

UNITED STATES AIR FORCE
ABBREVIATED AIRCRAFT
ACCIDENT INVESTIGATION
BOARD REPORT



MQ-1B PREDATOR, T/N 05-3136
20TH ATTACK SQUADRON
432D WING
CREECH AIR FORCE BASE, NEVADA



LOCATION: CENTCOM AOR

DATE OF ACCIDENT: 17 OCTOBER 2015

BOARD PRESIDENT: LT COL DANIEL C. JOHNSEN

**Abbreviated Accident Investigation Conducted pursuant to
Chapter 11 of Air Force Instruction 51-503**



DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR COMBAT COMMAND
JOINT BASE LANGLEY-EUSTIS VA

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24 OCT 2016

ACTION OF THE CONVENING AUTHORITY

The Report of the Accident Investigation Board, conducted under the provisions of AFI 51-503, that investigated the 17 October 2015 mishap, in the United States Central Command Area of Responsibility, involving an MQ-1B, T/N 05-3136, 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-1B Predator, T/N 05-3136
CENTCOM AOR
17 October 2015

On 17 October 2015, at approximately 0300 hours zulu (Z), while conducting a combat support mission in the United States Central Command (CENTCOM) area of responsibility (AOR), the mishap remotely piloted aircraft (MRPA), an MQ-1B Predator aircraft, tail number 05-3136, forward deployed from the 432d Wing, Creech Air Force Base (AFB), Nevada, experienced electronic flight control component failure resulting in loss of aircraft control. The MRPA impacted the ground and was destroyed. At the time of the mishap, the MRPA was operated by a mission control element (MCE) from the 20th Attack Squadron (ATKS), Whiteman AFB, Missouri. The estimated cost of aircraft and munition damage is \$5.2 million. There were no injuries or damage to other government or private property.

While transiting to the operations area, the MP identified a layer of clouds directly ahead and above the MRPA's altitude as haze and flew the MRPA into an area of rapidly changing weather undergoing the beginning stages of thunderstorm development. Lightning was present in the vicinity of the MRPA. The MQ-1B is not equipped with lightning protection, thus the effects of lightning induced high voltage throughout the wiring in the MRPA's wings, damaging the left and right wing control modules. With these components inoperative, and still flying under the base of the developing thunderstorm, the MRPA was unable to maintain controlled flight and impacted the ground.

The Abbreviated Accident Investigation Board (AAIB) President found by a preponderance of the evidence the cause of the mishap was a direct or proximity lightning strike inducing electronic flight control module failure resulting in loss of aircraft control.

The AAIB President found by a preponderance of the evidence that a factor substantially contributing to the mishap was the Mishap Pilot's (MP) misidentification of adverse weather. The MP misidentified a layer of clouds directly ahead and above the MRPA's altitude as haze and continued flight toward the area of developing weather. As the MRPA flew under the cloud layer, the MP did not notice further indications of developing weather, such as increasing cloud cover, virga (precipitation that evaporates before reaching the ground) or lightning, and continued flight below the base of the developing thunderstorm, where the MRPA was subsequently affected by lightning.

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.

SUMMARY OF FACTS AND STATEMENT OF OPINION
MQ-1B Predator, T/N 05-3136
17 October 2015

