UNITED STATES AIR FORCE
ABBREVIATED AIRCRAFT ACCIDENT INVESTIGATION BOARD REPORT

MQ-9A, T/N 10-4114
432D WING
CREECH AIR FORCE BASE, NEVADA

LOCATION: U.S. CENTRAL COMMAND AOR

DATE OF ACCIDENT: 24 NOVEMBER 2015

BOARD PRESIDENT: COL RYAN SHERWOOD

Abbreviated Accident Investigation, conducted pursuant to Chapter 11 of Air Force Instruction 51-503

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.

DEPARTMENT OF THE AIR FORCE
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24 JUN 2016

ACTION OF THE CONVENING AUTHORITY

The Report of the Accident Investigation Board, conducted under the provisions of AFI 51-503, that investigated the 24 November 2015 mishap, in the United States Central Command Area of Responsibility, involving an MQ-9A, T/N 10-4114, assigned to the 432nd Wing, Creech Air Force Base, Nevada, complies with applicable regulatory and statutory guidance; on that basis it is approved.

//Signed//

JERRY D. HARRIS, JR.
Major General, USAF
Vice Commander

EXECUTIVE SUMMARY
ABBREVIATED AIRCRAFT ACCIDENT INVESTIGATION

MQ-9A, T/N 10-4114
CENTCOM AOR
24 November 2015

On 24 November 2015, at approximately 1434 Zulu time (Z), the mishap aircraft (MA), an MQ-9A, tail number 10-4114, assigned to the 432d Wing, Creech Air Force Base (AFB), Nevada (NV) and operated by the 138th Attack Squadron (138 ATKS), 174th Attack Wing (174 AKTW), crashed while on an intelligence, surveillance, and reconnaissance (ISR) mission in the United Stated (U.S.) Central Command (CENTCOM) Area of Responsibility (AOR). MA impacted the ground and damage to U.S. government property totaled $9,931,234.00. Wreckage was not recovered. There were no fatalities, injuries or damage to civilian property.

Two different Launch and Recovery Elements (LRE) were involved in the mishap, the home station LRE and alternate LRE. The mission control element (MCE) consisted of a mishap instructor pilot (MIP), mishap pilot (MP), and mishap sensor operator (MSO). At approximately 1155Z, MCE gained control of MA from the home station LRE. At approximately 1315Z, MCE observed a "battery leaking current" warning message on the heads down display. MCE diagnosed this as a starter generator failure and began accomplishing the checklist for this situation. After conferring with the mission crew coordinator (MCC), MCE declared an emergency and requested MCC communicate with the Wing Operations Center (WOC) to coordinate a handoff with the closest alternate LRE in accordance with current guidance. Before the handover was attempted, MCE completed all emergency checklists and noted there was enough battery power to complete the handover and land the MA at the alternate, undisclosed LRE. All required aircraft information was passed on from the MCC to the alternate LRE. It is the responsibility of the gaining LRE to accomplish the required gaining checklists prior to assuming control of an aircraft based on that information. At approximately 1432Z and at 14,000 feet (ft) mean sea level (MSL), the alternate LRE established link with MA and assumed control of MA from MCE.

Immediately after the handover, MCE noticed a "beta" indication on the heads up display, meaning MA entered a reverse thrust mode. Additionally, MCE saw MA airspeed drop to 75 knots. MA quickly stalled, lost altitude, and lost link with the alternate LRE. The alternate LRE asked MCE to "take it back" and MCE then regained control of MA via satellite link and noticed that MA had lost 8,000 ft in less than one minute. MCE observed that all three Flight Control Assemblies (FCA) had failed as a result of the out of control condition. The FCAs are essential because they enable controlled flight of the aircraft. The failure of all three FCAs meant that the aircraft was not fully controllable or landable by MCE or alternate LRE. At approximately 1434Z, MIP was forced to guide the MA into the ground in an unpopulated area. The alternate LRE then stated that their detent calibrations were set wrong, meaning that they had not properly calibrated their Ground Control Station (GCS) to fly the MQ-9A.

The Abbreviated Accident Investigation (AAIB) Board President (BP) found by a preponderance of the evidence that the cause of the mishap was the failure of the alternate LRE to correctly calibrate the GCS to fly the MQ-9A aircraft. The AAIB BP found by a preponderance of the evidence that the following factor substantially contributed to the mishap: starter-generator failure resulting in the need to divert to the nearest alternate LRE location.

