UNITED STATES AIR FORCE
ABBREVIATED AIRCRAFT ACCIDENT
INVESTIGATION BOARD REPORT

MQ-9A, T/N 18-4369

184TH ATTACK SQUADRON
188TH WING
EBBING ANGB, ARKANSAS

LOCATION: UNITED STATES AFRICA COMMAND
AREA OF RESPONSIBILITY

DATE OF ACCIDENT: 4 May 2023

BOARD PRESIDENT: LIEUTENANT COLONEL AARON R. KNIGHT

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

12 APR 2024

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 4 May 2023 mishap at an undisclosed location in the AFRICOM Area of Responsibility, involving an MQ-9A, T/N 18-4369, complies with applicable regulatory and statutory guidance, and is hereby approved.

MICHAEL G. KŌSCHESKI
Lieutenant General, USAF
Deputy Commander

EXECUTIVE SUMMARY
UNITED STATES AIR FORCE
AIRCRAFT ACCIDENT INVESTIGATION

MQ-9A, T/N 18-4369
UNITED STATES AFRICA COMMAND AREA OF RESPONSIBILITY
4 May 2023

On 4 May 2023 at 7:33 Zulu time (z) an unmanned MQ-9A, tail number (T/N) 18-4369, experienced an in-flight propulsion system anomaly approximately 9.5 hours into flight that resulted in a loss of thrust. During the anomaly, the mishap aircraft's (MA) engine exceeded maximum operating limits, and its engine was shut down by the mishap crew (MC). The MA impacted the water 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 Mission Control Element that was comprised of the mishap pilot (MP) and mishap sensor operator (MSO). There was no reported damage to civilian property, no injuries, and no fatalities. The loss of government property was valued at $21,794,224.

During the mishap flight (MF), a mechanical failure within the MA's engine resulted in abnormal contact in the engine core between the rotating and static components. This contact between the rotational and static portions of the engine resulted in the aircraft's Digital Electronic Engine Controller (DEEC) decreasing torque and then increasing fuel flow to try to maintain normal engine speed. This decrease in torque caused the MA to lose all thrust and begin an uncontrolled descent. Also, the increased fuel flow to the engine resulted in indications of an engine fire to the MC. The MP shut the MA's engine down due to the engine fire and loss of thrust. No suitable recovery element or alternate airfield was within engine-out glide range for the MA's recovery. The MC, in coordination with the Air Operations Center and Persistent Attack and Reconnaissance Operations Center, intentionally flew the MA overwater in the direction of potential recovery assets. The MA continued to descend, engine out, until impact with the water. The MA was not able to be recovered. Due to the loss of the MA, post-mishap inspection of the engine was not possible. Multiple potential mechanical failures for the internal engine abnormal contact exist, and without inspection it was not possible to determine a specific cause of the abnormal contact between the engine's rotating and static components.

The Abbreviated Accident Investigation Board President found, by a preponderance of the evidence, that the cause of the mishap was a mechanical failure within the MA's engine at a mission location that prevented the MA from returning safely to a recovery location.

SUMMARY OF FACTS AND STATEMENT OF OPINION
MQ-9A, T/N 18-4369
UNITED STATES AFRICA COMMAND AREA OF RESPONSIBILITY
4 May 2023

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ACRONYMS AND ABBREVIATIONS

184 ATKS	184th Attack Squadron
188 WG	188th Wing
432 WG	432nd Wing
AAIB	Abbreviated Accident Investigation Board
ANG	Air National Guard
BP	Board President
ACC	Air Combat Command
AFB	Air Force Base
AFI	Air Force Instruction
AFMAN	Air Force Manual
AFRICOM	United States Africa Command
ANGB	Air National Guard Base
AOC	Air Operations Center
AOR	Area of Responsibility
AR	Arkansas
Capt	Captain
CRC	Crew Chief
DEEC	Digital Electronic Engine Controller
DoD	Department of Defense
EGT	Exhaust Gas Temperature
EX	Expeditor
FCU	Fuel Control Unit
IAW	In Accordance With
LA	Legal Advisor
LNO	Liaison Officer
LRE	Launch and Recovery Element
Lt Col	Lieutenant Colonel
MA	Mishap Aircraft
MC	Mishap Crew
MCE	Mission Control Element
MF	Mishap Flight
MGCS	Mishap Ground Control Station
MP	Mishap Pilot
MSgt	Master Sergeant
MSL	Mean Sea Level
MSO	Mishap Sensor Operator
MXM	Maintenance Member
PAROC	Persistent Attack and Reconnaissance Operations Center
PM	Pilot Member
REC	Recorder
SIB	Safety Investigation Board
T/N	Tail Number
TO	Technical Order
TSgt	Technical Sergeant
USAF	United States Air Force
V	Volume
z	Zulu