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ACRONYMS AND ABBREVIATIONS

12 AF	12th Air Force	LR	Launch and Recovery
20 ATKS	20th Attack Squadron	LRE	Launch and Recovery Element
432 WG	432d Wing	Lt	Lieutenant
AAIB	Abbreviated Accident Investigation Board	Lt Col	Lieutenant Colonel
A/C	aircraft	Maj	Major
ACC	Air Combat Command	MCC	Mission Commander
AF	Air Force	MCE	Mission Control Element
AFB	Air Force Base	mIRC	Microsoft Internet Relay Chat
AFE	Aircrew Flight Equipment	MIC	Mission Intelligence Coordinator
AFI	Air Force Instruction	MMCC	Mishap Mission Commander
AFTO	Air Force Technical Order	MMCE	Mishap Mission Control Element
AGM	Air-to-Ground Missile	MP	Mishap Pilot
AI	Air Interdiction	MQT	Mission Qualification Training
AIB	Accident Investigation Board	MR	Mission Ready
ATKS	Attack Squadron	MRPA	Mishap Remotely Piloted Aircraft
CAP	Combat Air Patrol	MSO	Mishap Sensor Operator
Capt	Captain	MWS	Major Weapon System
CAS	Close Air Support	NCO	Noncommissioned Officer
CENTCOM	United States Central Command	nm	nautical miles
CFACC	Combined Forces Air Component Commander	OPR	Officer Performance Report
COMACC	Commander, Air Combat Command	ORM	Operational Risk Management
CSAR	Combat Search and Rescue	PCS	Permanent Change of Station
DT	Dynamic Targeting	PMATS	Predator Mission Aircrew Training System
EP	Emergency Procedures	POC	Point of Contact
EPE	Emergency Procedures Evaluation	RPA	Remotely Piloted Aircraft
EPR	Enlisted Performance Report	SA	situational awareness
FGO	Field Grade Officer	SAR	Search and Rescue
fpm	foot/feet per minute	SIB	Safety Investigation Board
ft	foot/feet	SIM/sim	simulator
GA	General Atomics	SPINS	Special Instructions
GCS	Ground Control Station	SO	Sensor Operator
KIAS	Knots Indicated Airspeed	SOC	Squadron Operations Center
IAW	in accordance with	SrA	Senior Airman
IFR	Instrument Flight Rules	SSgt	Staff Sergeant
IFS	Initial Flight Screening	T/N	Tail Number
IO	Investigating Officer	TSgt	Technical Sergeant
IOS	Intelligence Operations Supervisor	TV	Television
IP	Instructor Pilot	TX	transition
IPUP	Instructor Pilot Upgrade	UPT	Undergraduate Pilot Training
IR	infrared	USAF	United States Air Force
ISB	Interim Safety Board	VFR	Visual Flight Rules
ISR	Intelligence, Surveillance, Reconnaissance	VVI	Vertical Velocity Indicator
JTAC	Joint Terminal Attack Controller	WG	Wing
KIAS	knots indicated airspeed	WOC	Wing Operations Center
L	local time	Z	Zulu

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

SUMMARY OF FACTS

1. AUTHORITY AND PURPOSE

a. Authority

On 2 June 2016, Major General Jerry D. Harris, Jr., Vice Commander, Air Combat Command, appointed Lieutenant Colonel Daniel C. Johnsen as the Abbreviated Accident Investigation Board (AAIB) President to investigate the 17 October 2015 accident involving an MQ-1B Predator aircraft, tail number 05-3136 (Tab Y-3 to Y-4). An AAIB was conducted at Whiteman Air Force Base (AFB), Missouri, from 11 July 2016 to 28 July 2016, in accordance with Air Force Instruction (AFI) 51-503, *Aerospace Accident Investigations*, Chapter 11 (Tab Y-3 to Y-4). A legal advisor and a recorder were also appointed to the AAIB (Tab Y-3 to Y-4).

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 17 October 2015, at approximately 0300 hours zulu (Z), while conducting a combat support mission in the United States Central Command (CENTCOM) area of responsibility (AOR), the mishap remotely piloted aircraft (MRPA), an MQ-1B Predator aircraft, tail number 05-3136, forward deployed from the 432d Wing, Creech Air Force Base (AFB), Nevada, experienced electronic flight control component failure resulting in loss of aircraft control (Tabs Q-5 and DD-4). The MRPA impacted the ground and was destroyed (Tabs Q-5 and DD-4).

At the time of the mishap, the MRPA was operated by a mission control element (MCE) from the 20th Attack Squadron (ATKS), Whiteman AFB, Missouri (Tab K-2). The estimated cost of aircraft and munition damage is \$5.2 million (Tab P-4). There were no injuries or damage to other government or private property (Tab P-2 to P-3).

