UNITED STATES AIR FORCE
ABBREVIATED AIRCRAFT ACCIDENT INVESTIGATION BOARD REPORT

MQ-1B, T/N 06-3160

20TH RECONNAISSANCE SQUADRON
432D WING
CREECH AIR FORCE BASE, NEVADA

LOCATION: CENTCOM AOR

DATE OF ACCIDENT: 22 JUNE 2015

BOARD PRESIDENT: LT COL SEAN S. SPRADLIN

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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14 MAR 2016

ACTION OF THE CONVENING AUTHORITY

The Report of the Accident Investigation Board, conducted under the provisions of AFI 51-503, that investigated the 22 June 2015 mishap, in the CENTCOM Area of Responsibility, involving an MQ-1B, T/N 06-3160, assigned to the 432nd Wing, Creech Air Force Base, Nevada, complies with applicable regulatory and statutory guidance; on that basis it is approved.

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

United States Air Force Abbreviated Accident Investigation Board Report

EXECUTIVE SUMMARY
UNITED STATES AIR FORCE
AIRCRAFT ACCIDENT INVESTIGATION

MQ-1B, T/N 06-3160
CENTCOM AOR
22 June 2015

On 22 June 2015, at 0537 Zulu time (Z), the mishap remotely piloted aircraft (MRPA), an MQ-1B Predator, tail number 06-3160, assigned to the 432d Wing, Creech Air Force Base, Nevada, and operated by the 20th Reconnaissance Squadron (20 RS), Whiteman Air Force Base, Missouri, experienced a loss of fuel pressure followed quickly by an engine fire while conducting a combat support mission in the United States Central Command (CENTCOM) Area of Responsibility (AOR). At approximately 0541 Z, the MRPA lost its satellite link and went into an un-controlled decent and crashed shortly after. The aircraft was destroyed and no wreckage was recovered. The estimated cost of the mishap is $4.66 million. No injuries, deaths or damage to private property were reported from the mishap.

On 22 June 2015, at approximately 0400 Z, after normal preflight checks, the MRPA departed an air base in the CENTCOM AOR. The Launch and Recovery Element handed off the MRPA to the 20 RS mission control element, the mishap crew (MC), uneventfully. The MC consisted of a mishap pilot (MP) and mishap sensor operator (MSO).

At 0537 Z, the MRPA experienced a rapid decrease in fuel pressure and the MC attempted to return the MRPA to the air base. At approximately 0540 Z, the MP received indications that the engine stopped and directed the MSO to rotate the camera ball and visually confirm the engine failure. The MC was able to see the propeller had stopped, confirming the engine failure, and saw fire coming from the engine compartment. At 0541 Z, a final transmission from the MRPA's data link showed the MRPA in an uncontrolled turn with the nose pointed just below the horizon, the engine at zero revolutions per minute (RPMs), and a "LOSS OF DATA" warning displayed.

The Abbreviated Accident Investigation Board (AAIB) President determined, by a preponderance of the evidence that the cause of this mishap was a fuel leak, indicated by a rapid decrease in fuel pressure, in the MRPA engine compartment. Specifically, the fuel leak ignited causing damage to the electrical system, data link, and flight control systems, which eventually led to a complete engine failure. Without thrust, data link, and effective flight controls the aircraft could not sustain flight, prevented the MRPA from flying its emergency lost link profile, and caused it to crash.