SUMMARY OF FACTS

1. AUTHORITY AND PURPOSE

a. Authority

On 26 January 2024, the Deputy Commander, Air Combat Command (ACC), appointed Lieutenant Colonel Aaron R. Knight as the Abbreviated Accident Investigation Board (AAIB) President to investigate a mishap that occurred on 4 May 2023 involving an MQ-9A aircraft in the United States Africa Command (AFRICOM) Area of Responsibility (AOR) (Tab Y-2). The AAIB was conducted virtually in accordance with Air Force Instruction (AFI) 51-307, *Aerospace and Ground Accident Investigations*, Chapter 12, from 12 February 2024 to 12 March 2024 (Tab Y-2 to Y-3). Additional board members included a Captain (Capt) Legal Advisor, a Capt Pilot Member, a Master Sergeant (MSgt) Recorder, and a Technical Sergeant (TSgt) Maintenance Member (Tab Y-2).

b. Purpose

In accordance with AFI 51-307, *Aerospace and Ground Accident Investigations*, this AAIB 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. This investigation was an abbreviated accident investigation, conducted pursuant to Chapter 12 of AFI 51-307.

2. ACCIDENT SUMMARY

On 4 May 2023 at 7:33:10 Zulu time (z) an unmanned MQ-9A, tail number (T/N) 18-4369, experienced an in-flight propulsion system anomaly approximately 9.5 hours into the flight that resulted in a loss of thrust (Tab DD-11 and DD-12). During the anomaly, the mishap aircraft's (MA) engine exceeded maximum operating limits, and the engine was shut down by the mishap crew (MC) (Tab J-5). The MA impacted the water at an undisclosed location within the AFRICOM AOR resulting in a complete loss of the aircraft (Tab J-3 and J-5). The MA was operated remotely by a Mission Control Element (MCE) that was comprised of the mishap pilot (MP) and mishap sensor operator (MSO) (Tab K-11). The MCE was assigned to the 184th Attack Squadron located at Ebbing Air National Guard Base (ANGB) near Fort Smith, Arkansas (Tabs CC-2 and Q-2). The MA belonged to the 432nd Wing located at Creech Air Force Base, Nevada (Tabs CC-12 and Y-2). The MA impacted the water and was not recovered (Tab J-3 and J-5). There was no reported damage to civilian property, no injuries, and no fatalities (Tabs P-2 and Q-2). The loss of government property was valued at $21,794,224 (Tab P-2).

3. BACKGROUND

a. Air Combat Command (ACC)

ACC, headquartered at Joint Base Langley-Eustis, Virginia, is one of ten major commands (MAJCOMs) in the United States Air Force (Tab CC-13). For more than seven decades, ACC has served as the primary provider of air combat forces to America's warfighting commanders (Tab CC-13). ACC organizes, trains, and equips Airmen who fight in and from multiple domains to control the air, space, and cyberspace (Tab CC-13). 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-13).

b. Air National Guard (ANG)

The Air National Guard's federal mission is to maintain well-trained, well-equipped units available for prompt mobilization during war and provide assistance during national emergencies (such as natural disasters or civil disturbances) (Tab CC-14). During peacetime, the combat-ready units and support units are assigned to most Air Force major commands to carry out missions compatible with training, mobilization readiness, humanitarian and contingency operations (Tab CC-14). The Air National Guard provides almost half of the Air Force's tactical airlift support, combat communications functions, aeromedical evacuations and aerial refueling (Tab CC-14).

c. 432nd Wing (432 WG)

The 432 WG is located at Creech Air Force Base, Nevada (Tab CC-12). The 432 WG is the U.S. Air Force's first unmanned (and later remotely piloted) aircraft systems wing (Tab CC-12). 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-12).

d. 188th Wing (188 WG)

The Arkansas Air National Guard's 188 WG is based at Ebbing ANGB in Fort Smith, Arkansas (Tab CC-18). The ready, elite Airmen of the 188 WG provide 24/7 actionable intelligence, MQ-9 operations, agile combat support, training for joint and international partners and execute those same missions along with domestic response and expeditionary medicine at home and deployed, in support of state and national objectives (Tab CC-18).

e. 184th Attack Squadron (184 ATKS)

The 184 ATKS is assigned to the 188 WG and based at Ebbing ANGB in Fort Smith, Arkansas (Tab CC-2). The unit's Citizen Airmen operate the MQ-9A

remotely piloted aircraft providing 24/7 global combat persistence enabling state and national objectives (Tab CC-10 and CC-20).

f. MQ-9A Reaper

The MQ-9A Reaper is employed primarily as an intelligence-collection asset and secondarily against dynamic execution targets (Tab CC-21). 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-21). 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-21). The MQ-9's capabilities make it uniquely qualified to conduct irregular warfare operations in support of combatant commander objectives (Tab CC-21).

