UNITED STATES AIR FORCE
ABBREVIATED AIRCRAFT ACCIDENT
INVESTIGATION BOARD REPORT

MQ-9A, T/N 17-4341

489th ATTACK SQUADRON
432d ATTACK WING
CREECH AIR FORCE BASE, NEVADA

LOCATION: UNITED STATES EUROPEAN COMMAND
AREA OF RESPONSIBILITY

DATE OF ACCIDENT: 14 July 2022

BOARD PRESIDENT: COLONEL DAVID J. RICE

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
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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 14 July 2022 mishap involving a MQ-9A, S/N 17-4341, operated by the 489th Attack Squadron, complies with applicable regulatory and statutory guidance, and on that basis it is approved.

RUSSELL L. MACK
Lieutenant General, USAF
Deputy Commander

EXECUTIVE SUMMARY
UNITED STATES AIR FORCE
AIRCRAFT ACCIDENT INVESTIGATION

MQ-9A, T/N 17-4341
UNITED STATES EUROPEAN COMMAND AREA OF RESPONSIBILITY
14 July 2022

On 14 July 2022, an unmanned MQ-9A, serial number (S/N) 17-4341, experienced controlled flight into terrain in the European Command Area of Responsibility. The mishap aircraft (MA) was operated in theater by the Launch and Recovery Element (LRE) comprised of the mishap pilot (MP) and the mishap sensor operator (MSO). The mishap resulted in minimal reported damage to civilian property. The mishap resulted in no injuries and no fatalities. The loss of government property was valued at $14,600,000.

The MA took off under control of the LRE and was handed off to the Mission Control Element (MCE) shortly thereafter. While under MCE control, the MA experienced two faults: one fault associated with the aircraft control network subsystem failing to transmit, which then contributed to the fault with the electrical engine control system. The MCE ran the appropriate checklists and the condition drove a "land as soon as possible" action. As a result, the MCE elected to return to base and hand the MA back to the LRE. The mishap crew (MC), comprised of the MP and MSO, gained the MA and began their troubleshooting process. The MC misdiagnosed the MA as having "stuck torque" and concluded that an engine out approach would be required to recover the MA. When the MA arrived at the initial approach point, the MP pulled the condition lever to the full AFT position. This action cut off fuel to the engine, shutting down the engine and placing the MA in the best possible glide condition. The aircraft control network failed to transmit. The Heads Down Display suggested the engine was still operating. Thinking the engine was still operational, the MC attempted a "Go Around" maneuver. The MA was unable to perform this procedure because of the loss of thrust from the previously shutdown engine. Due to lack of energy, the MA experienced controlled flight into terrain while under the control of the MP.

The Abbreviated Accident Investigation Board President found, by a preponderance of the evidence, the cause of the mishap was pilot error based on channelized attention and basic airmanship. The MP became channelized on the "stuck torque" indications, thus misdiagnosing the emergency procedure as Engine Throttle Control Failure. This incorrect diagnosis directly correlated to the MP's actions and the controlled flight into terrain during the unsuccessful attempt to recover the MA after an aborted engine out landing. Further, the AAIB Board President found, by a preponderance of the evidence that three factors substantially contributed to the mishap: (1) the MC incorrectly diagnosed the emergency procedures; (2) the MC failed to perform a controllability check; and (3) the MC's Commander should have been more involved during the incident.

SUMMARY OF FACTS AND STATEMENT OF OPINION
MQ-9A, T/N 17-4341
UNITED STATES EUROPEAN COMMAND AREA OF RESPONSIBILITY
14 July 2022

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ACRONYMS AND ABBREVIATIONS

1st Lt	First Lieutenant
15 AF	15th Air Force
432d WG	432d Attack Wing
489 ATKS	489th Attack Squadron
50 ATKS	50th Attack Squadron
ACC	Air Combat Command
AF	Air Force
AFB	Air Force Base
AFE	Aircrew Flight Equipment
AFI	Air Force Instruction
AAIB	Abbreviated Accident Investigation Board
AOR	Area of Responsibility
Capt	Captain
DoD	Department of Defense
EUCOM	European Command
GA-ASI	General Atomics Aeronautical Systems, Inc.
GCS	Ground Control Station
HDD	Heads Down Display
HUD	Heads-Up Display
ISR	Intelligence, Surveillance, and Reconnaissance
KTS	Knots
L	Local Time
LRE	Launch and Recovery Element
MA	Mishap Aircraft
MC	Mishap Crew
MCE	Mission Control Element
MGCS	Mishap Ground Control Station
MP	Mishap Pilot
MSL	Mean Sea Level
MSO	Mishap Sensor Operator
RCM	Redundant Control Module
RPA	Remotely Piloted Aircraft
RTB	Return-To-Base
SAR	Search and Rescue
SME	Subject Matter Expert
T/N	Tail Number
TO	Technical Order
TSgt	Technical Sergeant
USAF	United States Air Force
USAFE	United States European Command
U.S.C.	United States Code
Z	Zulu