SUMMARY OF FACTS AND STATEMENT OF OPINION
MQ-9A, T/N 10-4114
24 November 2015

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS

1st Lt	First Lieutenant
12 AF	Twelfth Air Force
138 ATKS	138th Attack Squadron
432 WG	432nd Wing
432 EOG	432 Expeditionary Operations Group
AAIB	Abbreviated Accident Investigation Board
ACC	Air Combat Command
AEG	Air Expeditionary Group
AF	Air Force
AFCENT	Air Forces Central Command
AFB	Air Force Base
AFI	Air Force Instruction
AFSOC	Air Force Special Operations Command
AFTO	Air Force Technical Order
AGL	Above Ground Level
AIB	Accident Investigation Board
AMU	Aircraft Maintenance Unit
AMPS	Ampere
ANG	Air National Guard
AOR	Area of Responsibility
ATKW	Attack Wing
Capt	Captain
CENTCOM	Central Command
Col	Colonel
CRC	Control and Reporting Center
DoD	Department of Defense
EP	Emergency Procedures
FCA	Flight Control Assembly
FCIF	Flight Crew Information File
Flt	Flight
Ft	Feet
HFACS	Human Factors Analysis and Classification
GA-ASI	General Atomics Aeronautical Systems Incorporated
GCS	Ground Control Station
IAW	In Accordance With
IFF	Friend or Foe Identification
IMDS	Integrated Data Maintenance System
ISR	Intelligence Surveillance and Reconnaissance
KU	Satellite Frequency Band
LRE	Launch and Recovery Element
Lt	Lieutenant
Lt Col	Lieutenant Colonel
MA	Mishap Aircraft
Maj	Major
MAJCOM	Major Command
MCC	Mission Crew Commander
MCE	Mission Control Element
MIP	Mishap Instructor Pilot
MIRC	Interact Relay Chat
MP	Mishap Pilot
MSO	Mishap Sensor Operator
MSgt	Master Sergeant
MSL	Mean Sea Level
MTS	Multi-Spectral Targeting System
MQT	Mission Qualification Training
NV	Nevada
NY	New York
NYANG	New York Air National Guard
OG	Operations Group
ORM	Operational Risk Management
PA	Public Affairs
ROC	RPA Operations Cell
RPA	Remotely Piloted Aircraft
RTB	Return-To-Base
SAR	Synthetic Aperture Radar
SAS	Stability Augmentation System
SIB	Safety Investigation Board
SMIC	Senior Military Intelligence Coordinator
SrA	Senior Airman
SSgt	Staff Sergeant
T/N	Tail Number
TSgt	Technical Sergeant
U.S.	United States
USAF	United States Air Force
V	Volume
WG	Wing
WOC	Wing Operation Center
Z	Zulu

The above list was compiled from the Summary of Facts, the Statement of Opinion, the Index of Tabs, and Witness Testimony (Tab V).

SUMMARY OF FACTS

1. AUTHORITY AND PURPOSE

a. Authority

On 8 April 2016, Major General Jerry D. Harris Jr., Vice Commander, Air Combat Command (ACC), appointed Colonel (Col) Ryan C. Sherwood to conduct an Abbreviated Accident investigation Board (AAIB) to investigate a mishap that occurred on 24 November 2015 involving an MQ-9A, tail number (T/N) 10-4114, in the United States (U.S.) Central Command (CENTCOM) Area of Responsibility (AOR) (Tabs V-3.1 and Y-2 toY-3). The Convening Order also appointed a legal advisor (Captain) and a recorder (Master Sergeant) (Tabs Y-2 to Y-3). The abbreviated accident investigation was conducted in accordance with (IAW) Air Force Instruction (AFI) 51-503, *Aerospace and Ground Accident Investigations*, Chapter 11, at Nellis Air Force Base (AFB), Nevada (NV), from 10 May 2016 through 23 May 2016.

b. Purpose

In accordance with AFI 51-503, *Aerospace and Ground Accident Investigations*, this 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 24 November 2015, at approximately 1434 Zulu time (Z), the mishap aircraft (MA), an MQ-9A, tail number 10-4114, assigned to the 432d Wing (432 WG), Creech AFB, NV and operated by the 138th Attack Squadron (138 ATKS), 174th Attack Wing (174 AKTW), crashed while on an intelligence, surveillance, and reconnaissance (ISR) mission in the United Stated (U.S.) Central Command (CENTCOM) Area of Responsibility (AOR). The MA impacted the ground and damage to U.S. government property totaled $9,931,234.00. The wreckage was not recovered. There were no fatalities, injuries or damage to civilian property.