3. BACKGROUND

a. Units and Organization

(1) Air Combat Command (ACC)

To support global implementation of national security strategy, ACC operates fighter, bomber, reconnaissance, battle-management and electronic-combat aircraft (CC-3). It also provides command, control, communications and intelligence systems, and conducts global information operations (CC-3). 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 (CC-3). Additionally, ACC develops strategy, doctrine, concepts, tactics, and procedures for air and space-power employment (CC-3). The command provides conventional and information warfare forces to all unified commands to ensure air, space and information superiority for warfighters and national decision-makers (CC-3). The command can also be called upon to assist national agencies with intelligence, surveillance and crisis response capabilities (CC-3). 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 (CC-3). ACC also augments forces to United States European, Pacific, Africa-based and Strategic Commands (CC-3).



(2) 12th Air Force (12 AF)

Twelfth Air Force, or Air Forces Southern, headquartered at Davis-Monthan AFB, Arizona, controls ACC's conventional fighter and bomber forces based in the western United States and also serves as the air component for United States Southern Command (Tab CC-5). In its numbered air force role, Twelfth Air Force is responsible for the combat readiness of ten active-duty wings and one direct reporting unit (Tab CC-5). These subordinate commands operate more than 800 aircraft with more than 64,000 uniformed and civilian Airmen (Tab CC-5). The command is also responsible for the operational readiness of gained wings and other units of the Air Force Reserve and Air National Guard (Tab CC-5).



(3) 432d Wing (432 WG)

The 432 WG "Hunters" consists of combat-ready Airmen who fly remotely piloted aircraft (RPA) in direct support of the joint warfighter (Tab CC-12). The Hunters conduct RPA training for aircrew, intelligence, weather, and maintenance personnel (Tab CC-12). The 432 WG flies and maintains the MQ-1B Predator and MQ-9 Reaper RPAs to support the United States and coalition war-fighters (Tab CC-12).



(4) 20th Attack Squadron (20 ATKS)

The 20 ATKS provides persistent intelligence, surveillance and reconnaissance and full motion video for real-time actionable intelligence and precision weapons employment in combat operations, using unmanned aircraft (Tab CC-12 to CC-15).



b. Aircraft: MQ-1B Predator

The MQ-1B Predator is an armed, multi-mission, medium-altitude, long-endurance RPA that is employed primarily as an intelligence-collection asset and secondarily against dynamic execution targets (Tab CC-17). 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-17). Predators can also perform the following missions and tasks: intelligence, surveillance, and reconnaissance (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-17). The MQ-1B's capabilities make it uniquely qualified to conduct irregular warfare operations in support of combatant commander objectives (Tab CC-17).

The Predator carries the Multi-Spectral Targeting System (MTS), which integrates an infrared sensor, color/monochrome daylight TV camera, image-intensified TV camera, laser designator and laser illuminator (Tab CC-17). The full-motion video from each of the imaging sensors can be viewed as separate video streams or fused (Tab CC-17). The aircraft can employ two laser-guided AGM-114 Hellfire missiles that possess high accuracy, low-collateral damage anti-armor/anti-personnel engagement capabilities (Tab CC-17).

The aircraft is employed from a ground control station (GCS) via a line-of-sight data link or a satellite data link for beyond line-of-sight operations (Tab CC-17). The basic crew for the Predator is a rated pilot to control the aircraft and command the mission and an enlisted aircrew member to operate sensors and weapons inside the GCS. In the Squadron Operations Center (SOC), a mission commander (MCC) provides supervision for daily missions and multiple mission intelligence coordinators (MIC) update intelligence and target information (Tab V-4.1).



Figure 1. Inside the GCS

In addition to a pilot and sensor operator (SO) in each GCS, there is a break pilot and SO available to relieve crewmembers for physiological or other needs that require exiting the GCS (Tab V-1.1 to V-1.2). During non-critical phases of flight, such as transiting to the operations area, and with the pilot's permission, the SO and MIC may leave their stations without replacement so long as they are available for immediate recall within the 20 ATKS complex (Tabs V-1.1 and V-2.1).

