UNITED STATES AIR FORCE
ABBREVIATED AIRCRAFT
ACCIDENT INVESTIGATION
BOARD REPORT

MQ-1B T/N 07-3220
57TH WING
NELLIS AIR FORCE BASE, NEVADA

LOCATION: ISLAMIC REPUBLIC OF AFGHANISTAN

DATE OF ACCIDENT: 14 APRIL 2012

BOARD PRESIDENT: LIEUTENANT COLONEL BRETT M THOMAS

Conducted IAW Air Force Instruction 51-503

Abbreviated Accident Investigation pursuant to Chapter 11

ACTION OF THE CONVENING AUTHORITY

16 AUG 2012

The Report of the Abbreviated Accident Investigation Board, conducted under the provisions of AFI 51-503, that investigated the 14 April 2012 mishap in Afghanistan, involving MQ-1B, T/N 07-3220, assigned to the 57 WG, Nellis AFB, NV, complies with applicable regulatory and statutory guidance and on that basis is approved.

WILLIAM J. REW
Lieutenant General, USAF
Vice Commander

EXECUTIVE SUMMARY

ABBREVIATED AIRCRAFT ACCIDENT INVESTIGATION (AAIB)
MQ-1B T/N 07-3220, Islamic Republic of Afghanistan
14 APRIL 2012

On 14 April 2012, at 03:41:13 Zulu (Z) time, the mishap remotely piloted aircraft (MRPA), an MQ-1B Predator, tail number (T/N) 07-3220, crashed in the Nangarhar Province, Islamic Republic of Afghanistan while attempting to return to Jalalabad Airbase. Destruction of the MRPA with one missile was assessed to be a financial loss of $3,832,053.18. No injuries, damage to other government property, or damage to private property resulted from the mishap.

The aircraft belonged to the 57th Wing at Nellis Air Force Base (AFB), Nevada, but was deployed at the time in support of Operation ENDURING FREEDOM. The crew flying the aircraft at the time of the mishap was from the 162 Reconnaissance Squadron (RS) at Springfield Air National Guard Base (ANGB), Ohio. The 62d Expeditionary Reconnaissance Squadron, Detachment1, provided the maintenance support.

Following normal pre-flight checks, the MRPA taxied and took off from Jalalabad Airbase at 02:12Z. The Launch and Recovery Element (LRE) handed off the MRPA to the Mission Control Element (MCE) uneventfully at 02:19Z. Sixty eight minutes later, the MRPA experienced a significant loss of power. With this loss of power, the MRPA started a descent in accordance with its autopilot programming, which maintains airspeed by sacrificing altitude. The Mishap Sensor Operator (MSO) noticed the descent, and the MP attempted to return the MRPA to its assigned altitude. The engine continued to lose power and the MP analyzed this as an engine failure. The MCE crew accomplished all the critical action procedure steps (CAPS) for an engine failure as they turned the MRPA back towards Jalalabad Airbase. The MCE coordinated with the LRE for handback of the MRPA and coordinated with the 432d Wing Operations Center (WOC) Director for guidance if the MRPA could not be successfully returned to the Airbase. At approximately 03:30Z the MCE crew determined that the MRPA could not successfully be returned to the airbase and, following the guidance received from the WOC Director, purposely flew the MRPA into the ground. Impact occurred at 03:41:13Z on an unpopulated mountainside approximately 20 nautical miles (nm) short of the airbase. The MRPA was a total loss with some damaged portions recovered.

The AAIB President determined by clear and convincing evidence that the cause of the mishap was engine failure. By a preponderance of the evidence, the AAIB president found that a substantially contributing factor to this single point failure was a unique data and power cable, because there was no other point on this particular MQ-1B that the two ignition circuits came together, because of redundancy upgrades to the ignition system accomplished in the past.