3. BACKGROUND

The MA belonged to the 432 WG, Twelfth Air Force (12 AF), ACC, stationed at Creech AFB, NV, and was operated by 138 AKTS, 174 ATKW, New York Air National Guard (NYANG), Hancock Field ANG Base in Syracuse, New York (NY) (Tabs Q-5 to Q-6 and V-1.1). The mishap instructor pilot (MIP) and mishap sensor operator (MSO) were assigned to the 138 ATKS, 174 ATKW, NYANG (Tab V-1.1). The mishap pilot (MP) was assigned to the 108 AKTS, 174 ATKW, NYANG (Tab V-2.1). At the time of the mishap, MCE controlled the MA from a Ground Control Station (GCS) owned by the 138 ATKS, 174 ATKW, NYANG (Tab V-2.1).

a. Air Combat Command

ACC is a major command of the U.S. Air Force and the primary force provider of combat airpower to America's warfighting commands (Tab CC-2). To support global implementation of national security strategy, ACC operates fighter, bomber, reconnaissance, battle-management and electronic-combat aircraft (Tab CC-2). It also provides command, control communications and intelligence systems, and conducts global information operations (Tab CC-2). As a force provider, 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-2). ACC numbered air forces provide the air component to U.S. Central, Southern and Northern Commands, with Headquarters ACC serving as the air component to Joint Forces Commands (Tab CC-2 to CC-4). ACC also augments forces to U.S. European, Pacific and Strategic Command (Tab CC-2 to CC-5).

b. Twelfth Air Force

12 AF has the warfighting responsibility for U.S. Southern Command as well as the U.S. Air Forces Southern (Tab CC-6). It is responsible for the readiness of nine active duty wings and one direct reporting unit (Tab CC-6). 12 AF's subordinate commands operate more than 600 aircraft with more than 55,000 uniformed and civilian Airmen (Tab CC-6). The command is also responsible for the operational readiness of 17 Twelfth Air Force-gained wings and other units in the Air Force Reserve and Air National Guard (Tab CC-6). As one of five numbered air forces assigned to ACC, 12 AF's mission is to enable combat-ready forces for rapid global employment; and receive, command and control, and employ joint air component assets to meet U.S. strategic objectives in the U.S. Southern Command area of responsibility, across the full spectrum of operations (Tab CC-6).

c. 432d Wing

Following a period of inactivity, the 432 WG returned to active service in May 2007 at Creech AFB, NV (Tab CC-9). The 432 WG trains and employs existing and rapidly expanding unmanned precision attack and intelligence, surveillance, and reconnaissance combat missions their in support of overseas contingency operations (Tab CC-9).

a. Air National Guard

The Air National Guard (ANG) has both federal and state missions (Tab CC-10). The federal mission is to maintain well-trained units available for prompt mobilization during war and provide assistance during national emergencies such as natural disasters or civil disturbances (Tab CC-10). When ANG units are not mobilized or under federal control, they report to the governor of their respective state, territory, or the commanding general of the District of Columbia National Guard (Tab CC-10).

b. 174th Attack Wing

The 174 ATKW is a unit of the NYANG located in Syracuse, NY adjacent to Hancock International Airport (Tab CC-13). The wing has both federal and state missions (Tab CC-13). The federal mission is to provide qualified Airmen and weapon systems engaging in global air, space, and cyberspace operations, as well as support homeland defense and joint operations (Tab CC-13). The state mission is to support civil authorities at the direction of the Governor in times of crisis (Tab CC-13). The 174 ATKW flies the state-of-the-art MQ-9 Reaper (Tab CC-13).

c. 138th Attack Squadron

The 138 ATKS is a unit of the NYANG 174 ATKW located at Hancock Field ANG Base, Syracuse, NY (Tab CC-14). On 9 September 2012, the 138th Fighter Squadron was renamed the 138 ATKS (Tab CC-14). As a component of the 174 ATKW, 138 ATKS has assisted the federal mission by conducting 24-hour, 7-day a week Combat Air Patrols with the MQ-9 Reaper in support of Operation Enduring Freedom (Tab CC-14).

d. MQ-9A Reaper

The MQ-9 Reaper is an armed, multi-mission, medium-altitude, long-endurance remotely piloted aircraft that is employed primarily as an intelligence-collection asset and secondarily against dynamic execution targets (Tab CC-16). 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-16). Reapers can also perform the following missions and tasks: intelligence, surveillance, reconnaissance, close air support, combat search and rescue, precision strike, buddy-laser, convoy/raid over watch, route clearance, target development, and terminal air guidance (Tab CC-16). The MQ-9's capabilities make it uniquely qualified to conduct irregular warfare operations in support of combatant commander objectives (Tab CC-16).