4. SEQUENCE OF EVENTS

a. Mission

On 17 October 2015, the MRPA was authorized by an Air Tasking Order to conduct a combat support mission in the CENTCOM AOR (Tabs A-2, S-4, and V-5.1).

b. Planning

On 16 October 2015, at 2020Z, the Mishap MCE (MMCE) consisting of the Mishap Pilot (MP) and Mishap Sensor Operator (MSO) attended a mission brief at the 20 ATKS SOC (Tabs R-5, R-15, and V-1.1). The briefing was standard with no risk factors noted (Tabs V-1.1 and V-4.1). Weather slides updated at 2000Z and briefed at 2020Z indicated favorable current weather conditions and did not forecast any significant weather for the MRPA's operations area (Tabs W-3, V-1.2, and V-4.1).

c. Preflight

Preflight checks and launch were conducted by a Launch and Recovery Element (LRE) with no maintenance discrepancies (Tab D-3 to D-6).

d. Summary of Accident

The MSO and the break pilot gained control of the MRPA from the LRE at approximately 0020Z (Tab DD-4). At approximately 0100Z, the MP entered the GCS and assumed control from the break pilot during the MRPA's climb to altitude and transit to the operations area (Tabs R-5, V-1.1, and V-5.1). Upon reaching transit altitude, the MSO refreshed the weather slides issued by the Wing Operations Center (WOC) located at Creech AFB, Nevada (Tab V-1.2). These slides had not changed since the briefing and indicated clear weather for the route of flight and operations area (Tabs W-3 and V-1.2). The MSO also performed a weather sweep with the MTS, leveling the camera with the horizon and rotating 360 degrees to view the MRPA's surroundings (Tab V-1.1). The MTS weather sweep did not display adverse weather in the area (Tab V-1.2). Comfortable with the weather situation and the MRPA's sensors, the MSO locked the MTS camera to the forward position, level relative to the aircraft's horizontal axis (Tab V-1.2).

The MSO received permission from the MP to take a break and leave the GCS to eat and prepare an instructional scenario for the next day's sortie (Tabs V-1.2 and V-5.1). The MP continued to fly the MRPA to the operations area alone in the GCS (Tabs V-5.1 and Z-3). At approximately 0215Z the MTS displayed a layer of scattered clouds on the horizon directly ahead and above the MRPA's altitude (Tab Z-3). The MP identified this layer of clouds as haze (Tab V-5.1 to V-5.2). The MRPA continued flying toward the area of clouds (Tab Z-3). At 0250Z, a small area of virga, precipitation that evaporates before reaching the ground, appeared on the MTS display directly in front of the MRPA (Tabs Z-3 and DD-4). At 0254Z, the MRPA flew through this area of virga and encountered turbulence and downdrafts (Tab Z-3). The MRPA lost 200 feet (ft) of altitude and regained assigned altitude over a period of 45 seconds (Tab Z-3). At approximately 0257Z, the MTS recorded a single lightning discharge ahead of the MRPA (Tab Z-3). The MRPA lost satellite link at 0300Z (Tabs S-4, V-1.2, Z-3, and DD-6).

The MP recalled the MSO to the GCS (Tabs V-1.2 and V-5.2). The MTS displayed an indiscernible gray image with a “NO DATA” warning (Tabs S-4, Z-3, and V-1.2). Additionally, other instruments indicated abnormal voltage readings (Tab V-1.2). Suspecting a lightning strike, the MCE pulled lightning strike data from the WOC web page (Tabs W-3, V-1.2, and V-2.1). The lightning strike data displayed an isolated group of recent cloud-to-ground lightning strikes in the area where the MRPA was operating at the time of the mishap (Tabs W-3, V-1.2, and V-2.1).

The MCE contacted the LRE after waiting to see if the MRPA was able to complete its preprogrammed emergency return (Tab V-1.2). The Mishap Mission Commander (MMCC) contacted other agencies in the AOR to determine if the MRPA was still airborne (Tab V-4.1). All inquiries resulted in negative contact with the MRPA (Tabs V-1.2 and V-4.1).

e. Impact

At 0300Z, satellite link was lost (Tabs S-4, Z-3, and DD-6). The MRPA impacted the ground sometime thereafter on 17 October 2015 (Tabs Q-5 and DD-7).