SUMMARY OF FACTS AND STATEMENT OF OPINION
MQ-1B, T/N 06-3160
22 JUNE 2015

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ACRONYMS AND ABBREVIATIONS

12 AF	Twelfth Air Force
20 RS	20th Reconnaissance Squadron
432 OG	432d Operations Group
432 WG	432d Wing
A1C	Airman First Class
AAIB	Abbreviated Accident Investigation Board
ACC	Air Combat Command
AF	Air Force
AFB	Air Force Base
AFE	Aircrew Flight Equipment
AFI	Air Force Instruction
AFRES	Air Force Reserve
AFTO	Air Force Technical Order
AGE	Aerospace Ground Equipment
ANG	Air National Guard
AOA	Angle of Attack
AOR	Area of Responsibility
ATC	Air Traffic Control
BDA	Battle Damage Assessment
BFS	Battlespace Flight Services
C4ISR	Command, Control, Communications, Computer, Intelligence, Surveillance and Reconnaissance
Capt	Captain
CDE	Collateral Damage Estimate
CENTCOM	United States Central Command
CHT	Cylinder Head Temperature
CL	Command Link
CONUS	Continental United States
CRM	Crew Resource Management
CST	Central Standard Time
DoD	Department of Defense
EEI	Essential Elements of Information
EGT	Exhaust Gas Temperature
ER	Exceptional Release
ES&H	Environmental, Safety and Health
F	Fahrenheit
FAC	Forward Air Controller
FCIF	Flight Crew Information Files
FDP	Flight Duty Period
FENCE	Fuel, Emitters, Navigation, Communication, and Engage
FMC	Fully Mission Capable
fpm	feet per minute
g	gravitational force
GA	General Atomics
GCS	Ground Control Station
GDT	Ground Data Terminal
GLS	GPS Landing System
GMT	Greenwich Mean Time
GPS	Global Positioning System
GSE	Ground Support Equipment
Hr	hour
HUD	Heads-Up Display
IAW	In Accordance With
IFR	Instrument Flight Rules
IOS	Intelligence Operator Supervisor
IFF	Identification, Friend or Foe
Insp	Inspection
ISR	Intelligence, Surveillance, and Reconnaissance
JA	Judge Advocate
JAO	Joint Air Operations
KIAS	Knots Indicated Air Speed
Kt	Knots
Lbs	Pounds
LCT	Link Communications Technician
LOS	Line of Sight
LRE	Launch and Recovery Element
LNO	Liaison Officer
Lt Col	Lieutenant Colonel
MAJCOM	Major Command
MAP	Manifold Air Pressure
MC	Mishap Crew
MCC	Mission Crew Commander
MCE	Mission Control Element
MCT	Manifold Charge Temperature
MESL	Minimum Equipment Serviceability List
MGCS	Mishap Ground Control Station
MIC	Mission Intelligence Coordinator
MM	Maintenance Member
MO	Missouri
MP	Mishap Pilot
MRPA	Mishap Remotely Piloted Aircraft

MSL	Mean Sea Level
MSO	Mishap Sensor Operator
MTS	Multi-Spectral Targeting System
MXG	Maintenance Group
NM	Nautical Mile
NOTAM	Notices to Airmen
NTTR	Nevada Test and Training Range
NV	Nevada
OCONUS	Outside Continental United States
ORM	Operational Risk Management
PIC	Pilot in Command
PPSL	Predator Primary Satellite Link
PSI	Pounds Per Square Inch
PWS	Performance Work Statement
QA	Quality Assurance
ROE	Rules of Engagement
RPA	Remotely Piloted Aircraft
RPM	Revolutions Per Minute
SAR	Search and Rescue
SARM	Squadron Aviation Resource Management
SCAR	Strike, Coordination, and Reconnaissance
SCIF	Secure Compartmentalized Information Facility
SIB	Safety Investigation Board
SIF	Selective Identification Feature
SPINS	Special Instructions
SrA	Senior Airman
TFW	Tactical Fighter Wing
T/N	Tail Number
T.O.	Technical Order
TOLD	Takeoff and Landing Data
TOT	Time on Target
UAS	Unmanned Aircraft System
US	United States
USSOUTHCOM	United States Southern Command
VFR	Visual Flight Rules
WOC	Wing Operations 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 30 December 2015, Major General Jerry D. Harris, Jr., Vice Commander, Air Combat Command (ACC), appointed Lieutenant Colonel (Lt Col) Sean S. Spradlin to conduct an abbreviated aircraft accident investigation of a mishap that occurred on 22 June 2015 involving an MQ-1B, tail number 06-3160, in the United States Central Command (CENTCOM) Area of Responsibility (AOR) (Tabs A-2 and Y-3). The abbreviated aircraft accident investigation board (AAIB) 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 11 January 2016 – 29 January 2016. A legal advisor and recorder were also appointed as members of the board (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 22 June 2015, at approximately 0537 Zulu time (Z), the mishap remotely piloted aircraft (MRPA), an MQ-1B Predator, tail number 06-3160, assigned to the 432d Wing, Creech Air Force Base, Nevada, and operated by the 20th Reconnaissance Squadron (20 RS), Whiteman Air Force Base, Missouri (MO), experienced a loss of fuel pressure followed quickly by an engine fire while conducting a combat support mission in the CENTCOM AOR (Tabs J-3 to J-5, K-2, N-2 to N-4, and V-1.1 to V-1.2). At approximately 0541 Z, the MRPA lost its satellite link, went into an un-controlled decent, and crashed shortly after (Tabs J-3 to J-5, K-2, N-2 to N-7, V-1.2, and DD-4 to DD-9). The aircraft was destroyed and no wreckage was recovered (Tabs V-2.1 and DD-4). The estimated cost of the mishap is $4.66 million (Tab P-4). No injuries, deaths or damage to private property were reported from the mishap (Tab P-3).