SUMMARY OF FACTS

1. AUTHORITY AND PURPOSE

a. Authority

On 2 February 2023, the Deputy Commander, Air Combat Command (ACC), appointed Colonel David J. Rice as the Abbreviated Aircraft Investigation Board (AAIB) President to investigate a mishap that occurred on 14 July 2022 involving an MQ-9A aircraft in the European Command (EUCOM) Area of Responsibility (AOR) (Tab Y-1). The appointment letter was later amended on 8 February 2023 (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 15 February 2023 to 31 March 2023 (Tab Y-2) . Additional board members included a Captain (Capt) Legal Advisor, Technical Sergeant (TSgt) Recorder, First Lieutenant (1st Lt) Maintenance Member, and Captain (Capt) MQ-9 Pilot Member (Tab Y-2).

b. Purpose

In accordance with AFI 51-307, 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 14 July 2022, the mishap aircraft (MA), an MQ-9A, serial number (S/N) 17-4341, departed from an undisclosed location within the EUCOM Area of Responsibility (Tabs J-1, R-6, and V-1). Assigned to the 432d Wing (432WG), Creech AFB, Nevada, the MA was operated briefly by the 50th Attack Squadron (50 ATKS), Mission Control Element (MCE), located at Shaw AFB, South Carolina (Tabs J-1, R-6, and V-1). At the time of the mishap, the MA was operated by the 489th Attack Squadron (489 ATKS) Launch and Recovery Element (LRE), located in theater (Tabs J-1, R-6 and V-1). Shortly after handover to the MCE, the MA experienced malfunctions with the aircraft control network subsystem that contributed to a fault with the electrical engine control system, resulting in a return to base requirement due to a land as soon as possible flight condition (Tabs J-1, R-6 and V-1). The MCE elected to return aircraft control to the LRE to further troubleshoot the issues (Tabs J-1, R-6, V-1, and V-2). The mishap crew (MC), consisting of the mishap pilot (MP) and mishap sensor operator (MSO), ran the emergency checklists and had elected and planned to do an emergency engine out landing (Tabs J-1, V-3, and V-4). Upon arrival to the initial approach point, the MP pulled the condition lever to the AFT position, shutting off fuel flow to the engine and feathering the propeller (Tabs J-1, V-3, and V-4). Due to unexpected indications, the MP, believing the MA still had thrust from the engine, tried unsuccessfully to execute a "go around" (Tabs J-1, V-3, and V-4). The MA impacted an open field southeast of the

intended airfield (Tabs J-1). The loss of Government Property was valued at $14,600,000 (Tab P). There were no fatalities and minimal damage to civilian property was reported (Tab P).

3. BACKGROUND

a. Air Combat Command (ACC)

ACC is a major command of the United States Air Force (USAF) and the primary force provider of combat airpower to America's warfighting commands (Tab CC-1). ACC operates fighter, air support, reconnaissance, air battle management, and offensive/defensive cyber operations (Tab CC-1). It also provides command, control, communications, and intelligence systems, and it conducts global information operations (Tab CC-1). As a force provider and Combat Air Forces lead agent, ACC organizes, trains, equips, and maintains combat-ready forces for rapid deployment and employment while ensuring strategic air defense forces are ready to meet the challenges of peacetime air sovereignty and wartime air defense (Tab CC-1). ACC also augments forces to United States European, Indo-Pacific, Africa-based, and Strategic Commands (Tab CC-1).

b. Fifteenth Air Force (15 AF)