SUMMARY OF FACTS AND STATEMENT OF OPINION
MQ-1B T/N 07-3220
14 April 2012

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COMMONLY USED ACRONYMS & ABBREVIATIONS

ACC	Air Combat Command
AEW	Air Expeditionary Wing
AF	Air Force
AFB	Air Force Base
AFI	Air Force Instruction
AFSC	Air Force Specialty Code
AFSOC	Air Force Special Operations Command
AFTO	Air Force Technical Order
AGM	Air-Ground Missile
AIB	Accident Investigation Board
AAIB	Abbreviated Accident Investigation Board
ATC	Air Traffic Control
CAPS	Critical Action Procedure Steps
CCSM	Control Console Serial Module
EGT	Exhaust Gas Temperature
EP	Emergency Procedure
GA	General Atomics
GCS	Ground Control Station
GDT	Ground Data Terminal
HUD	Head-up Display
IC	Incorporating Change
ISR	Intelligence, Surveillance and Reconnaissance
KIAS	Knots Indicated Airspeed
L	Local Time
LOS	Line of Sight
LRE	Launch and Recovery Element
MAP	Manifold Air Pressure
MC	Mishap Crew
MCE	Mission Crew Element
MIC	Mission Intelligence Coordinator
MP	Mishap Pilot
MRPA	Mishap Remotely Piloted Aircraft
MSO	Mishap Sensor Operator
NM	Nautical Miles
OG	Operations Group
OS	Operations Supervisor
OSS	Operational Support Squadron
PCL	Point and Click Loiter
PMATS	Predator Mission Aircrew Training System
PPSL	Predator Primary Satellite Link
RPA	Remotely Piloted Aircraft
RPM	Revolutions Per Minute
RS	Reconnaissance Squadron
RW	Reconnaissance Wing
SATCOM	Satellite Communications
SIB	Safety Investigation Board
TCTO	Time Compliance Technical Order
T/N	Tail Number
TO	Technical Order
UAV	Unmanned Aerial Vehicle
USAF	United States Air Force
USAFCENT	United States Air Forces Central
USCENTCOM	United States Central Command
WOC	Wing Operations Center
WOCD	Wing Operations Center Director
Z	Zulu or Greenwich Meridian Time (GMT)

The above list was compiled from the Summary of Facts, the Statement of Opinion, the Index of Tabs, and witness testimony (Tab R & Tab V).

SUMMARY OF FACTS

1. AUTHORITY AND PURPOSE

a. Authority.

On 4 June 2012, Lieutenant General William J. Rew, Vice Commander Air Combat Command, appointed Lieutenant Colonel Brett M. Thomas as the Abbreviated Accident Investigation Board (AAIB) President to investigate the 14 April 2012 crash of an MQ-1B Predator aircraft, tail number T/N 07-3220. An abbreviated AIB was conducted at Springfield Air National Guard Base (ANGB), Ohio, from 26 June 2012 to 13 July 2012, pursuant to Chapter 11 of Air Force Instruction (AFI) 51-503, *Aerospace Accident Investigations*. A Legal Advisor and Recorder were also appointed to the AAIB. A maintenance non-commissioned officer served as a Functional Area Expert. (Tab Y-3, Y-6)

b. Purpose.

This is a legal investigation convened to inquire into the facts surrounding the aircraft or aerospace accident, to prepare a publicly-releasable report, and to gather and preserve all available evidence for use in litigation, claims, disciplinary actions, administrative proceedings, and for other purposes.