3. BACKGROUND

The MRPA belonged to the 432d Wing (WG), 12th Air Force, Air Combat Command stationed at Creech AFB, NV (Tab K-5). The mishap crew (MC), consisting of the mishap pilot (MP) and mishap sensor operator (MSO), are assigned to the 20th Reconnaissance Squadron (20 RS), Whiteman AFB, MO (Tab V-1.1 and V-2.1). Additionally, at the time of the mishap, the MRPA

was forward deployed to CENTCOM AOR and was maintained by Battlespace Flight Services (BFS), Limited Liability Company (Tab V-1.1)

a. Air Combat Command (ACC)

ACC is the primary force provider of combat airpower to America's warfighting commands. To support global implementation of national security strategy, ACC operates fighter, bomber, reconnaissance, battle-management, and electronic-combat aircraft. It also provides command control, communications, and intelligence systems, and conducts global information operations (Tab CC-3).

b. Twelfth Air Force (12 AF)

Twelfth AF is responsible for the combat readiness of seven active-duty wings and one direct reporting unit. The subordinate commands operate more than 360 aircraft with more than 20,300 uniformed and civilian Airmen. The command is also responsible for the operational readiness of seventeen 12 AF-gained wings and other units of the Air Force Reserve (AFRES) and Air National Guard (ANG) (Tab CC-10).

c. 432d Wing (432 WG)

The 432 WG and its associated deployed unit, the 432d Air Expeditionary Wing, also known as the "Hunters," consists of combat-ready Airmen who fly remotely piloted aircraft (RPA) in direct support of the joint force warfighter. The RPA system provides real-time reconnaissance, surveillance, and precision attack against fixed and time-critical targets. The Hunters conduct RPA training for aircrew, intelligence, weather, and maintenance personnel (Tab CC-14).

d. 432d Operations Group (432 OG)

The 432 OG employs remotely piloted aircraft in Combat Air Patrols 365 days a year in support of combatant commander needs and deploys combat support forces worldwide. The 432 OG currently oversees global operations of six squadrons, including the 20th Reconnaissance Squadron (Tab CC-15).

e. 20th Reconnaissance Squadron (20 RS)

The 20 RS is a tenant unit at Whiteman AFB, MO, and is part of the 432 OG which falls under the 432 WG at Creech AFB, NV. The primary mission of the 20 RS is to provide persistent intelligence, surveillance and reconnaissance and full motion video for real-time actionable intelligence and precision weapons employment in combat operations using the MQ-1B (Tab C-16 to C-17).

f. Battlespace Flight Services (BFS)

BFS provides organizational maintenance support for MQ-1B aircraft and systems to sustain the combat and training at tasked locations worldwide. The primary objective of BFS is to provide qualified management and supervisory personnel at MQ-1B operational locations, and a level of support for their personnel that allow them to accomplish their objective. Support includes aircraft maintenance, supply support, command, control, communications, computer, intelligence, surveillance, and reconnaissance (ISR) systems, quality assurance and an environmental, safety and health program (Tab CC-19 to CC-20).