15 AF is responsible for ensuring the agile combat support capabilities of 13 wings and three direct reporting units, preparing Airmen for the dynamic requirements of air, space and cyberspace of the future (Tab CC-2). These units encompass about 600 aircraft and more than 47,000 active duty and civilian members (Tab CC-2). 15 AF is also responsible for the operational readiness of 16 National Guard and Air Force Reserve Units. (Tab CC-2).

c. 432d Wing (432d WG)

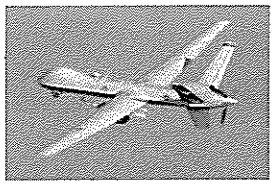
The 432d WG consists of combat-ready Airmen who fly and maintain the MQ-9 Reaper remotely piloted aircraft (RPA) in direct support of the United States total force components and combatant commanders (Tab CC- 3). 432 WG also trains aircrew, intelligence, weather, and maintenance personnel for RPA operations (Tab CC-3). The RPA systems provide real-time intelligence, surveillance, and reconnaissance (ISR), as well as precision attack against fixed and time-critical targets (Tab CC-3).

d. 489th Attack Squadron (489 ATKS)

The 489th ATKS is the only squadron in the 432nd Wing/432nd Air Expeditionary Wing whose sole mission is to deploy aircrew downrange (Tab CC-4). The squadron does this because the MQ-9 currently requires line-of-sight piloting for take-offs and landings, meaning that while most Aircrew for the MQ-9 are located stateside, a select few Airmen must be forward deployed

to enable the 24/7 mission (Tab CC-4). Mission control element (MCE) pilots and sensor operators rely on the LRE aircrew downrange to launch a Reaper, and safely land it once the mission is accomplished (Tab CC-4). This is a process the Airmen of the 489th ATKS are trained and equipped to execute daily.

e. MQ-9A Reaper



The MQ-9A Reaper is an armed, multi-mission, medium altitude, long endurance RPA employed secondarily as an intelligence collection asset and primarily against dynamic-target execution (Tab CC-5). The MQ-9A's capabilities, including its significant loiter time, wide-range sensors, multi-mode communications suite, and precision weapons, make it uniquely qualified to conduct irregular, time-sensitive warfare operations in support of combatant commander objectives (Tab CC-5). Reapers can perform the following missions and tasks: ISR, close air support, combat search and rescue, precision strike, buddy-lase, convoy/raid overwatch, route clearance, target development, and terminal air guidance (Tab CC-5).

4. SEQUENCE OF EVENTS

a. Mission

On 14 July 2022, the MA conducted an operational mission at an undisclosed location within the EUCOM AOR (Tabs J-1 and R-6).

b. Planning

The flight authorizations and paperwork for the MA and Mishap Ground Control Station (MGCS) were in order (Tab V-4). The MC received all the required weather and operations briefs prior to launch (Tab V-4).

c. Preflight

The MC, consisting of the MP and MSO, conducted all preflight requirements and determined there were no factors precluding flight (Tab AA-1). The mishap flight (MF) was nominal from engine start through takeoff, with no contributing factors to the mishap (Tab AA-1). Additionally, the MA and MGCS preflight checks were conducted without incident (Tab D-1 and D-2).

d. Summary of Accident

On 14 July 2022, an unmanned MQ-9A, serial number (S/N) 17-4341, stalled and crashed into an open field in an undisclosed location in the EUCOM AOR (Tabs J-1, R-6, and V-1). That morning, the mishap aircraft (MA) took off under control of the launch and recovery element (LRE) (Tabs J-1, R-6, and V-1). The MA was then handed off to the mission control element (MCE) without incident (Tabs J-1, R-6, and V-1). Shortly after, the MA experienced a series of faults (Tabs J-1, R-6, and V-1). The MCE responded to the heads down display (HDD) messages that were addressing faults with the aircraft control network subsystem (Tabs J-1, R-6, and V-1). This fault

subsequently contributed to a fault with the electrical engine control system (Tabs J-1). The MCE ran the applicable checklist to address the faults presented by the MA (Tabs J-1, R-6, and V-1). Upon completion of the checklists, the MCE elected to return to base and hand the MA back to the LRE for recovery (Tabs J-1, R-6, and V-1). In accordance with the emergency procedure checklist, the electrical engine control system did not reset after 10 attempts, and the MCE was directed to a "land as soon as possible" flight condition (Tab V-1). The MCE handed off the MA to the LRE (Tabs J-1, R-6, V-1, and V-2).