4. SEQUENCE OF EVENTS

a. Mission

On 4 May 2023, the MA conducted an operational mission at an undisclosed location within the AFRICOM AOR (Tabs K-4, V-1.1, and V-2.1).

b. Planning

The flight authorizations and paperwork for the MA and Mishap Ground Control Station (MGCS) were in order (Tabs K-2 to K-12, V-1.2, and V-2.2). The MC received all required weather and operations briefs from the Operations Supervisor prior to flight (Tabs F-2, K-9, V-1.2, and V-2.2). MC reported no anomalies with flight authorizations, paperwork, or weather, and operational briefs (Tabs V-1.2 and V-2.2).

c. Preflight

The MC, consisting of the MP and the MSO, conducted crew changeout briefings prior to assuming control of the MA (Tabs V-1.2 and V-2.2). The MC reported no anomalies passed on from previous flight crew (Tabs V-1.2 and V-2.2). The mishap flight (MF) was nominal from engine start through takeoff and climb out, with no indicated anomalies prior to mishap (Tabs J-4, V-1.2, and V-2.2).

d. Summary of Accident

On 4 May 2023, while under the control of the MCE, the MA, tail number (T/N) 18-4369, experienced an in-flight propulsion system anomaly that resulted in the MC performing a forced landing of the MA into the ocean in the AFRICOM AOR (Tabs J-3 and V-2.3). During the event, from initial indications to forced landing, engine torque decreased to 0% and oil decreased below 50% (Tab J-3). Exhaust Gas Temperature (EGT) increased above maximum operating limits and the MC shutdown the engine (Tab J-3). The MA glided, engine out, and executed a forced landing

into the ocean (Tabs J-3 and V-2.3). The MA and associated hardware were not recovered (Tab J-3).

MF data logs showed, and the MC reported, that the start, taxi, takeoff and climb-out appeared normal (Tabs J-4, V-1.2, and V-2.2). After takeoff, the MA climbed to its appropriate commanded altitude where it loitered for approximately 8.5 hours, with EGT, fuel flow, and engine torque appearing normal for operations (Tab J-4). At 7:33:10z fuel flow and EGT began to increase from previously held indications (Tab J-4). After EGT reached the upper limit of normal operating parameters, engine torque began to decrease and power gauge indications began to increase, with the Digital Electronic Engine Controller (DEEC) managing fuel flow (Tab J-4). With decreased engine torque, the MA began to descend from its commanded altitude (Tab J-4). At 7:34:13z, the DEEC returned to normal operations, engine torque sharply increased, and power gauge indications sharply decreased (Tab J-4). Approximately one second later fuel flow and engine torque began to steadily decrease, while power gauge indications began a steady increase (Tab J-4). At 7:34:31z, the oil level began to sharply decrease below 50% (Tab J-3 to J-4).

With engine torque declining and uncommanded loss of altitude, a warning alert in the MGCS began to alert the MC that the MA was not close to its assigned altitude (Tabs J-4, V-1.2, and V-2.2). The MP executed critical action procedures for loss of control and noticed decreasing torque and a red, above maximum operating limits indication for EGT (Tab V-2.2). During this time, power gauge indications immediately decreased, propeller speed began to rapidly decrease, and EGT began to rapidly increase well above maximum operating limits (Tab J-4). The MP pulled the condition lever aft to shutdown the engine in accordance with engine fire checklist procedures, then executed critical action procedures for Engine Failure (Tabs J-4, V-1.2, and V-2.2). The MSO used the MA's on-board heat-sensing camera to look at the aft section of the aircraft (Tab V-1.2). The MC observed a significant abnormal heat source from the engine area reflected on the fuel tank and smoke trailing from the propeller (Tabs J-5 and V-1.2). Following the intentional engine shutdown as a result of MC performing the Engine Fire checklist, the MA's EGT, fuel flow, and propeller speed began to rapidly decrease (Tab J-5).