g. MQ-1B – Predator

The MQ-1B Predator is an armed, multi-mission, medium-altitude, long-endurance RPA employed primarily as an intelligence-collection asset and secondarily against dynamic execution targets. Given its significant loiter time, wide-range sensors, multi-mode communications suite and precision weapons, the Predator provides a unique capability to perform strike, coordination and reconnaissance missions against high-value, fleeting and time-sensitive targets. Predators can also perform the following missions and tasks: ISR, close air support, combat search and rescue, precision strike, buddy-lase, convoy and raid overwatch, route clearance, target development and terminal air guidance. The MQ-1B's capabilities make it uniquely qualified to conduct irregular warfare operations in support of combatant commander objectives. The MQ-1B Predator system consists of an aircraft (with sensors), a ground control station (GCS), a Predator Primary Satellite Link (PPSL), and operations and maintenance personnel for deployed 24-hour operations. The basic crew for the MQ-1B Predator is one pilot and one sensor operator. The crew flies the MQ-1B Predator from inside the GCS via a line of sight (LOS) radio data link and via a satellite data link for beyond-LOS flight. A ground data terminal antenna provides LOS communications for takeoff and landing, while the PPSL provides beyond-LOS communications during the remainder of the mission (Tab CC-21 to CC-22).

4. SEQUENCE OF EVENTS

a. Mission

On 22 June 2015, the MRPA was authorized by a classified CENTCOM Air Tasking Order to conduct a combat support mission in the CENTCOM AOR (Tab K-2). The launch and recovery element (LRE) consisted of a pilot and sensor operator who launched the MRPA from an air base in the CENTCOM AOR (Tabs K-2 and DD-4 to DD-5). Following the uneventful launch procedure, the MRPA was handed off to a mission control element (MCE) crew, which was also the mishap crew (MC) (Tabs K-2, V-1.1, and DD-5). The MC consisted of a mishap pilot (MP) and mishap sensor operator (MSO) assigned to the 20 RS and operated out of the mishap ground control station (MGCS) (Tabs K-2 and V-1.1).

b. Planning

The squadron aviation resource management (SARM) personnel confirmed the MP and MSO had no issues with their go/no-go's (Tabs V-1.1 and V-2.1). The MC received a mass briefing supervised by the Mission Crew Commander (MCC) and the Intelligence Operations Supervisor followed by individual intelligence briefings (Tabs V-1.1 and V-2.1). The MC conducted a standard crew briefing where they reviewed emergency procedures and outlined potential tactical situations (Tab V-1.1). The MCC signed the flight orders after finding no issues with the MC's operational risk management scores and supervising the mission planning IAW Air Force Instruction (AFI) 11-2MQ-1&9, Volume 3, *Operations Procedures*, Attachment 2 (Tabs V-1.1, V-2.1, AA-3 to AA-4, and BB-5 to BB-9). There is no evidence to suggest mission planning was a factor in this mishap.

c. Preflight

There were no significant Notices to Airman noted (Tabs V-1.1 and V-2.1). The MP reviewed the MGCS forms and there were no outstanding issues (Tab V-1.1). The Maintenance Supervisor signed an exceptional release for an engine swap on 21 June 2015 (V-3.1). The MP reported no issues from the Launch and Recovery Element after the MRPA was launched from the deployed location uneventfully and began its climb to altitude (Tabs D-3, V-1.1, V-3.1, and V-4.1).

d. Summary of Accident

On 22 June 2015, at approximately 0537 Z, the MRPA was climbing with 100% throttle setting when a rapid decrease in fuel pressure occurred (Tabs J-3 to J-5, N-2 to N-7, and DD-4 to DD-7). MCE data logs show fuel pressure dropped rapidly from 60 pounds per square inch (psi) to 14 psi within six seconds, fuel pumps indicated normal operations, and no abnormal fluctuations were indicated in the fuel tanks (Tabs J-3 to J-5, N-2 to N-3, and DD-4 to DD-7). When the MC received the "Fuel – pressure drop" caution they began consulting their engine failure checklist at approximately 0538 Z and noticed decreases in exhaust gas temperature (EGT) and engine speed from 5,244 to 3,272 revolutions per minute (RPM) (Tabs J-3 to J-5, N-2 to N-3, V-1.1, and DD-4 to DD-7). The drop in EGT and engine speed led the MP to initiate the engine failure checklist and begin a turn back toward the launch and recovery site (Tab J-3 to J-5, N-2 to N-3, V-1.1, and DD-4 to DD-7).