Upon regaining control of the MA, the MC began to diagnose the issues with the MA. The MC referenced the emergency checklists (Tabs J-1, V-3, and V-4). The MC started to run the normal procedures checklists when they decided to dump fuel to lower the weight of the MA (Tab L-1). Shortly after, the MC tried to climb in order commence the fuel dump (Tab L-1). The MC diagnosed the MA as having "stuck torque" (Tabs J-1, L-1, and V-3). The MC began to plan for an engine out approach due to stuck torque indications (Tabs L-1 and V-3). The MC ran the Engine Throttle Control Failure emergency checklist. (Tab L-3). The MC referenced multiple emergency checklists to prepare to recover the MA (Tabs L-3, L-4, and L-5).

The MP commanded the MA to descend, but while in decent, the MP did not adjust power and the MA accelerated. (Tabs J-1 and L-5). When the MP extended the landing gear, the MA did not display "down and locked" indications (Tabs V-3 and V-4). The MP and MSO referenced the checklist and concluded there was not a checklist for the "Landing gear needs servicing" message receive via the HDD (Tab J-1). The MP elected to continue with the approach and descended to initial approach point altitude (Tabs J-1, L-5, and V-3).

After receiving the landing clearance, the MP proceeded to pull the condition lever to the full AFT position (L-5, V-3, and V-4). This action cut off fuel to the engine and feathered the propeller, effectively shutting down the engine and placing the MA in the best possible glide condition (J-1). Due to the aircraft control network subsystem failure, the indication on the HDD suggested the engine was still operating (V-3 and V-4). Thinking the engine was still operational, the MC attempted a "Go Around" (Tabs J-1, V-3, and V-4). The MA was unable to perform this procedure because of the loss of thrust from the previously shutdown engine (J-1). Soon after beginning the procedure, the MP stated he was "unable to control the aircraft" (Tabs J-1, L-5, and V-3). During the procedure, the MP commanded the MA to execute an excessive nose high attitude (Tabs J-1, L-5, and V-3). However, the MA only had the energy to execute a portion of this command and slowed well below stall speed, causing it to sink towards the ground (Tabs J-1 and L-5). The MP recognized the lack of sufficient energy to safely recover the MA and elected to turn left to an unpopulated field near the location (Tabs L-6, V-3, and V-4). Shortly after the MA lost link with the MGCS and impacted the ground Southeast (SE) of the intending landing airfield (Tabs J-1, L-6, V-3, and V-4).

e. Impact

At the time of impact, the MA was being hand flown by the MP (L-6, V-3, and V-4). The MP commanded the MA to execute an excessive nose high attitude, thus inducing a stall (Tab L-6). Shortly after, the MP made a stalling left turn and identified an empty field (Tab L-6, V-3, and V-4). The MA lost link and impacted the ground at an undisclosed location in the EUCOM AOR (Tabs J-1, L-6, and V-3).

f. Egress and Aircrew Flight Equipment (AFE)

Not applicable.

g. Search and Rescue (SAR)

Not applicable.

h. Recovery of Remains

Not applicable.

5. MAINTENANCE

No evidence indicated the maintenance of the MGCS (forms documentation; inspections; maintenance procedures; maintenance personnel and supervision; or unscheduled maintenance) was a factor in the mishap (Tab D-1).

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 day revealed no relevant discrepancies or issues and showed no overdue Time Compliance Technical Orders (D-1 and D-2). All preflight inspections and release procedures were followed (Tab D-2). All preflight inspections and release procedures were followed (Tabs D-2 and AA-1).

b. Inspections

All MA maintenance inspections were current and complied with by relevant authorities (Tab D-2). The most recent Pre-Flight inspection was accomplished on 14 July 2022 (Tabs AA-1 and D-2). A 2,000-hour airframe inspection was accomplished on 8 July 2022. (Tabs AA-5 and D-2).

c. Maintenance Procedures

Maintenance personnel conducted all maintenance procedures in accordance with applicable Technical Orders (TO) and guidance (Tabs AA-1 through 5, and D-1).

d. Maintenance Personnel and Supervision

Maintenance personnel and supervision were not a factor in this mishap (Tab D-2).