4. SEQUENCE OF EVENTS

a. Mission

The purpose of the MCE's 24 November 2015 MQ-9A mission was to conduct ISR operations in the CENTCOM AOR (Tabs V-1.1 and V-2.1). The NYANG members of MCE were on Title 10 orders and received flight orders to conduct their segment of the mission (Tabs V-1.1, V-2.1, V-3.1, and AA-2 to AA-3). The mission was authorized via the daily Air Tasking Order published by U.S. Air Forces Central Command (AFCENT) in the CENTCOM AOR. (Tab V-3.1).

b. Planning

MCE's mission planning consisted of standard mission briefing procedures and utilized briefing guides developed by their unit (Tabs V-1.1 and V-2.4). MCE's crew briefings included a brief on weather conditions, intelligence pertinent to the mission, special interest items, emergency procedures, and operational notes; the mission crew coordinator (MCC) briefed all applicable subjects for that morning's mission step brief (Tab V-1.1). This was also a Mission Qualifying Training (MQT) syllabus event for the MP in which a gaining handover and simulated attacks were planned (Tab V-1.1). MP briefed these items prior to the flight (Tab V-2.4).

c. Preflight

A pre-flight inspection of MA's maintenance records and inspections was completed and no discrepancies were noted (Tabs V-2.1 and V-2.4). MCE ran their pre-flight checklist within the Ground Control Station (GCS) and assumed control of MA from the launching LRE without incident (Tab V-2.4).

d. Summary of Accident

At approximately 1155Z, MCE gained control of MA from the home station LRE (Tab V-1.4). MCE then climbed to a transit altitude of 25,500 feet (ft) mean sea level (MSL) and began doing simulated attacks to meet the MQT requirement for MP (Tab V-2.4). At approximately 1315Z, following the first simulated weapons attack, MCE observed a "battery leaking current" warning message on the heads down display (Tab V-2.4). MCE diagnosed this as a starter generator failure and began accomplishing the checklist for this emergency by turning off power depleting systems to conserve power, and resetting the generator multiple times, which proved unsuccessful (Tabs DD-3 to DD-4, V-1.4, and V-2.4). At the same time, MCE contacted MCC to coordinate divert options with the Wing Operations Center (WOC) (Tab V-2.4). A divert option was needed because previously established WOC guidance required that MCE find a closer LRE if the aircraft experienced a starter generator failure and was greater than 45 minutes from their home station LRE (Tab V-2.1). When the starter generator failed, MA was 80 minutes from the home station LRE and only 20 minutes from an alternate LRE (Tab V-3.5). MCE declared an emergency and, together with MCC, decided to divert to the alternate LRE (Tab V-1.4). MCC called the WOC director just a few minutes after 1315Z to facilitate a handoff of MA to an alternate, undisclosed LRE as required (Tab V-1.5).

The WOC director was unavailable when MCC initially called; MCC left a message, and called again 10 minutes later (Tab V-1.5). Approximately 15 minutes later, MA was positioned at the alternate LRE still awaiting coordination from the WOC to hand the aircraft over to the alternate LRE (Tab V-1.5). Before the handover was attempted, MCE completed all emergency checklists and noted there was enough battery power to complete the handover and safely land MA at the alternate LRE location even with the starter generator failure (Tab V-1.5). At approximately 1405Z, the WOC director made contact with MCC and passed on frequencies for handover from the alternate LRE to MCC (Tab V-1.6). MCE passed on the specific aircraft information to the alternate LRE and ran the losing handover checklist (Tab V-1.6). Based on the information they received, it was the responsibility of the alternate LRE to accomplish their gaining handover checklists and ensure that the GCS was properly calibrated for MQ-9A operations (Tab V-2.2). At approximately 1432Z, the alternate LRE stated that they had established link with MA at around 14,000 ft MSL via line of sight

control with a standard terminology of "ours" typed over mIRC to MCC (Tabs V-1.6, V-2.6, and V-3.6).

MCE then immediately noticed a "beta" indication on the heads up display, meaning that MA entered a reverse thrust mode (Tab V-2.5). Additionally, MCE saw MA airspeed drop quickly to around 75 knots (Tab V-2.5). MA went into a nose low attitude and MCE noticed an audible stall warning in the headset (Tab V-2.5). MA quickly stalled and started losing altitude (Tab V-3.1 and 3.7). Soon after, the alternate LRE used mIRC to tell MCE to "take it back," but MA was already in a lost link condition due to the aircraft departure from controlled flight (Tabs V-1.2 and V-2.5). MA lost approximately 8,000 ft in under one minute while neither MCE nor alternate LRE had control (Tab V-1.6). After a short period of time, MCE was able to regain control of MA via satellite link and noticed that MA altitude was just above 6,000 ft MSL and trying to climb at 180 knots with the landing gear down (Tab V-2.6). As a result, multiple warning messages were now present on the heads down display (Tabs V-2.6 and 3.7). Most notably, MCE observed that all three Flight Control Assemblies (FCA) had failed as a result of the out of control condition (Tabs V-2.6 and 3.7). The FCAs are essential because they enable controlled flight of the aircraft; the failure of all three FCAs meant that the aircraft was not fully controllable or landable by MCE or alternate LRE (Tab V-3.7). MCC asked the MIP to swap seats with MP and suggested that he attempt a controlled crash into an unpopulated area because the MA was not recoverable (Tab V-1.2, V-1.6, and V-2.6).