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 MRPA’s maintenance documentation, recorded in the Air Force Technical Order (AFTO) 781 series revealed no relevant discrepancies (Tab D-2 to D-14). AFTO Form 781H for 16 October 2015 revealed total MRPA airframe time of 9,696.6 hours (Tab D-6).

b. Inspections

All maintenance inspections were complied with (Tab D-3 to D-6).

c. Maintenance Procedures

Preflight inspections, servicing operations, and launch procedures were accomplished without incident (Tab D-3 to D-6).

d. Maintenance Personnel and Supervision

All preflight servicing and maintenance was correctly documented by properly trained, qualified, and supervised military and civilian maintenance personnel (Tab D-2 to D-14).

e. Fuel, Hydraulic, and Oil Inspection Analyses

Maintenance documentation shows proper servicing and correct levels of fluids in the aircraft at takeoff (Tab D-2). Post-accident fluid samples were not obtained from the MRPA (Tab D-2).

f. Unscheduled Maintenance

Maintenance documentation revealed no unscheduled maintenance (Tab D-3 to D-5).

6. AIRFRAME, MISSILE, OR SPACE VEHICLE SYSTEMS

a. Structures and Systems

The MRPA wreckage was recovered from the crash site and reviewed (Tab DD-7). The Primary Control module (PCM), Left Wing Control Module (LWCM), and Right Wing Control Module (RWCM) were sent to General Atomics (GA), the MQ-1B manufacturer, for analysis (Tab DD-7).

b. Evaluation and Analysis

The MQ-1B is not equipped with lightning protection (Tab BB-13). The aircraft is commanded by satellite link and controlled by electronic flight control modules, motors and servos (Tabs CC-17 and DD-4 to DD-9). A direct lightning strike can cause serious damage or destroy the aircraft and a close lightning discharge can disable these electronics and interrupt the satellite link (Tab DD-15). Damaged electronic components or wiring in the aircraft degrades its ability to maintain controlled flight (Tab DD-4 to DD-9).

GA analysis of the integrated circuits in the LWCM and RWCM revealed damage consistent with a lightning strike inducing high voltage through the electrical cables in the wings (Tab DD-7). Both the LWCM and RWCM passed functional tests when the integrated circuits were removed and replaced (Tab DD-7).

GA also analyzed data logs, which indicated the MRPA entered turbulence several minutes prior to the mishap sequence (Tabs DD-3 to DD-4, and DD-8). Electronic component damage and failure modes caused by lightning are not easily predictable; however, the indications revealed in the data logs are similar to previous confirmed lightning strikes (Tab DD-9).

7. WEATHER

a. Forecast Weather

Weather slides updated at 2000Z and briefed at 2020Z indicated favorable current weather conditions and did not forecast any significant weather for the MRPA mishap area (Tabs W-3, V-1.2, V-4.1, and V-5.1).

b. Observed Weather

Lightning strike data for 0310Z indicated a tight group of multiple recent cloud-to-ground lightning strikes isolated to a small area where the MRPA mishap occurred (Tabs W-3, V-1.2, V-2.1, and V-4.1).

The WOC did not update weather until 0400Z (Tab W-3). In this update, current conditions for the MRPA's operating area indicated a large area of weather labeled "Degraded RPA Operations" with a smaller embedded area of adverse weather labeled "Recommend No-Fly" (Tab W-3). Conditions for the MRPA mishap location were scattered clouds at altitudes of 25,000-30,000ft, broken cumulonimbus clouds at an altitude of 12,000-35,000ft with isolated thunderstorms, rain showers and virga (Tab W-3).

Virga is visible wisps or strands of precipitation falling from clouds that evaporate before reaching the surface (Tab BB-8). Virga is a common occurrence in the hot, dry, and unstable continental tropical air masses that form over desert or high plateau regions found in the CENTCOM AOR (Tab BB-5). When precipitation forms, it tends to fall from high-based thunderstorms as virga or intense rain showers (Tab BB-5 to BB-6). The evaporation process that creates virga cools the air (Tab BB-6 to BB-7). This cooler, denser air sinks, creating a downdraft (Tab BB-6).

c. Operations

MQ-1B crews must limit aircraft exposure to turbulence to the maximum extent practical and not operate the aircraft within 25 nautical miles (nm) of known thunderstorm activity (Tab BB-3 to BB-4). The MRPA was operating in an area of rapidly changing weather conditions within 25nm of a developing thunderstorm (Tabs W-3 and Z-3). However, there is no evidence to suggest the MRPA was intentionally operated outside of its prescribed operational weather limits.