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

Fuel, hydraulic, oil, and oxygen inspection analysis were determined not to be a factor in this mishap (Tabs D-2 and J-1).

f. Unscheduled Maintenance

A review of the maintenance history revealed that 4 flights prior to the mishap, the MA experienced a hard landing (Tab D-2). The MA forms indicate that all required maintenance and inspections were completed (Tab D-2). Based on this and the General Atomics Aeronautical System Inc. Report (Tab J-1), the board concluded the Hard Landing was not a factor in the mishap (Tabs AA-4, D-2, and J-1).

Maintenance documentation revealed no significant unscheduled maintenance was performed on the MA since completion of the last 2,000-hour airframe inspection accomplished on 8 July 2022 (Tabs AA-5 and D-2).

6. AIRFRAME, MISSILE, OR SPACE VEHICLE SYSTEMS

a. Structures and Systems

The Aircraft Digital Control System uses the control module and a dual aircraft control network subsystem (Tab J-1). The network subsystem consists of two redundant channels: Channel A and Channel B (Tab J-1). Once a command is initiated by the GCS, those commands are received via the control module and then routed throughout the aircraft using channel A and channel B of the subsystem concurrently (Tab J-1). After a command-completion signal is received by the subsystem, it is routed through channel A or channel B (dependent on which one was selected by aircrew) to the control module and ultimately back to the GCS where those commands are updated on the Heads-Up display (Tab J-1).

(1) Electronic Engine Control System

Engine commands (throttle lever angle, speed lever angle, commanded Exhaust Gas Temperature, etc.) are transmitted from the GCS to the control module interface processor board via the aircraft control network subsystem command signals, which are then passed along to the electric engine control system (Tab J-1). Simultaneously, duplicate signals from the GCS are sent directly to the engine so that if the control module and/or aircraft control network subsystems are not transmitting as designed, though the aircrew can still control the engine (Tab J-1). Failure to receive data from the electric engine control system causes the control module to flag the electric engine control system as failed and switch to Backup mode (Tab J-1).

In Backup mode, the electric engine control system limits engine torque and throttle to the minimum needed to maintain altitude to potentially prevent additional damage (Tab J-1). This allows enough power to return to base for troubleshooting and repairs (Tab J-1). Once the aircraft is configured for landing, full control of the engine is restored allowing the aircrew to manipulate the engine as needed for landing conditions (Tab J-1).

b. Evaluation and Analysis

The control module and data logs were sent for technical review (inspection and testing) by GA-ASI (Tab J-1). The GA-ASI report indicated the mishap control module was sent to GA-ASI for inspection and testing, and a visual inspection indicated there was no damage to the seven internal

populated circuit boards (Tab J-1). The report also showed that there was no apparent damage to the visible side of the backplane, no Foreign Object Debris (FOD), no damage to components, no smoke residue, and no corrosion (Tab J-1).

Using the mishap control module circuit boards, GA-ASI attempted to duplicate the fail as depicted by the data logs (Tab J-1). GA-ASI stated that the control module powered up properly and communicated on aircraft subsystems (Channel A and Channel B) normally, which indicated the fault was not in the control module (Tab J-1). GA-ASI conducted a short circuit simulation to the downstream done or cable (Tab J-1). This test indicated that aircraft subsystems channel B was working as advertised; however, channel A was not communicating (Tab J-1). These results were consistent with the mishap flight indications (Tab-J-1).

GA-ASI concluded that after the MCE transferred aircraft control back to the LRE, the LRE retained control of the aircraft but incorrectly analyzed the situation as a "stuck" torque, likely due to not observing a torque indication change after briefly moving the throttle to flight idle (Tab J-1). Though the torque indication did not change, the immediate decrease in airspeed indicated that the engine was functioning and responding to control inputs (Tab J-1). During the aircraft control network subsystem failure emergency procedure, the crew did not realize that the "stuck" torque indication was an indication of failure due to the aircraft subsystem transmit failure (Tab J-1). Thinking they had a stuck power lever, the crew planned to fly an overhead forced landing and shut down the engine at initial approach point (Tab J-1). During the forced landing, the crew moved the condition lever aft, shutting down the engine as planned, but because the engine indications on the HUD did not change, they did not believe the engine was shut down ("it didn't kill the engine") (Tab J-1). The pilot attempted to go-around by increasing power and turning away from the runway, but the engine was shut down (as commanded) and did not respond (Tab J-1). The pilot nearly stalled the aircraft during the turn back toward the runway, and the aircraft impacted the ground just past the departure end (Tab J-1).