Upon regaining control of the MA after engine shutdown, the MC began to coordinate with the Air Operations Center (AOC) Liaison Officer (LNO) and Persistent Attack and Reconnaissance Operations Center (PAROC) to determine a suitable landing or recovery site (Tabs J-5, V-1.3, and V-2.2). With the MA's engine shutdown, the MA had insufficient glide distance available to travel to a suitable landing or recovery site (Tabs V-1.4 and V-2.3). At the direction of the AOC LNO, the MC flew the MA toward the ocean to conduct a forced landing in the vicinity of friendly seaborne assets for attempted MA recovery (Tabs R-7, V-1.2, V-2.3, and DD-9). The MA continued to glide, engine out, until total downlink failure near the surface of the impact site (Tab J-5).

e. Impact

At the time of the impact and total downlink failure, the MP was flying the MA (Tab V-2.3). The MP maintained an average descent rate of approximately 600-700 feet per minute and a glide of

stall speed plus 5 knots (Tab DD-5 and DD-7). The MA impacted the water just after the MC lost datalink connection at 8:08z at an undisclosed location in the AFRICOM AOR (Tab DD-2 and DD-13).

f. Egress and Aircrew Flight Equipment (AFE)

Not applicable.

g. Search and Rescue (SAR)

Not applicable.

h. Recovery of Remains

Not applicable.

5. MAINTENANCE

a. Forms Documentation

An examination of maintenance records for the MGCS and MA leading up to the day of the mishap indicates no significant discrepancies or concerns with the MGCS (Tab D-34 to D-55). For the MA, there was an overdue inspection (Tabs U-3, BB-2, BB-5, BB-11). All required preflight, postflight inspections, release procedures, and Time Compliance Technical Orders were successfully conducted (Tab D-4).

b. Inspections

There were no relevant discrepancies or concerns with the MGCS (Tab D-34 to D-55). For the MA, not all required maintenance inspections were current and complied with by relevant authorities (Tab D-13). The spectrometric oil analysis check was not conducted within the specified time interval as required (Tabs U-3, BB-2, and BB-11).

c. Maintenance Procedures

Maintenance personnel conducted all maintenance procedures in accordance with all applicable Technical Orders (TO) and guidance. There is no evidence maintenance procedures were a factor in this mishap (Tab BB-2, BB-5, and BB-11).

d. Maintenance Personnel and Supervision

There is no evidence that training, qualifications, or supervision of maintenance personnel were a factor in the mishap (Tab D-4).

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

There is no evidence that fuel, hydraulic, oil, and oxygen inspection analyses were a factor in this mishap (Tab D-16, D-17).

f. Unscheduled Maintenance

There is no evidence that unscheduled maintenance was a factor in this mishap (Tab D-12, D-13).

6. AIRFRAME, MISSILE, OR SPACE VEHICLE SYSTEMS

a. Structures and Systems

The MQ-9A aircraft is equipped with a Honeywell turboprop engine (Tab BB-14). The engine is a single shaft engine (Tab BB-14). This engine has a DEEC (Tab BB-14). When operating normally, the DEEC controls the throttle and speed functions of the engine via electrical servos (Tab BB-14). There are only two electrical servos, the throttle and stop/feather servos (Tab BB-14). The throttle servo is set in response to the pilot's throttle commands (Tab BB-14). It is used only to provide backup engine control in case of DEEC failure and to control propeller pitch at settings below idle flight (Tab BB-14). DEEC mode is the normal engine operating mode (Tab BB-14). The DEEC provides functions including engine torque and temperature limiting, engine speed switches, automatic fuel enrichment, single red line EGT conditioning, closed loop power control, and engine/DEEC fault monitoring (Tab BB-14).

In normal propellor governing operations, the DEEC attempts to maintain a constant engine speed. To maintain this constant speed, engine power must equal propeller load (torque) (Tab J-6). Engine power is regulated by fuel supply, while engine speed is controlled by the propeller governor (Tab J-6). 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 (Tabs J-6 and BB-15). The DEEC modulates fuel flow through the FCU to increase engine power (Tab J-6). However, there is a temperature limiter, designed to prevent the engine from overheating (Tabs J-6 and BB-19). If EGT is sensed to be above normal operating limits, the DEEC will command the FCU to limit fuel flow (Tab J-7). At this point, the DEEC will attempt to maintain engine speed by reducing the propeller pitch (Tab J-7). The propeller governor can reduce load on the engine by decreasing blade pitch angle, which will reduce thrust and indicated torque (Tabs J-6, J-7, and BB-15).