8. CREW QUALIFICATIONS

a. Mishap Pilot

The MP was current and had been qualified in the MQ-1B since 26 April 2015 (Tab G-3). The MP had a total flight time of 396.9 hours in the MQ-1B (Tab G-4). The MP's flight time during the 90 days before the mishap was as follows (Tab G-4):

	Hours	Sorties
Last 30 Days	60.6	11
Last 60 Days	165.5	30
Last 90 Days	263.2	47

b. Mishap Sensor Operator

The MSO was current and had been qualified in the MQ-1B since 1 November 2012 (Tab G-10). The MSO had a total flight time of 1,758.8 hours in the MQ-1B (Tab G-11). The MSO’s flight time during the 90 days before the mishap was as follows (Tab G-11):

	Hours	Sorties
Last 30 Days	38.3	17
Last 60 Days	41.7	19
Last 90 Days	49.9	45

9. MEDICAL

a. Qualifications

At the time of the mishap, MMCE crewmembers were fully medically qualified for flight duty (Tab K-2).

b. Health

There is no evidence to suggest the health of MMCE crewmembers contributed to the mishap.

c. Toxicology

The medical clinic at Whiteman AFB, Missouri, collected blood and urine samples from the MMCE after the mishap (Tab T-3 to T-4). All toxicology testing resulted in negative findings (Tab T-3 to T-4).

d. Lifestyle

There is no evidence to suggest lifestyle factors were a factor in the mishap (Tab R-4 to R-11, and R-14 to R-22).

e. Crew Rest and Crew Duty Time

Aircrew members are required to have proper crew rest prior to performing in-flight duties, defined as a minimum of 12-hours non-duty time before the designated flight duty period begins (Tab BB-9). The MCE met crew rest requirements (Tabs R-4 and R-14). There is no evidence to suggest crew rest and crew duty time were factors in the mishap.

10. OPERATIONS AND SUPERVISION

a. Operations

The 20 ATKS operates MQ-1Bs around-the-clock, with crews working eight-hour shifts in six-day scheduled blocks (Tab V-1.1). Additional duties, such as squadron administration, instructor preparation, or other non-mission related duties are accomplished during crew breaks or post-shift (Tab V-1.1). Manning levels in the 20 ATKS are not sufficient to conduct flight operations and afford personnel non-flying duty days for the purpose of accomplishing these tasks (Tab V-1.1).

b. Supervision

The MMCC in the SOC was providing general oversight to the MMCE and three other MCEs during the mishap (Tab V-4.1). There is no evidence to suggest that mission oversight was a factor in the mishap.

11. HUMAN FACTORS

There is no evidence to suggest human factors were a factor in the mishap.

12. GOVERNING DIRECTIVES AND PUBLICATIONS

a. Publically Available Directives and Publications Relevant to the Mishap

- (1) AFI 51-503, *Aerospace Accident Investigations*, 14 April 2015
- (2) AFI 51-503, *Aerospace Accident Investigations, Air Combat Command Supplement*, 28 January 2016
- (3) AFI 91-204, *Safety Investigations and Reports*, 12 February 2014
- (4) AFI 11-2MQ-1&9, Volume 3, *MQ-1 and MQ-9 Operations Procedures*, 1 November 2012, Incorporating Change 1, 28 August 2015
- (5) AFH 11-203, Volume 1, *Flying Operations – Weather for Aircrews*, 12 January 2012
- (6) AFI 11-202, Volume 3, *General Flight Rules*, 7 November 2014

NOTICE: All publications are available digitally on the Air Force Departmental Publishing Office website at: <http://www.e-publishing.af.mil>.

b. Other Directives and Publications Relevant to the Mishap

- (1) Technical Order (T.O.) 1Q-1(M)B-1, *Flight Manual, USAF Series, MQ-1B System*, 20 March 2015, Change 1, 18 August 2015
- (2) Air Force Tactics, Techniques and Procedures 3-3.MQ-1, *Combat Aircraft Fundamentals MQ-1*, 7 February 2014
- (3) *20th Reconnaissance Squadron Standards*, 1 October 2013

c. Known or Suspected Deviations from Directives or Publications

The MP unintentionally deviated from AFI 11-2MQ-1&9, Volume 3, *MQ-1 and MQ-9 Operations Procedures*, paragraph 4.3.5, by flying the MRPA within 25nm of a thunderstorm (Tabs Z-3 and BB-4).