7. WEATHER

a. Forecast Weather

The forecasted weather for the duration of the mishap flight was favorable (Tab F-1). Winds were forecasted to be light throughout the entire period varying from 330 degrees at 6 KTS to 200 degrees at 6 KTS (Tab F-1) with visibility of better than 7 statute miles, reported as 9999 in the weather brief. (Tab F-1). Clouds were not anticipated to be a factor, as they were forecasted FEW to SCT around 8,000' with a brief BKN ceiling between 2000Z on the mishap day and 0200Z (Tab F-1) the following day. The temperature was fair at 21-24 degrees Celsius, and there were no forecasted hazards for the mishap flight (Tab F-1).

b. Observed Weather

No significant weather was reported or observed at the time of the mishap (Tab F-1). The MP observed clear skies and indicated the weather was consistent with the forecast (Tab F-1).

c. Space Environment

The board found no evidence the space environment played a role 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 at the time of the mishap (Tabs G-10). The MP had 202 hours of MQ-9A flight time and 85.9 hours of MQ-9A simulator time around the time of the mishap (Tab G-10). Recent flight hours were as follows (Tab G-10):

	Flight Hours	Sorties
Last 30 Days	9.3	20
Last 60 Days	22.7	45
Last 90 Days	34.3	71

b. Mishap Sensor Operator

The MSO was current and qualified to accomplish the mission in the MQ-9A at the time of the mishap (Tabs G-11). The MSO had 464 hours of MQ-9A flight time and 56.2 hours of MQ-9A simulator time around the time of the mishap (Tab G-11). Recent flight hours were as follows (Tab G-11):

	Flight Hours	Sorties
Last 30 Days	9.9	23
Last 60 Days	25	48
Last 90 Days	34.2	70

9. MEDICAL

a. Qualifications

All crew members were physically and medically qualified for the mission (Tabs G-7 to G-11 and K-1).

b. Health

There was no evidence to indicate any health factors directly contributed to the mishap (Tabs G-7 to G-11 and K-1).

c. Pathology

After review of blood and urine samples collected, pathology was determined not to be a factor in the cause of the mishap (Tab DD-1).

d. Lifestyle

There is no evidence to suggest lifestyle factors were a factor in the mishap (Tabs G-7 to G-11 and DD-1).

e. Crew Rest and Crew Duty Time

Prior to the start of flying duties, the MP and MSO signed the preflight authorizations stating that each were legally ready to fly as defined in paragraph 3.1, Air Force Manual (AFMAN) 11-202 Volume 3, Flight Operations (Tab K-1).

10. OPERATIONS AND SUPERVISION

a. Operations

There was no evidence found that suggests operations tempo contributed to the mishap (Tabs K-1, G-7, G-8, G-10 and G11).

b. Supervision

There was no evidence found that suggests the Operations Supervision contributed to the mishap (Tabs K-1, G-7, G-8, G-10 and G11).

11. HUMAN FACTORS ANALYSIS

a. Introduction

The Department of Defense Human Factors Analysis and Classification System 7.0 (DoD HFACS 7.0) lists potential human factors that can play a role in aircraft mishaps and identifies potential areas of assessment during an accident investigation (Tab BB-1).

b. Relevant factors identified by the AAIB

(1) Fixation (PC102) is a factor when the individual is focusing all conscious attention on a limited number of environmental cues to the exclusion of others (Tab BB-1). The MP became channelized on torque indications throughout the mishap (Tabs J-1 and V-1). This fixation directly contributed to the mishap, as the MP did not see the expected indications upon shutting the engine down by pulling the condition lever.

(2) Checklist Not Followed Correctly (AE102) is a factor when the individual, either through an act of commission or omission, makes a checklist error or fails to run an appropriate checklist (Tab BB-1). During the mishap, the MP and MSO failed to execute critical action procedures in accordance with the engine out checklist (Tab J-1). Additionally,

the MP and MSO did not execute table 5-3 in accordance with the emergency checklist (Tab J-1). Further, with the MC concerns regarding controllability, the MC never ran the controllability checklist (Tabs V-1 to V-2).

(3) Procedure Not Followed Correctly (AE103) is a factor when a procedure is performed incorrectly or accomplished in the wrong sequence (Tab BB-1). The MP did not follow the forced landing profile or pre-emptively reference the engine out checklist (Tab V-1). The MP never got established at glide speed or on profile (Tab V-1).