At approximately 0539:45 Z the MP indicated that the MRPA was pointed towards the LRE and continued with the engine failure checklist (Tabs N-2 to N-3 and V-1.1). At approximately 0540 Z the MP noticed the "engine stopped" and directed the MSO to "swing the ball" in an effort to confirm the engine had stopped (Tabs N-3 to N-4, V-1.1, and V-2.1). Seconds later, at 0540:11 Z, the MC visually confirmed, via video feed from the MRPA, the propeller had stopped and observed flames coming from the engine compartment (Tabs N-4, V-1.1, V-2.1, and DD-22). After observing the fire, the MP initiated the engine fire checklist (Tab V-1.2).

At approximately 0540:30 Z the MC received a "Lost Link" warning (Tab N-5). With the loss of the satellite data link, which transmits commands from the ground control station (GCS) to the

RPA, the MC was unable to complete the engine failure and engine fire checklists (Tabs N-5 to N-7 and V-1.2). The MC attempted to regain link connectivity by running the lost link checklist and IAW step two, requested assistance from the on-duty link communications technician (LCT) to verify correct system settings (Tab N-6 to N-7). At 0541 Z a momentary, final update from the MRPA to the MSO heads-up display (HUD) video showed the MRPA in an un-commanded turn with the nose pointed just below the horizon, the engine at zero RPMs and a "LOSS OF DATA" warning displayed (Tab DD-9 and DD-24). During the momentary update, a left tail servo failure was also recorded in the data logs (Tab DD-9).

e. Impact

When the link was lost, the MRPA was in a standard cruise configuration with the landing gear up (Tab V-1.2). Shortly after losing the link to the MRPA, the MC was informed that the aircraft was no longer in an operable state, which resulted in an unsuccessful return to base (Tabs V-2.1 and DD-4). The aircraft crashed, was destroyed on-site, and no wreckage was recovered (Tabs I-2, J-3 and DD-4).

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

The Air Force Technical Order (AFTO) 781 series forms for the MRPA were documented IAW applicable maintenance guidance (Tab D-3 to D-18). Due to multiple issues, maintenance personnel removed the engine, installed a new engine, serial number GTD7682040, and performed quality assurance checks on 21 June 2015 (Tab D-2 and D-6 to D-16). Prior to the mishap sortie, tail number (T/N) 06-3160 had flown 19,151.4 total hours and its current engine, serial number GTD7682040, had 735 hours and had flown zero hours since its installation in T/N 06-3160 (Tab D-2).

The AFTO 781 series forms for the MGCS were documented IAW applicable maintenance guidance (Tab D-22 to D-24). There were no issues that prevented the MGCS from completing the mission (Tab V-1.1). There is no evidence to suggest that the MGCS was a factor in this mishap.

b. Inspections

All MRPA maintenance inspections were completed and documented IAW applicable regulations and Technical Orders (T.O.s) (Tab D-2 to D-18). Maintenance personnel completed a 150-hour inspection of the MRPA on 21 June 2015 in the CENTCOM AOR (Tab D-2). BFS installed a new engine in the MRPA on 21 June 2015 and the checks required by regulations and T.O.s were completed (Tab D-2 to D-18). Prior to engine installation in the MRPA, the last inspection of the engine was the 720-hour inspection completed on 25 May 2015 (Tab D-2).

c. Maintenance Procedures

The MRPA's engine was replaced by BFS personnel in the CENTCOM AOR on 21 June 2015 following the procedures in T.O. 1Q-1(M)B-2-72JG-00-2 (Tab D-11). Torque Wrench calibrations were current at the time of the mishap (Tab S-2 to S-4).