The alternate LRE asked MCC via mIRC if MCE had control of MA and MCC responded that, due to controllability issues, they were going to be forced to "put it into the ground" (Tab V-1.6). The alternate LRE then responded over mIRC that "all of our detent calibrations were set wrong," meaning that the alternate LRE had not properly calibrated their GCS to fly an MQ-9A aircraft (Tabs V1.2, V-2.1, V-1.6, and V-3.8).

e. Impact

After the decision was made to crash MA away from a populated area, MIP, working with MCC, choose a suitable place to crash MA (Tab V-2.6). MIP began orientating MA to that location and tried guided MA to impact in an undisclosed location (Tabs V-1.2 and V-2.6). At approximately 1432Z, the satellite link with MA was lost and it was deemed that MA had impacted the ground (Tab V-1.2).

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

A review of the Air Force Technical Order (AFTO) 781-series forms for MA up until the day prior of the incident revealed no relevant discrepancies (Tab U-2). MA was maintained by military personnel and a maintainer assigned to MA signed the Exceptional Release on 21 November 2015 to certify MA was safe for flight through 23 November 2015 (Tab D-3).

b. Inspections

MA records indicated that prior to the mishap, the mishap starter-generator had 807.3 flight hours since install and 356.1 flight hours since last overhaul, for a total of 1163.4 hours of operation (Tab DD-5). MA's AFTO Form 781H indicated the aircraft was inspected three days prior to the mishap and cleared for subsequent missions (Tab D-3). MCE also reviewed all inspection documentation prior to assuming control of MA and no discrepancies were identified (Tab V-2.1).

c. Maintenance Procedures

All maintenance procedures were properly conducted IAW all applicable technical orders and guidance (Tabs U-2 and V-2.1).

d. Maintenance Personnel and Supervision

According to the forms review, all preflight maintenance for MA was properly performed prior to the mishap flight (Tab U-2 and V-2.1). There is no evidence that the training and qualifications of the maintenance personnel and supervision were a factor in this mishap.

e. Fuel, Hydraulic, and Oil Inspection Analyses

According to MA's AFTO Form 781H and MP's testimony, MA's fluid levels were adequate to conduct the mishap mission (Tabs D-4 and V-2.1). Due to the destruction of MA, post-mishap fluid analysis was not conducted nor provided (Tab DD-4).

f. Unscheduled Maintenance

MA did not undergo any unscheduled maintenance according to the documents available (Tab U-2).

6. AIRFRAME, MISSILE, OR SPACE VEHICLE SYSTEMS

a. Structures and Systems

Due to location of impact, no portion of the MA wreckage was returned to the manufacturer for analysis (Tabs DD-3 and DD-4).

b. Evaluation and Analysis

Starter-generator: The starter generator is the primary source of in-flight power for the MQ-9A (Tab V-1.1). In the event of generator failure, there is no alternator to recharge the batteries while in flight (Tab V-1.1). Once the generator fails, the aircraft is solely relying on the battery power, and when the battery power is depleted, the aircraft ceases to have any power to continue flight (Tab V-1.1). Analysts from the Engineering Field Support team from General Atomics Aeronautical System Incorporated (GA-ASI) analyzed the data loggers for the mishap flight (Tabs DD-3 to DD-4). The GA-ASI report noted that the data logs were normal prior to the generator failure and all electrical system parameters were normal (Tabs DD-3 and DD- 5). Approximately 26 minutes prior to the starter generator failure, Bus 1 voltage oscillations were observed with increasing variance and the generator air temperature increased significantly (Tab DD-4). Approximately 84 minutes after takeoff, the starter generator current decreased from 156 amps to 0 amps, which indicated a failure (Tab DD-4). The generator was inhibited and reset multiple times by MCE, but the generator did not come back online before it impacted the ground (Tabs DD-5 and V-2.4). The data logs indicated an abrupt starter generator failure (Tab DD-3). The starter generator serial number was GD3304 with 807.3 hours since install, 356.1 hours since last overhaul, and 1163.4 total hours (Tab DD-5).