b. Evaluation and Analysis

The MA data logs indicated that the engine torque anomaly was likely caused by abnormal rotational contact in the engine core (Tab J-7). This abnormal contact caused an increase in friction in the engine core (Tab J-7). The increase in friction caused engine speed to decrease, and the system responded normally by altering the propellor blade angle to maintain normal engine speed (Tab J-7). This resulted in a decrease in engine torque and thrust (Tab J-7). Once the propellor blade pitch was reduced to its lowest possible torque setting, and with engine speed still slowing, the DEEC attempted to maintain engine speed by increasing fuel flow (Tab J-7). This caused the EGT to rapidly increase above normal operating limits (Tab J-7). As the EGT increased, the MP diagnosed an engine fire and shut down the engine, feathering the propeller blades (Tabs J-7 and DD-3). The MSO subsequently used the MA's on-board heat-sensing camera system to look at the aft end of the aircraft confirming that abnormal heat was coming from the engine area and a smoke trail was coming from the MA (Tabs J-7 and V-1.2). With the blades feathered, oil in the propeller pitch control system was returned to the oil tank and oil level increased, until the engine stopped

turning and the oil pumps stopped (Tab J-7). Multiple potential faults may have caused the loss of engine power (DD-17). Without the MA's spectrometric oil analysis results, hardware, and engine available for inspection and testing, the cause of the initial rotational contact within the engine could not be determined (Tabs DD-17 and J-7). No historical instances of this anomaly have been reported with this engine series, including civilian operations (Tab J-7).

7. WEATHER

a. Forecast Weather

The forecasted weather for the duration of the MF was favorable (Tab F-2). The temperature for the MA flight was fair between 84 and 96 degrees Fahrenheit (Tab F-9).

b. Observed Weather

The MP observed no adverse weather near their operating area (Tab V-2.3). There is no evidence indicating that weather was a factor in this mishap.

c. Space Environment

There is no evidence indicating that space weather and the space environment were a factor in this mishap.

d. Operations

Not applicable.

8. CREW QUALIFICATIONS

a. Mishap Pilot

The MP was current and qualified to accomplish the mission in the MQ-9A, experienced with over 1200 hours in the MQ-9A, and had a supervised situational emergency procedure training ride current as of 2 May 2023 (Tab G-3, G-4, and G-16). Recent flight time is as follows (Tab G-8).

	Hours	Sorties
Last 30 days	36.8	10
Last 60 days	46.5	16
Last 90 days	69.9	26

b. Mishap Sensor Operator

The MSO was current and qualified to accomplish the mission in the MQ-9A, experienced with over 600 hours in the MQ-9A, and had a supervised situational emergency procedure training ride current as of 2 May 2023 (Tab G-20, G-21, and G-36). Recent flight time is as follows (Tab G-25).

	Hours	Sorties
Last 30 days	47.6	11
Last 60 days	68.8	18
Last 90 days	91.5	28

9. MEDICAL

a. Qualifications

All crew members were physically and medically qualified for the mission (Tab DD-37).

b. Health

There is no evidence to indicate any health factors were a factor in this mishap (Tab DD-37).

c. Pathology

There is no evidence to indicate any pathology results for the crew were a factor in this mishap (Tab DD-37).

d. Lifestyle

There is no evidence to indicate any lifestyle events were a factor in this mishap (Tab DD-37).

e. Crew Rest and Crew Duty Time

Prior to performing in-flight duties, aircrew members must have proper rest, as defined in the ACC Supplement to AFMAN 11-202, Volume (V) 3, *Flight Operations*, Chapter 3, General Flight Rules. AFMAN 11-202 V3 defines normal crew rest as a minimum of 12-hour non-duty period before the designated flight duty period begins. Crew rest is defined as free time, and includes time for meals, transportation, and the opportunity for at least 8 hours of uninterrupted sleep. MP and MSO verified they had received the proper crew rest to conduct the MF by signing the pre-flight authorization (Tab K-11).

10. OPERATIONS AND SUPERVISION

a. Operations

There is no evidence to indicate operations tempo factors were a factor in this mishap (Tabs V-1.2, V-2.2).

b. Supervision

There is no evidence to indicate operations supervision was a factor in this mishap (Tabs R-4 to R-5, V-1.2, and V-2.2 to V-2.3).