2. ACCIDENT SUMMARY

The mishap remotely piloted aircraft (MRPA) taxied and departed from Jalalabad Airbase at 02:12:49Z. Sixty eight minutes later, the MRPA experienced a partial rollback of the engine, followed four minutes and forty-four seconds later by a complete engine failure. (Tab AA-3) The crew applied all Critical Actions Procedures (CAPS) and accomplished the appropriate checklists while turning the MRPA back towards Jalalabad Airbase. (Tabs AA-3, V-2.1) At approximately 03:30Z the MCE crew determined that the MRPA would not successfully be able to return to the air base and, following the guidance received from the WOC Director, purposely flew the MRPA into the ground. Impact occurred at 03:41:13Z on an unpopulated mountainside approximately 20 nautical miles (nm) short of the airbase. (Tab AA-4)

The aircraft was a total loss, valued at $3,832,053.18 with some damaged portions recovered. (Tab P-3, Tab AA-7) There were no injuries or damage to personal property. (Tab P-4)

3. BACKGROUND

a. Units and Organization

(1) Air Combat Command (ACC)

Air Combat Command is a major command of the United States Air Force and primary force provider of combat airpower to America's warfighting commands. Its mission is to organize, train, equip, and maintain 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. ACC operates fighter, bomber, reconnaissance, battle-management, and electronic-control aircraft and provides command, control, communications, and intelligence systems and conducts global information operations. Over 96,000 active duty members and civilians, and when mobilized, 57,000 Air National Guard and Reserve members compose ACC, and its units operate 2,000 aircraft. (Tab X-3)

(2) 12th Air Force (12 AF)

12th Air Force controls ACC's conventional forces in the western United States and has the warfighting responsibility for U.S. Southern Command as well as the U.S. Southern Air Forces (AFSOUTH). (Tab X-5) It manages all Air Force assets and personnel in the USSOUTHCOM Area of Responsibility, which includes Central and South America. As one of four numbered air forces assigned to ACC, 12th AF's mission is to provide combat ready forces to ACC, train and equip 10 combat wings and one RED HORSE squadron. Its subordinate commands operate more than 731 combat aircraft with more than 66,400 uniformed and civilian Airmen. 12th Air Force directs 10 active duty wings and one direct reporting unit as well as 18 gained wings and other units of the Air National Guard and Reserve. (Tab X-7)

(3) 432d Reconnaissance Wing (432 RW)

The 432d Wing (432 WG), stationed at Creech AFB, Nevada, flies remotely piloted aircraft (RPA) systems to provide real-time reconnaissance, surveillance, and precision attack against fixed and time-critical targets to support American and coalition forces worldwide. The 432 WG also conducts initial qualification training for aircrew, intelligence, weather, and maintenance personnel who will fly and support RPA systems. The wing's organization includes two groups, six RPA flying squadrons, an operational support squadron, and three maintenance squadrons. The wing and its subordinate units are components of the Air Force's ACC and 12 AF. (Tabs X-11)

(4) 57th Wing (57 WG)

The 57th Wing provides advanced aerospace training to world-wide combat air forces and showcases aerospace power to the world while overseeing the dynamic and challenging flying operations at Nellis. It manages all flying operations at Nellis Air Force Base and conducts advanced aircrew, space, logistics and command and control training through the USAF Weapons School, Red Flag and Green Flag exercises. Important components of the training include adversary tactics replication (provided by the wing's aggressor squadrons) and graduate level instruction and tactics development (accomplished through each of its schools). (Tab X-19)

(5) 432d Operations Group (432 OG)

The 432d Operations Group employs RPA in 24-hour Combat Air Patrols in support of combatant commander needs, and deploys combat support forces worldwide. This includes combat command and control, tactics development, intelligence support, weather support, and standardization and evaluation oversight for ACC, USAFCENT, Air Force Material Command, Air National Guard, the United Kingdom Royal Air Force, seven geographic combatant commanders, and Air Reserve Command RPA units. The Group is also responsible for all air traffic control, airfield management, and weather services for RPA operations at Creech AFB, NV. (Tab X-13)

(6) 162d Reconnaissance Squadron (162 RS)

The 162d Reconnaissance Squadron provides combatant commanders with persistent intelligence, surveillance and reconnaissance (ISR) capability, full-motion video and precision weapons engagement. Its global operations architecture supports continuous MQ-1B Predator employment providing real-time actionable intelligence, strike, interdiction, close air support, and special missions to deployed war fighters. (Tab AA-11)