Other MA systems: All other aircraft systems were operating normally (Tab DD-4).

GCS Analysis: Post mishap analysis of the MCE's GCS revealed the GCS was acting normally during the mishap and was deemed mission capable (Tab U-3).

Beta Engine Mode: Immediately following handover to the alternate LRE, MCE noticed the "beta" indicator was highlighted in the heads up display (Tab V-2.5). This is a mode usually used on the ground to slow the aircraft down and reverses the pitch of the propellers (Tab V-3.1). Beta indicates a reverse thrust situation (Tab V-3.1). MA immediately slowed to around 75 knots and stalled even though it was in a nose low attitude (Tab V-2.5). These parameters would be consistent with being in "beta" and indicate a reverse thrust mode (Tab V-2.5, V-3.1). Being in the "beta" mode means that the throttle could be calibrated incorrectly in one of two ways:

1. The throttle pin not being in the right location on the throttle quadrant differentiating an MQ-1 configuration from an MQ-9A, or
2. Not having the forward and aft throttle settings configured correctly in the GCS racks for the aircraft the pilot intends to fly (Tab V-2.1).

7. WEATHER

a. Forecast Weather

The forecast for the MA's operational area consisted of unlimited visibility, with no significant weather issues (Tab F-2). In addition, clouds were scattered at 25,500 ft MSL with no thunderstorms, icing, or precipitation forecast for the day (Tab F-2).

b. Observed Weather

No data available due to classification at time of incident.

c. Space Environment

Not applicable.

d. Operations

There is no evidence to suggest MA was being operated outside its prescribed operational weather limits.

8. CREW QUALIFICATIONS

a. Mishap Instructor Pilot

MIP was current and qualified on the MQ-9A at the time of the mishap (Tabs V-1.4 and G-3 to G-4). MIP had 705.4 hours of MQ-9A time and 481.6 hours of total MQ-9A instructor flying time (Tab G-7). MIP was instructor of record for the MQT upgrade sortie the MP was performing during the mishap flight (Tab V-1.4). At the time of the mishap, recent flight times were as follows (Tab G-7):

	Flt Hours	Flt Sorties
Last 30 Days	9.5	6
Last 60 Days	34.0	15
Last 90 Days	49.4	23

b. Mishap Pilot

MP was current and qualified on the MQ-9A at the time of the mishap but was going through MQT training to become qualified for combat (Tabs V-1.4 and G-16 to G-17). MP had 17.0 hours of MQ-9A simulator time, and 27.9 hours of total MQ-9A flying time (Tab G-18). At the time of the mishap, recent flight times were as follows (Tab G-19):

	Flt Hours	Flt Sorties
Last 30 Days	11.1	5
Last 60 Days	21.8	12
Last 90 Days	27.9	16

c. Mishap Sensor Operator

MSO was current and qualified on the MQ-9A at the time of the mishap (Tabs G-25 to G-26). MSO had 60.5 hours of MQ-9A simulator time and 264.7 hours of total MQ-9A flying time (Tab G-27). At the time of the mishap, recent flight times were as follows (Tab G-43):

	Flt Hours	Flt Sorties
Last 30 Days	6.9	4
Last 60 Days	13.2	8
Last 90 Days	29.2	15

9. MEDICAL

a. Qualifications

At the time of the mishap, MCE were medically qualified for flight duty and had current annual flight physical examinations on record (Tabs G-10, G-21, and G-29).

b. Health

A review of the 72-Hour and 14-Day History forms for MCE indicate they were in good health and had no duty or performance limiting conditions or illness (Tabs R-2 to R-9, R-10 to R-17, and R-18 to R-25). There is no evidence to suggest health factors were a factor in the mishap (Tabs R-8 to R-19, R-28 to R-39, and R-44 to R-55).

c. Pathology

Not applicable.

d. Lifestyle

There is no evidence to suggest lifestyle factors were a factor in the mishap (Tabs R-8 to R-19, R-28 to R-39, and R-44 to R-55).

e. Crew Rest and Crew Duty Time

Aircrew members must have proper rest, as defined in AFI 11-202, Volume (V) 3, *General Flight rules*, (ACC Supplement), dated 28 November 2012, prior to performing in-flight duties (Tab BB-3). AFI 11-202 V3 defines normal crew rest as a minimum of 12-hour non-duty period before the designated flight duty period begins, during which time an aircrew member may participate in meals, transportation, or rest (Tab BB-3). MCE met all requirements for crew rest and were within their respective crew duty days at the time of the mishap (Tab V-2.1).