d. Maintenance Personnel and Supervision

Contractors with BFS maintained the MRPA in the CENTCOM AOR (Tabs D-2 to D-18, V-1.1, and CC-19). A review of the training records for the maintenance crew showed they were trained and certified to complete their tasks (Tab G-223 through G-274). Maintenance personnel performed adequate handover between shifts and performed quality assurance checks after performing tasks (Tabs D-7 to D-18, V-3.1, and V-4.1). There is no evidence to suggest maintenance supervision was a factor in this mishap.

e. Fuel, Hydraulic, and Oil Inspection Analyses

Records indicate maintenance personnel refueled the MRPA, and serviced and inspected the MRPA's oil prior to the mishap flight with no discrepancies reported (Tab D-5 to D-6). Fuel samples were taken from the servicing fuel carts following the mishap and were within specifications (Tab J-12). There is no evidence to suggest that fuel or oil quality or servicing was a factor in this mishap.

f. Unscheduled Maintenance

During the engine change on 21 June 2015, the MRPA's 7,500-hour inspection was completed (Tab D-2). Between the inspection on 21 June 2015 and the mishap on 22 June 2015, unscheduled maintenance did not occur.

6. AIRFRAME, MISSILE, OR SPACE VEHICLE SYSTEMS

a. Structures and Systems

The MRPA was not recovered (Tab I-2). As a result, no structural or systems evaluations were accomplished.

b. Evaluation and Analysis

The MRPA was climbing at 0537 Z when a drastic loss of 46 psi of fuel pressure occurred in six seconds followed by engine failure, an engine fire, and lost data link (Tabs J-3 to J-5, N-2 to N-7, V-1.1, and DD-4 to DD-7). These events led to the crash of the MRPA and its complete destruction after the mishap (Tabs J-3, V-2.1, and DD-4). Without wreckage, the manufacturer, General Atomics (GA), analyzed the mishap using the data logs and provided a detailed report (Tab DD-3 to DD-25).

GA concluded that following an engine replacement on 21 June 2015, the MRPA was cleared for the flight on 22 June 2015 and took off with normal engine and fuel system indications (Tab DD-4). At approximately 0537 Z a rapid decrease in fuel pressure from 60 psi to 14 psi within six seconds was recorded in the data logs (Tabs N-2 and DD-5). No other engine parameters indicated abnormal levels prior to the decrease in fuel pressure (Tabs V-1.1 and DD-4). MCE data logs show normal acceleration and did not indicate excessive air turbulence (Tab DD-5). No abnormal decrease in measured fuel level in the forward or aft tanks was observed (Tab DD-5). Moments after the drop in fuel pressure, additional data log indications showed a decrease in all four exhaust gas temperature (EGT) values from 1,500° Fahrenheit (F) to the minimum reportable value within 31 seconds (Tab DD-5). Data logs also revealed a decrease in engine speed from 5,244 to 3,272 RPM and a fuel flow rate decrease from 30.2 to 10.6 pounds per hour (Tab DD-5). Around 45 seconds later, data logs indicate an approximate 10 second period of normal engine combustion followed by over one minute of sporadic combustion and abnormal engine operation (Tab DD-6). Then the engine stopped, fuel and oil pressure decreased to zero psi, and the data logs abruptly stopped updating (Tab DD-6 to DD-7). The total elapsed time from the start of abnormal engine operation to the time the data logs stopped updating was approximately 3.3 minutes (Tab DD-7).

GA concluded that a fuel leak in the engine compartment caused multiple sensor failures, which eventually ignited and destroyed other components, electrical wiring harnesses, and most likely caused the data link loss (Tab DD-9).

The root cause of the fuel leak could not be determined without returned hardware (Tab DD-9).