(7) 62d Expeditionary Reconnaissance Squadron (62 ERS)

The 62d Expeditionary Reconnaissance Squadron is home to the MQ-1 Predator and MQ-9 Reaper aircraft at Kandahar Air Field. The unit has flown and supported these aircraft, beginning in 2005. The reconnaissance unit is comprised of Air Force members deployed from the 432nd Operations Group, Creech Air Force Base, Nev., and the 27th Special Operations Group, Cannon AFB. Additionally, the British Royal Air Force also operates RPAs from Creech AFB and KAF. The aircraft are operated jointly by the 62nd ERS and by Airmen at Creech AFB and Cannon AFB, as well as by Air National Guard crews located across the U.S. and by RAF crews in the UK. (Tab X-23, CC-7)

b. Aircraft: MQ-1B Predator

The MQ-1B Predator is a medium-altitude, long-endurance, unmanned aircraft system with primary missions of close air support, air interdiction, and ISR. It acts as a Joint Forces Air Component Commander-owned theater asset for reconnaissance, surveillance and target acquisition in support of the Joint Forces Commander. The MQ-1B is actually a system, not just an aircraft, which consists of four aircraft (with sensors and weapons), a Ground Control Station (GCS), a Predator Primary Satellite Link (PPSL), and spare equipment along with operations and maintenance crews for deployed 24-hour operations. The entire system is deployable worldwide for operations and can be transported on almost any Air Force cargo aircraft. (Tabs X-15 and X-16)

Figure 1. Fully Armed MQ-1B Predator Taxiing (Report Cover Page) (Tab CC-6)

Figure 2. Inside View of Ground Control Station (Tab CC-3)

The basic crew for the Predator consists of a pilot to control the aircraft and command the mission and an enlisted aircrew member to operate sensors and weapons plus a mission coordinator, when required. The crew employs the aircraft from inside a GCS via a line-of-sight data link or a satellite data link for beyond line-of-sight operations. The MQ-1B carries the Multi-spectral Targeting System, or MTS-A, which integrates an infrared sensor, a color/monochrome daylight television (TV) camera, an image-intensified TV camera, a laser designator and a laser illuminator into a single package. The full motion video from each of the imaging sensors can be viewed as separate video streams or fused together. The aircraft can

employ two laser-guided AGM-114 Hellfire missiles which possess a highly accurate, low collateral damage, and anti-armor and anti-personnel engagement capability. The aircraft has a wingspan of 55 feet, a maximum takeoff weight of 2,250 pounds, and cruises at 84 miles per hour. (Tab X-15 and Tab X-16)

The aircraft is controlled by two different Ground Control Stations (GCS). The Launch and Recovery Element (LRE), which consists of a crew in a GCS at the forward operating location, uses line-of-sight data link connections between the aircraft and ground data terminal, for takeoff and landing. A stateside crew will control the aircraft via beyond-line-of-sight links and performs the designated mission until the aircraft is ready to land, at which time control is returned to the LRE. (Tab X-16)

4. SEQUENCE OF EVENTS

a. Mission.

On 14 Apr 12, the MPRA was performing a classified tasking in the OEF area of responsibility. (Tab AA-13)

b. Planning and Preflight.

The MRPA launched from the Jalalabad Airbase at 0212Z by the LRE using line of sight (LOS) C-Band transmitters, and was then handed off at 0219Z to the MCE crew via Ku Band satellite transmissions. (Tab AA-3) The launching LRE accomplished all preflight mission requirements and briefed in accordance with standard operating procedures. (Tab R-4, R-16)

The launching LRE conducted a standard preflight, launch, and handoff. No MRPA anomalies were noted and aircraft handover to the MCE crew was uneventful. (Tab AA-3, Tab R-3 through R-16, Tab V-3.1)

The mishap crew (MC) was assigned to the 162d Reconnaissance Squadron and 432d Operations Group, Springfield ANGB, and the MRPA was assigned to Nellis AFB. (Tabs V-1.1, V-5.1, Tab AA-9)

c. Summary of Accident.