10. OPERATIONS AND SUPERVISION

a. Operations

MCR indicated the operations tempo for their respective units was normal and sustainable at the time of the mishap for ISR operations (Tabs V-2.1 and V-3.1).

b. Supervision

MP was supervised by the MIP during the mission brief and throughout the tasked mission (Tabs R-4 and V-2.1). The MCC was notified and brought into the discussion after the first indication of a generator failure was noticed (Tab V-2.4). MCC then elevated the situation to the WOC director to attain immediate guidance concerning where to divert MA (Tab V-2. 4).

11. HUMAN FACTORS

Not applicable.

12. GOVERNING DIRECTIVES AND PUBLICATIONS

(a) AFI 11-202, Volume 3, *General Flight Rules (ACC Supplement)*, 28 November 2012
(b) AFI 51-503, *Aerospace Accident Investigations*, 14 April 2015
(c) AFI 91-204, *Safety Investigations and Reports,* 12 February 2014, Corrective Actions Applied on 10 April 2014

All publications listed are viewable at http://www.e-publishing.af.mil.

//Signed//

23 MAY 2015

RYAN C. SHERWOOD, Colonel, USAF
President, Abbreviated Accident Investigation Board

STATEMENT OF OPINION

MQ-9A, T/N 10-4114
CENTCOM AOR
24 NOVEMBER 2015

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 24 November 2015, at approximately 1434 Zulu time (Z), the mishap aircraft (MA), an MQ-9A, tail number 10-4114, assigned to the 432d Wing, Creech Air Force Base (AFB), Nevada (NV) and operated by the 138th Attack Squadron (138 ATKS), 174th Attack Wing (174 AKTW), crashed while on an intelligence, surveillance, and reconnaissance (ISR) mission in the United Stated (U.S.) Central Command (CENTCOM) Area of Responsibility (AOR). This mission included Mission Qualification Training (MQT) events for the Mishap Pilot (MP) in the areas of gaining handover and simulated attacks. MA impacted the ground and damage to U.S. government property totaled $9,931,234.00. Wreckage was not recovered. There were no fatalities, injuries or damage to civilian property.

Two different Launch and Recovery Elements (LRE) were involved in the mishap, the home station LRE and alternate LRE. The mission control elements (MCE) consisted of a mishap instructor pilot (MIP), MP, and mishap sensor operator (MSO). At approximately 1155Z, MCE gained control of MA from the home station LRE. MCE climbed to 25,500 feet (ft) mean sea level (MSL) and began simulated attacks to meet the MQT requirement for the MP. At approximately 1315Z, MCE observed a "battery leaking current" warning message on the heads down display. MCE diagnosed this as a starter generator failure and began accomplishing the checklist for this situation. After conferring with the mission crew coordinator (MCC), MCE declared an emergency and requested MCC communicate with the Wing Operations Center (WOC) to coordinate a handoff with an alternate LRE. An alternate LRE was needed because previously established guidance required that the MCE find a closer LRE if the aircraft experienced a starter generator failure and was greater than 45 minutes from their home station LRE. When the generator failed, the MA was 80 minutes from the home station LRE and only 20 minutes from an alternate, undisclosed LRE.

To coordinate with the alternate LRE, MCC had to work through the WOC director. The WOC director was unavailable when the MCC initially called; MCC left a message, and called again 10 minutes later. Approximately 15 minutes later, MA was positioned at the alternate LRE still awaiting coordination from the WOC to hand the aircraft over. Before the handover was attempted, MCE completed all emergency checklists and noted there was enough battery power to complete the handover and safely land MA at the alternate LRE location even with the starter generator failure. At approximately 1405Z, the WOC director made contact with MCC and passed on frequencies for handover from the alternate LRE to MCC. MCE then passed on the specific aircraft information to the alternate LRE and ran the losing handover checklist. It was the responsibility of the alternate LRE to run the gaining handover checklists and ensure that their Ground Control Station (GCS) was properly calibrated for MQ-9A operations. At approximately 1432Z and at 14,000 ft MSL, the alternate LRE established link with and control of MA.