(4) Wrong Choice of Action During an Operation (AE206) is a factor when the individual, through faulty logic or erroneous expectations, selects the wrong course of action (Tab BB-1). The MP and MSO never did a controllability check to verify how the MA would fly in the approach configuration (Tabs V-1 to V-2). Further, due to the MC not attempting a low/practice approach, the MC had no definitive proof that the MA was not capable of a power on landing (Tabs V-1 to V-2). This action, or lack of action, directly contributed to the engine out approach and unsuccessful recovery attempt.

(5) Supervisory/Command Oversight Inadequate (SI001) is a factor when the availability, competency, quality or timeliness of leadership, supervision or oversight does not meet task demands (Tab BB-1). Inappropriate supervisory pressures are also captured under this code (Tab BB-1). The unit commander, a current and qualified pilot who performed the MA takeoff, was requested more than once in the MGCS as a safety pilot and experienced aviator (Tabs V-1 to V-2).

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) Department of the Air Force Instruction (DAFI) 91-204, *Safety Investigations and Reports,* 10 March 2021.

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

(5) AFMAN 11-290, *Cockpit/Crew Resource Management and Threat & Error Management Program*, 25 October 2021.

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

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

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

(9) AFMAN 11-217, *Flight Operations*, 10 June 2019.

(10) AFI 21-101, Air Combat Command Supplement, *Aircraft and Equipment Maintenance Management*, 22 April 2021.

(11) Department of the Air Force Instruction 21-101, *Aircraft and Equipment Maintenance Management*, 16 January 2020.

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

(1) Department of Defense, *Human Factors Analysis and Classification System 7.0.*

(2) Air Force Pamphlet 11-238, *Aircrew Quick Reference to the METAR and TAF Codes*, 17 March 2011.

c. Known or Suspected Deviations from Directives or Publications

Though not a direct contributing factor, there is evidence to suggest there was a violation of AFMAN 11-2MQ-9v3, section 3, paragraphs 3.1.1 and 3.2.6, which state that only a qualified pilot or instructor pilot may fly the aircraft, and minimum GCS aircrew to operate the aircraft during non-critical phases of flight is a single current, qualified pilot (Tabs V-3 and V-4). During the AAIB interview of the MP, the MP stated he passed the commander outside of the GCS on the way to the facilities (Tab V-4). When asked who was flying the MA, the MP stated, "I guess autonomously, it was flying," (Tab V-4). The board determined there was no clear handover of aircraft control during the MP's brief absence. This violates the minimum crew required to operate the MQ-9.

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7 JUNE 2023

DAVID J. RICE, Colonel, USAF
President, Accident Investigation Board

STATEMENT OF OPINION

MQ-9A, T/N 17-4341
UNITED STATES EUROPEAN COMMAND AREA OF RESPONSIBILITY
14 JULY 2022

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 14 July 2022, the mishap aircraft (MA), an MQ-9A, serial number (S/N) 17-4341, departed from an undisclosed location within the European Command Area of Responsibility. Shortly after handover to the Mission Control Element (MCE), the MA experienced malfunctions with the aircraft control network subsystem, which contributed to a fault with the electrical engine control system. These indications prompted the hand back to the Launch and Recovery Element (LRE) due to a land as soon as possible flight condition.

Upon regaining control of the MA, the mishap crew (MC) at the LRE incorrectly analyzed the emergency procedure as "stuck [engine] torque." The mishap pilot (MP) determined the only way to successfully recover the MA would be to do an emergency engine out landing. Upon arrival to initial approach point, the MP pulled the condition lever to the AFT position, shutting off fuel flow to the engine and feathering the propeller, effectively shutting the engine down. The MA executed the appropriate commands, though due to the aircraft control network subsystem fault, the mishap Ground Control Station (MGCS) did not display the correct indications. The MP, believing the MA still had thrust from the engine, tried unsuccessfully to execute a "go around." The MA impacted in an open field southeast of the intended airfield.

The loss of Government Property was valued at $14,600,000. There was minimal reported damage to civilian property. There were no reported injuries or fatalities.