At 03:20:24Z, the engine speed dropped from nearly 5,000 RPM to approximately 3,800 RPM with accompanying loss of thrust. (Tab AA-3) At 03:20:47Z, the Mishap Sensor Operator (MSO) notified the Mishap Pilot (MP) that the MRPA was descending. (Tab AA-3) The MP verified aircraft settings but was unable to return the MRPA to its assigned altitude. (Tab V-5.1) At 03:23:00Z, in consultation with the Operations Superintendent (OS), the MP commanded landing configuration to gain manual control of the MRPA's engine. (Tab AA-3) During this time, the aircraft continued away from the LRE, and continued to descend, reaching a final distance away from the LRE of 42 nautical miles (nm). (Tab AA-3) When manual control did

not result in a return to normal engine operations, the MP turned the aircraft back toward the LRE at 03:23:16Z. (Tab AA-3)

The MP and MSO began running the Engine Failure Checklist at 03:24:38Z, at which point, the MRPA was 40 nm from the LRE. Implementation of the checklist resulted in no change to engine operation. At 03:25:14Z, the engine further degraded with revolutions per minute (RPM) and manifold air pressure (MAP) falling below the red warning threshold. (Tab AA-3) Operations supervision coordinated between the aircrew and the 432d WOC Director, gathering guidance on what the MC's course of action should be in recovering the MRPA. Operations supervision interjected with possible courses of action based on aviation experience. (Tab V-2.1) At 03:29:36Z, the OS received direction from the 432d Wing Operations Center (WOC) to crash the MRPA if the mishap crew (MC) was unable to return the MRPA to the LRE. The MC determined that the MRPA was unrecoverable and proceeded, as directed, to crash the MRPA with impact at 0341:13Z, approximately 20 nm away from the LRE. (Tab AA-4)

The MRPA impacted a mountain 20nm to the west of Jalalabad Airbase and was still relatively intact after the crash as indicated in photos taken by other theater assets and the U.S. Army Recovery Team. However, after recovering those parts deemed sensitive, the MRPA and its AGM-114 missile was destroyed by the Recovery Team. (Tab AA-7) The total estimated cost for the MRPA and equipment is $3,832,053.18. (Tab P-3)

d. Egress and Aircrew Flight Equipment.

This section is not applicable for mishaps involving RPA.

e. Search and Rescue.

This section is not applicable for mishaps involving RPA.

f. Recovery of Remains.

This section is not applicable for mishaps involving RPA.

5. MAINTENANCE

a. Forms Documentation.

The active 781-series forms for the MRPA were documented in accordance with applicable maintenance guidance for the MQ-1B, and the forms indicated that the MRPA had no outstanding maintenance issues that would prevent it from flying. The Air Force Technical Order (AFTO) Form 781A for the MRPA had no outstanding issues. The AFTO Form 781J engine time and airframe times were both found to be correct. (Tab U-10 through Tab U-32, Tab D-170) The AFTO Form 781K had delayed discrepancies and the production superintendent, the maintainer who ultimately approves the aircraft for flight, approved the aircraft for flight after

reviewing all forms. (Tab U-18) The production superintendent certified the aircraft for flight. (Tab U-4)

Review of all maintenance forms documentation revealed no factors in the mishap.

b. Inspections.

All required inspections were accomplished on the MRPA, and there were no overdue aircraft time compliance technical orders (TCTOs) directing hardware, software, or inspection criteria modifications. The engine hours log and engine inspection checklist were complied with, with no deficiencies noted. (Tabs U-30 through U-32) The MRPA's next scheduled inspection was a 60-Day Weapons 101 Check due 26 April 2012, 28-day Battery Reconditioning due 6 May 2012, and a 30-Day Records Review due 11 May 2012. (Tabs U-28 through U-29) The next powerplant inspection was a 60-hour engine inspection due at 115 hours. On the date of the incident, the MRPA powerplant had a total of 55.5 hours. (Tab D-170)

c. Maintenance Procedures.