11. HUMAN FACTORS ANALYSIS

a. Introduction

The Department of Defense Human Factors Analysis and Classification System 8.0 (DoD 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 BB-22). There were no relevant factors identified by the AAIB.

12. GOVERNING DIRECTIVES AND PUBLICATIONS

a. Publicly Available Directives and Publications Relevant to the Mishap

(1) AFI 51-307, *Aerospace and Ground Accident Investigations,* 18 March 2019

(2) AFI 51-307, Air Combat Command Supplement, *Aerospace and Ground Accident Investigations,* 3 December 2019

(3) AFMAN 11-202, Volume 3, *Flight Operations,* 10 January 2022

(4) AFMAN 11-2MQ-9 Volume 1, *Aircrew Training,* 12 January 2023

(5) AFMAN 11-2MQ-9 Volume 2, *Aircrew Evaluation Criteria,* 12 January 2023

(6) AFMAN 11-2MQ-9 Volume 3, *Operations Procedures,* 12 January 2023

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

(1) T.O. 1Q-9(M)A-1, *Flight Manual USAF Series 2400 Software and Above, MQ-9A Aircraft,* 15 October 2023

(2) T.O. 1Q-9(M)A-2, *Maintenance Manual, MQ-9A Reaper, Change 79*, 14 December 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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8 April 2024

AARON R. KNIGHT, Lt Col, USAF
President, Accident Investigation Board

STATEMENT OF OPINION

MQ-9A, T/N 18-4369
UNITED STATES AFRICA COMMAND AREA OF RESPONSIBILITY
4 MAY 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 4 May 2023 at 7:33 Zulu time (z) an unmanned MQ-9A, tail number (T/N) 18-4369, experienced an in-flight propulsion system anomaly approximately 9.5 hours into flight that resulted in a loss of thrust. During the anomaly, the mishap aircraft's (MA) engine exceeded maximum operating limits, and the engine was shut down by the mishap crew. The aircraft impacted the water at an undisclosed location within the AFRICOM AOR resulting in a complete loss of the aircraft. The MA was operated remotely by a Mission Control Element (MCE) that was comprised of the mishap pilot (MP) and mishap sensor operator (MSO). The MCE was assigned to the 184th Attack Squadron located at Ebbing Air National Guard Base near Fort Smith, Arkansas. The MA belonged to the 432nd Wing located at Creech Air Force Base, Nevada. The MA impacted the water and was not recovered. There was no reported damage to civilian property, no injuries, and no fatalities. The loss of government property was valued at $21,794,224.

2. CAUSE

As the Abbreviated Accident Investigation Board President, I find, by a preponderance of the evidence, that a mechanical failure within the MA's engine resulted in abnormal contact in the engine core between the rotating and static components. This contact between the rotational and static portions of the engine resulted in the aircraft's Digital Electronic Engine Controller (DEEC) decreasing torque to try to maintain normal engine speed. This decrease in torque caused the MA to lose all thrust and begin a gradual uncontrolled descent. The DEEC was unable to maintain speed by torque reduction due to the engine's abnormal internal contact. The DEEC increased fuel flow to the engine to try to maintain normal speed, resulting in excessive engine temperature and indications of an engine fire to the MP and MSO. The MP and MSO performed applicable steps of the checklists for the excessive EGT, loss of control, and intentional engine shutdown. These actions successfully shut the MA's engine down and feathered the propellor which reduced the descent rate to 600-700 feet per minute. However, no suitable Launch and Recovery Element (LRE) or alternate airfield was within engine-out glide range for MA recovery. The MP and MSO, in coordination with the Air Operations Center and Persistent Attack and Reconnaissance Operations Center, intentionally flew the MA overwater in the direction of potential recovery assets. The MA continued to descend until impact with the water. Recovery of the MA was not accomplished, inspection of the engine post-mishap was not possible, and while multiple potential

mechanical pathways for the internal engine abnormal contact exist, without post-mishap inspection, it was not possible to determine a specific malfunction.

3. SUBSTANTIALLY CONTRIBUTING FACTORS

I find, by a preponderance of the evidence, there is insufficient evidence indicating any substantially contributing factors.

4. 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 a mechanical failure within the MA's engine at a mission location that prevented the MA from returning safely to a recovery location. As the MA was not recovered, it was not possible to conduct inspection or testing on the MA's engine after the mishap. Thus, I am not able to determine a specific cause of the abnormal contact between the engine's rotating and static components.

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8 April 2024

AARON R. KNIGHT, Lt Col, USAF
President, Accident Investigation Board

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