2. CAUSE

I find, by a preponderance of the evidence, the cause of the mishap was pilot error based on channelized attention and basic airmanship. The MP became channelized on the "stuck torque" indications, thus misdiagnosing the emergency procedure as Engine Throttle Control Failure. This incorrect diagnosis directly correlated to the MP's actions and the controlled flight into terrain during the unsuccessful attempt to recover the MA after an aborted engine out landing.

a. Channelized Attention

As a result of the electrical anomaly, the engine indications were frozen on the pilot's display, and the MC became channelized on certain indications from the MA. This channelization severely inhibited their ability to methodically work through the issues the MA presented, and it effectively distracted them from seeing that the basic flight instruments responded correctly throughout the duration of the flight. For example, the MA responded accordingly when the MP pulled the power back, and the MA decreased airspeed and altitude due to lack of thrust. Furthermore, the MP "discounted" the control authority of the throttle in the descent, where the MA accelerated) as the MC descended for the approach.

b. Airmanship

Throughout the entirety of the mishap flight (MF), the MA was in positive control and operated at an appropriate approach speed for the MP to attempt a normal landing had they chosen to do so. When the MP pulled the condition lever at initial approach point, channelized attention and poor airmanship directly contributed to the mishap. The MP never correlated the decreasing energy state was due to the complete loss of thrust from the commands to the MA. Additionally, the MP relied on "expected" indications from a HUD engine stack he had already determined to be unreliable. The MP repeatedly demanded performance from the MA that it simply could not provide with the engine intentionally shutdown. The MP induced the MA into a stalled condition eight times before the MA was out of energy and was flown into terrain.

3. SUBSTANTIALLY CONTRIBUTING FACTORS

Further, I find by a preponderance of the evidence, that each of the following factors substantially contributed to the mishap; (1) incorrect diagnosis of emergency procedure, which led the MC to the wrong solution as to how to recover the MA; (2) omission of a controllability check; and (3) Commander's lack of involvement. The MC never conducted a controllability check in the landing configuration.

a. Incorrect Diagnosis of Emergency Procedure

Upon regaining the MA from the MCE, the MC never gave due diligence to the two interrelated faults that led to the "land as soon as possible" condition. Nowhere in that checklist does it drive the MC to any of the subsequent emergency checklists they ran. At certain points, it was obvious they were running checklists less from a strategy or a defined plan perspective, but rather for any future board that might come as a result to consider in an attempt to cover all bases. This poor checklist discipline contributed to the MC perceiving there were additional issues with the MA. Further, had the MC understood the MA systems better, they should have been able to conclude the MA was flying in a nominal configuration, allowing for a normal landing with the caveats of the emergency checklist. The MC compounded the perception of their situation due to lack of sound crew resource management and judgement. Their inability to formulate a comprehensive plan in accordance with the emergency checklists contributed to the MA controlled flight into terrain.

b. Omission of a Controllability Check

The MC had concerns about the ability of the MA to perform in the landing configuration. These concerns were never addressed prior to the MP deciding to commence an engine out approach. The MC never methodically worked through the indications they were receiving from the MA. Had the MC conducted a controllability check, they would have gained a better understanding as to how the MA was going to handle in the landing configuration. The omission of this check substantially contributed to the mishap.

c. Commander's Involvement

While not directly contributing to the mishap, leadership could have potentially altered the course of events that day. The Commander, also a qualified pilot, was the responsible pilot for the takeoff under the supervision of the MP. After the takeoff, the Commander left the MGCS and was later notified of the emergency in progress. It was apparent from the evidence, however, the Commander wanted nothing to do with the events leading up to the mishap. The crew clearly wanted him in the MGCS as a safety pilot and third set of eyes and ears. However, the Commander made a rather obvious attempt to distance himself from the situation. This clearly caused frustration with the crew and did not help their crew resource management. Had the Commander stayed in the MGCS as a safety pilot longer than a few minutes, it is very likely there would have been a much more in-depth discussion on the exact nature of the emergency and the necessity to try an engine-out landing.

4. CONCLUSION

I reviewed the data logs, aircraft maintenance forms documentation, witness testimony, video evidence, photographic evidence, and technical reports. I find, by a preponderance of the evidence, the cause of the mishap was pilot error. The MP shut down the engine at initial approach point, and although this could have been avoided, once committed, the MP did not fly the engine out profile as trained.

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7 JUNE 2023

DAVID J. RICE, Colonel, USAF
President, Accident Investigation Board

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