//Signed//

28 July 2016

DANIEL C. JOHNSON, Lt Col, USAF
President, Abbreviated Accident Investigation Board

STATEMENT OF OPINION

**MQ-1B Predator, T/N 05-3136
CENTCOM AOR
17 October 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 17 October 2015, at approximately 0300 hours zulu (Z), while conducting a combat support mission in the United States Central Command (CENTCOM) area of responsibility (AOR), the mishap remotely piloted aircraft (MRPA), an MQ-1B Predator aircraft, tail number 05-3136, forward deployed from the 432d Wing, Creech Air Force Base (AFB), Nevada, experienced electronic flight control component failure resulting in loss of aircraft control. The MRPA impacted the ground and was destroyed. At the time of the mishap, the MRPA was operated by a mission control element (MCE) from the 20th Attack Squadron (ATKS), Whiteman AFB, Missouri. The estimated cost of aircraft and munition damage is \$5.2 million. There were no injuries or damage to other government or private property.

I find by a preponderance of the evidence the cause of the mishap was a direct or proximity lightning strike inducing electronic flight control module failure resulting in loss of aircraft control.

I find by a preponderance of evidence that a factor substantially contributing to the mishap was the Mishap Pilot's (MP) misidentification of adverse weather.

I developed my opinion by analyzing factual data from engineering analysis, witness testimony, flight data, maintenance records, and Air Force Instructions and Technical Orders.

2. CAUSE

I find by a preponderance of the evidence the cause of the mishap was a direct or proximity lightning strike inducing electronic flight control module failure resulting in loss of aircraft control. The weather forecast for the MRPA's route of flight was favorable and did not indicate hazardous conditions. The MRPA flew into an area of rapidly changing weather undergoing the beginning stages of thunderstorm development. Lightning was present in the vicinity of the MRPA at the time of the mishap. The MQ-1B Predator is not equipped with lightning protection, thus the effects of lightning induced high voltage through wiring in the MRPA's wings, damaging left and right wing control modules. With these components inoperative, and still in the base of the developing thunderstorm, the MRPA was unable to maintain controlled flight and impacted the ground.

3. SUBSTANTIALLY CONTRIBUTING FACTORS

I find by a preponderance of evidence that a factor substantially contributing to the mishap was the MP's misidentification of adverse weather. The Multi-Spectral Targeting System video displayed a layer of clouds ahead and above the MRPA's altitude. The MP misidentified this layer of clouds as haze and continued flight toward the area of developing weather. Because of this misidentification, coupled with an expectation of clear weather, the MP did not feel the need to gather more in-depth weather information. As the MRPA flew under the cloud layer, the MP did not notice further indications of developing weather, such as increasing cloud cover, virga and lightning, and continued flight below the base of the developing thunderstorm, where the MRPA was subsequently affected by lightning.

Had the MP properly identified the layer of the clouds early on, the MP may have focused more attention on ascertaining the true nature of the unexpected weather ahead. While early identification of the cloud layer, by itself would not have been enough to support a decision to alter the route of flight, a heightened sense of awareness could have facilitated the MP in identifying the additional signs of adverse weather as the MRPA approached the developing storm. Nonetheless, the rapidly changing weather offered little room for error, and even had the MP been aware enough to identify the additional indications of adverse weather, the point at which a decision to alter the MRPA's route of flight may have been too late to avoid the risk of lightning.

4. CONCLUSION

I find by a preponderance of the evidence the cause of the mishap was a direct or proximity lightning strike inducing electronic flight control module failure resulting in loss of aircraft control. Further, I find by a preponderance of evidence that a factor substantially contributing to the mishap was the MP's misidentification of adverse weather.

//Signed//

28 July 2016

DANIEL C. JOHNSEN, Lt Col, USAF
President, Abbreviated Accident Investigation Board

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