Review of maintenance procedures noted zero discrepancies.

d. Maintenance Personnel and Supervision.

Aircraft maintenance records provided by maintenance personnel indicated all preflight maintenance and supervisory activities were normal. (Tab U-3 through Tab U-32)The AAIB accomplished a thorough review of the training records provided and special certification rosters of those who performed maintenance on the MRPA. All individual training records indicate the maintenance personnel were trained and qualified. (Tab G-19 through G-343) Maintenance personnel qualification and proficiencies were not a factor in this mishap.

e. Fuel, Hydraulic and Oil Inspection Analysis.

Maintenance personnel properly serviced fuel tanks and oil reservoirs in accordance with technical data. The servicing certification on the AFTO Form 781H reflected full oil levels and adequate fuel levels. (Tab U-11 and U-12) The "Info Note" page correctly reflected the 3:2 ratio in the forward and aft fuel tanks per the applicable technical order. (Tab U-13)

f. Unscheduled Maintenance.

All necessary repairs or replacements were properly made when required independent of maintenance schedules and were not a factor to the mishap.

6. AIRCRAFT AND AIRFRAME, MISSILE, OR SPACE VEHICLE SYSTEMS

a. Structures and Systems.

The MRPA impacted a mountain and was still relatively intact after the crash as indicated in photos taken by other theater assets and the U.S. Army Recovery Team. However, after recovering those parts deemed sensitive, the MRPA and its AGM-114 missile were destroyed by the Recovery Team. (Tab AA-7) The MCE GCS was immediately impounded for test and evaluation and determined to not be a factor in the mishap. (Tabs U-3 through U-8)

b. Engineering Evaluations and Analyses.

General Atomics (GA) analyzed the data logger files from the GCS. The GA report asserts that a single point failure of the ignition control system caused both ignition circuits to lose ignition simultaneously. (Tab Z-4) The report also suggests that the rest of the MRPA appeared to be functioning normally and that it continued to react to its own automated inputs and inputs from the MCE crew through the GCS for the remainder of the flight. (Tab Z-4) GA analyzed the maintenance records, and found that the only ignition-related maintenance performed at the most recent inspection was to replace the spark plugs. GA determined that it was unlikely that the spark plug replacement could have caused the anomaly, as they were powered by an independent ignition circuit. (Tab Z-11)

Further analysis led GA to concentrate on where the two separate ignition circuits came together, as the mission data logs showed that both circuits failed simultaneously. (Tab Z-12) Due to redundancy upgrades to the ignition circuits on this particular airframe, the possible failure points were limited to three - the engine kill switch in the Ground Control Station (GCS), the engine kill switch on the exterior of the aircraft, and a unique data and power cable. Data logs confirmed that the engine kill switch in the GCS was never used by the MC and therefore was ruled out as the cause of the ignition failure. (Tab Z-10) The engine kill switch on the exterior of the aircraft is for ground use only and uses a knots indicated airspeed (KIAS) lockout switch (the engine kill switch is rendered useless when the aircraft is operating above a specified KIAS). Since the MRPA was operating above the specified KIAS at the time of the failure, GA deemed it unlikely that this switch was the cause of the failure. This led GA to conclude that the unique cable was most likely the cause of the failure. (Tab Z-4)

7. WEATHER

a. Forecast Weather.

This AAIB did receive the weather forecast that the MC received but the document is classified and therefore is not included in this report. The weather forecast was found to have no bearing on the incident. (Tab F-1)

b. Observed Weather.

The previous pilot acknowledged that there were clouds in the area. The MSO also acknowledged the existence of clouds. The AAIB confirmed the flight conditions from the MRPA HUD tape and found the weather was not a factor in the mishap. (Tab F-1, Tab V-3.1)

c. Operations.