Immediately MCE noticed a "beta" indication on the heads up display, meaning that MA entered a reverse thrust mode. Additionally, MCE saw MA airspeed drop quickly to around 75 knots. MA went into a nose low attitude and MCE noticed an audible stall warning in the headset. MA quickly stalled and started losing altitude. Soon after, the alternate LRE used Internet Relay Chat (mIRC) to tell MCE to "take it back," but MA was already in a lost link condition due to the aircraft departure from controlled flight. MA lost approximately 8,000 ft in under one minute while neither MCE nor alternate LRE had control. After a short period of time, MCE was able to regain control of MA via satellite link and noticed that the MA altitude was just above 6,000 ft MSL and trying to climb at 180 knots with the landing gear down. As a result of the aircraft departure, multiple warning messages were now present on the heads down display (Tabs V-2.6 and 3.7). Most notably, MCE observed that all three Flight Control Assemblies (FCA) had failed as a result of the out of control condition. The FCAs are essential because they enable controlled flight of the aircraft. The failure of all three FCAs meant that the aircraft was not fully controllable or landable by MCE or alternate LRE. MCC asked MIP to swap seats with MP and together they decided to attempt a controlled crash into an unpopulated area because MA was not recoverable.

The alternate LRE asked MCC via mIRC if MCE had control of MA and MCC responded that due to controllability issues they were going to be forced to "put it into the ground." The alternate LRE then responded over mIRC that "all of our detent calibrations were set wrong," meaning that the gaining LRE had not properly calibrated their GCS to fly an MQ-9 aircraft which resulted in the "beta" condition, stall, departure from controlled flight, and aircraft damage. This damage was sufficient enough to render MA unrecoverable. At approximately 1434Z, MIP guided MA into the ground.

I find by a preponderance of the evidence that the cause of the mishap was the failure of the alternate LRE to correctly calibrate the GCS to fly the MQ-9A aircraft. I find by a preponderance of the evidence that the following factor substantially contributed to the mishap: starter-generator failure resulting in the need to divert to the nearest alternate LRE.

I developed my opinion by analyzing factual data from historical records, Air Force directives and guidance, engineering analysis, witness testimony, flight data, and information provided by technical experts.

2. CAUSE

I find by a preponderance of the evidence that the cause of the mishap was the failure of the alternate LRE to correctly calibrate the GCS to fly the MQ-9A aircraft. Incorrectly calibrating the GCS would explain why MA immediately went into "beta" mode causing a stall and rapid loss of altitude along with aircraft damage highlighted by the three FCA failures witnessed by MCE. These conditions made recovery impossible even after the MCE reestablished command link and resulted in MA crash.

The AAIB was unable to interview the alternate LRE personnel. However, based on the statements from MCC and MCE, and the actual flight characteristics of MA once the alternate LRE established link, it appears that the alternate LRE GCS was not configured correctly for MQ-9A operations. This was confirmed by the statement in mIRC from the alternate LRE to MCC that "all of detent calibrations were set wrong."

Additionally, the word "beta" was clearly highlighted in the heads up display following the handoff of MA to the alternate LRE. This is a mode usually used on the ground to slow the aircraft down and

reverses the pitch of the propellers. Beta indicates a reverse thrust situation. MA immediately slowed to around 75 knots and stalled even though it was in a nose low attitude. These parameters would be consistent with being in "beta" and indicate a reverse thrust mode. Being in the "beta" mode means that the throttle could be calibrated incorrectly in one of two ways:

1. The throttle pin not being in the right location on the throttle quadrant differentiating an MQ-1 configuration from an MQ-9, or
2. Not having the forward and aft throttle settings configured correctly in the GCS racks for the aircraft the pilot intends to fly.

Either of these situations would indicate that the GCS was not configured correctly prior to taking control of MA by the alternate LRE personnel.

3. SUBSTANTIALLY CONTRIBUTING FACTORS

I find by a preponderance of the evidence that the following factor substantially contributed to the mishap: starter-generator failure resulting in the need to divert to the nearest alternate LRE.

MA experienced a starter-generator failure and MCE was forced to divert to a closer LRE to ensure there was enough battery power available to attempt a handoff and landing. MCE accomplished all required generator failure checklists and correctly flew to the alternate LRE. Before the handover was attempted, MCE noted there was enough battery power to complete the handover and safely land MA at the alternate LRE even with the starter generator failure. The failed generator by itself did not cause the aircraft to crash, because had the generator reset and provided full aircraft power while holding at the alternate LRE, the mishap would have still transpired due to the incorrect GCS configuration set by the alternate LRE, which resulted in the "beta" condition, stall, loss of aircraft control, and subsequent aircraft damage that rendered MA unrecoverable.

4. CONCLUSION

I find by a preponderance of the evidence that the cause of the mishap was the failure of the alternate LRE to correctly calibrate the GCS to fly the MQ-9A aircraft. I find by a preponderance of the evidence that the following factor substantially contributed to the mishap: starter-generator failure resulting in the need to divert to the nearest alternate LRE.

//Signed//

23 MAY 2015

RYAN C. SHERWOOD, Colonel, USAF
President, Abbreviated Accident Investigation Board

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