7. WEATHER

a. Forecast Weather

The weather forecasted for the CENTCOM AOR around the time of the mishap was winds out of the northwest at 20 knots, gusting up to 26 knots, with blowing dust and outside air temperatures over 100°F (Tab F-3). There were no other significant weather occurrences in the forecast.

b. Observed Weather

There were no significant differences between forecasted and observed weather (Tabs F-3 and V-1.1). No evidence suggests weather was a factor in this mishap.

c. Space Environment

No space weather impacts were noted (Tab F-3).

d. Operations

There is no evidence to suggest any system was operated outside of its prescribed operation weather limits.

8. CREW QUALIFICATIONS

a. Mishap Pilot (MP)

The MP was a current and qualified MQ-1B pilot (Tab G-5). The MP had 1,859.7 hours in the MQ-1B since 13 March 2012 and 1,946.5 total hours (Tab G-2).

Recent flight time is as follows (Tab G-3):

	Hours	Sorties
Last 30 Days	86.1	20
Last 60 Days	158.6	43
Last 90 Days	202.0	58

There is no evidence to suggest the MP's qualifications were a factor in this mishap.

b. Mishap Sensor Operator (MSO)

The MSO was a current and qualified MQ-1B sensor operator (Tab G-20). The MSO had 469.7 hours in the MQ-1B since 4 October 2013 and 469.7 total hours (Tab G-20).

Recent flight time is as follows (Tab G-21):

	Hours	Sorties
Last 30 Days	28.4	8
Last 60 Days	40.5	12
Last 90 Days	41.4	15

There is no evidence to suggest the MSO's qualifications were a factor in this mishap.

9. MEDICAL

a. Qualifications

At the time of the mishap, the MC was medically qualified for flight duty (Tab K-2 to K-3).

b. Health

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

c. Pathology

Toxicology results were negative for the MC (Tab T-3 to T-4).

d. Lifestyle

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

e. Crew Rest and Crew Duty Time

Air Force regulations require aircrew members have proper crew rest prior to performing flight duties (Tab BB-4). AFI 11-202, Volume 3, *General Flight Rules*, paragraph 2.1, defines crew rest as a minimum of 12 non-duty hours before Flight Duty Period (FDP) begins (Tab BB-4). This period includes at least 8 hours of uninterrupted sleep, meals, and transportation (Tab BB-4). Crew rest cannot begin until after the completion of official duties (Tab BB-4). The go/no-go verification was completed and documented on the flight orders as all crewmembers eligible to conduct flight operations (Tab K-2). All crew members met the crew rest requirements (Tab V-1.1 and V-2.1).

10. OPERATIONS AND SUPERVISION

a. Operations

On the day of the mishap, it was a normal duty day for the MC who were on mid-shift (Tab V-1.1). There were no significant issues reported and the operations tempo was considered normal by the MP and MSO (Tab V-1.1 and V-2.1). There is no evidence to suggest operations tempo contributed to the mishap.

b. Supervision

On the day of the mishap, the MC received their daily mass briefing as they came on shift, which the mission crew commander (MCC) and intelligence operations supervisor oversaw (Tab V-1.1). The MC conducted their standard mission briefing (Tab V-1.1). The MC was current on their go/no-go requirements and their operational risk management (ORM) was signed off by the squadron aviation resource management (SARM) and MCC (Tab V-1.1). There is no evidence to suggest supervision contributed to the mishap.

11. HUMAN FACTORS ANALYSIS

There is no evidence to suggest that any human factors contributed to this mishap.

12. GOVERNING DIRECTIVES AND PUBLICATIONS

a. Publically Available Directives and Publications Relevant to the Mishap

(1) AFI 51-503, *Aerospace and Ground Accident Investigations,* 14 April 2015
(2) AFI 11-202, Volume 3, *General Flight Rules*, 7 November 2014, incorporating Air Force Guidance Memorandum 2015-01, dated 13 April 2015
(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, dated 28 August 2015

NOTICE: All directives and publications listed above 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) T.O. 1Q-1(M)B-2-72JG-00-2, Organizational Maintenance Engine Reciprocating, General – Volume II, 23 June 2014, Change 4 20 July 2015
(2) T.O. 1Q-1(M)B-2-72JG-10-1, Organizational Maintenance Engine Reciprocating, Fuel and Intake, 29 April 2014, Change 2 23 December 2014
(3) T.O. 1Q-1(M)B-1CL-1, Flight Crew Checklist, 20 March 2015, Change 1 18 August 2015
(4) T.O. 1Q-1(M)B-1, Flight Manual, 20 March 2015, Change 1 18 August 2015

c. Known or Suspected Deviations from Directives or Publications

There are no known or suspected deviations from directives or publications by crewmembers or others involved in the mishap.

