test of the MA's parts after the mishap. I am, therefore, not able to determine a specific cause of the mechanical failure within the MA's FCU which resulted in the catastrophic loss of torque and forced landing of the MA.

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31 MARCH 2025

TOBY J. MILLER, Lt Col, USAF
President, Abbreviated Accident Investigation Board

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