29 January 2016

SEAN S. SPRADLIN, Lt Col, USAF
President, Abbreviated Accident Investigation Board

STATEMENT OF OPINION

MQ-1B, T/N 06-3160
CENTCOM AOR
22 June 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 22 June 2015, at 0537 Zulu time (Z), the mishap remotely piloted aircraft (MRPA), an MQ-1B Predator, tail number 06-3160, assigned to the 432d Wing, Creech Air Force Base, Nevada, and operated by the 20th Reconnaissance Squadron at Whiteman Air Force Base, Missouri, experienced a loss of fuel pressure followed quickly by an engine fire while conducting a combat support mission in the United States Central Command (CENTCOM) Area of Responsibility (AOR). At approximately 0541 Z, the MRPA lost its satellite link and went into an un-controlled decent and crashed shortly after. The aircraft was destroyed and no wreckage was recovered. The estimated cost of the mishap is $4.66 million. No injuries, deaths or damage to private property were reported from the mishap.

I find by a preponderance of the evidence that the cause of this mishap was a fuel leak, indicated by a rapid decrease in fuel pressure, in the MRPA engine compartment. Specifically, the fuel leak ignited causing additional damage to electrical, data link, and flight control systems, which eventually led to a complete engine failure. Without thrust, data link, and effective flight controls the aircraft could not sustain flight and therefore prevented the MRPA from flying its emergency lost link profile and caused it to crash.

I developed my opinion by analyzing factual data from historical records, flight data logs, manufacturer reports, maintenance records, witness testimony, Air Force directives and guidance, Air Force Technical Orders, and the inspection of standard engine components and configurations.

2. CAUSE

I find by a preponderance of the evidence that the cause of this mishap was a fuel leak in the MRPA engine compartment. Specifically, the fuel leak ignited causing damage to the electrical system, data link, and flight control systems, which eventually led to a complete engine failure. At 0500 Z on 22 June 2015, data logs from the mishap ground control station (MGCS) show the MRPA in level flight with all indications normal. At 0530 Z the mishap crew (MC) increased the throttle to 100% and started a climb in altitude. At 0537 Z, as the MRPA was climbing in altitude, the MGCS displayed fuel pressure drop indications followed quickly by indications of

decreased exhaust gas temperature and engine speed. Data logs also show there were multiple engine sensor failures. At 0540 Z, the mishap sensor operator (MSO) rotated the MRPA's camera ball and confirmed that the propeller had stopped and flames were coming from the engine compartment. At approximately 0540:30 Z the MC received a "Lost Link" warning and the MC was unable to complete the engine failure and engine fire checklists, started at 0538 Z and 0540 Z respectively. At approximately 0541 Z the MGCS suddenly stopped receiving data from the MRPA when the satellite return signal ceased. The final update from the MRPA showed the aircraft in a right hand turn with the nose pointed just below the horizon, the engine at zero revolutions per minute (RPMs), and a "Loss of Data" warning displayed as well as a left tail servo failure. Shortly after losing the link to the MRPA, the MC was informed that the aircraft was no longer in an operable state.

3. CONCLUSION

By a preponderance of the evidence, I find the cause of the mishap was a fuel leak in the MRPA engine compartment. Specifically, the fuel leak ignited causing damage to electrical system, data link, and flight control systems, which eventually led to a complete engine failure. Without thrust, data link, and effective flight controls the aircraft could not sustain flight, prevented the MRPA from flying its emergency lost link profile and caused it to crash.

29 January 2016

SEAN S. SPRADLIN, Lt Col, USAF
President, Abbreviated Accident Investigation Board

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