There was no significant weather in the forecast that would affect the ability for the MQ-1B to effectively operate. No evidence suggests weather was a factor in the mishap. (Tab F-1)

8. CREW QUALIFICATIONS

a. Mishap Pilot

(1) **Training**

The MP has been qualified in the MQ-1B since 5 November 2011. (Tab G-4)

(2) **Experience**

MP had a total flight time of 3303.0 hours, with 157.5 hours in the MQ-1B. The MP was designated as an "Inexperienced" crewmember in the MQ-1B. The MP's flight time during the 90 days before the mishap was as follows:

	Hours	Sorties
30 days	31.7	9
60 days	50.4	15
90 days	54.4	16

(Tabs G-6, G-7)

b. Mishap Sensor Operator

(1) **Training**

The MSO has been qualified in the MQ-1B since 22 June 2011. (Tab G-12)

(2) **Experience**

MSO had a total flight time of 378.6 hours, all in the MQ-1B. The MQ-1B was MSO's first flight operations assignment. Prior to becoming a MQ-1 B sensor operator, the MSO was in a non-aviation career field. MSO was designated as an "Inexperienced" crewmember in the MQ-1B. The MSO's flight time during the 90 days before the mishap was as follows:

	Hours	Sorties
30 days	25.5	9
60 days	50.0	17
90 days	53.0	18

(Tab T-3)

9. MEDICAL

a. Qualifications.

At the time of the mishap flight, both crew members had current flight physicals, no known illnesses or injuries, and were medically qualified to perform flying duties. (Tab AA-6)

b. Health.

No health issues for the mishap crew members were relevant to the cause of the mishap. (Tab AA-6)

c. Pathology.

Pathology was not applicable to this mishap. (Tab AA-6)

d. Lifestyle.

No lifestyle factors were found to be relevant to this mishap. (Tab AA-6)

e. Crew Rest and Crew Duty Time.

Aircrew members are required to have 12 hours of crew rest, eight of which must be uninterrupted, and both mishap crew members reported having the required amount of sleep prior to the mishap. (Tab AA-6)

10. OPERATIONS AND SUPERVISION

a. Operations.

Operations tempo was thoroughly investigated and found not a factor in this mishap flight.

b. Supervision.

Operations supervision was thoroughly investigated and found not a factor in this mishap flight.

11. HUMAN FACTORS ANALYSIS

A human factor is any environmental or individual physical or psychological factor a human being experiences that contributes to or influences his performance during a task. There is no evidence to suggest that any human factors contributed to this mishap.

12. GOVERNING DIRECTIVES AND PUBLICATIONS

We reviewed multiple Technical Orders (TOs). The applicable TOs were not releasable, either due to containing proprietary information, or because of the Arms Export Control Act.

a. Known or Suspected Deviations from Directives or Publications.

There are no known or suspected deviations from directives or publications.

13. ADDITIONAL AREA OF CONCERN

None.

6 August 2012

BRETT M. THOMAS, Lt Col, USAF
President, Abbreviated Accident Investigation Board

STATEMENT OF OPINION
MQ-1B T/N 07-3220 ACCIDENT
14 APRIL 2011

Under 10 U.S.C. 2254(d), the opinion of the accident investigators 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:

Based on aircraft records, mission data logs, the Mishap Remotely Piloted Aircraft (MRPA) Heads-up Display (HUD) and voice recordings, maintenance records, interviews with the Mishap Crew (MC), interviews with operations supervision and support personnel, and General Atomics (GA) reports, I find by clear and convincing evidence that the cause of the mishap was engine failure. Specifically, the MRPA experienced a single point failure that caused a loss of ignition from both ignition circuits simultaneously. By a preponderance of the evidence, I find that a substantially contributing factor to this single point failure was a failure of the unique data and power cable. The evidence points to this cable, because it was the only point on this particular MQ-1B that joined the two ignition circuits.

2. DISCUSSION OF OPINION:

On 14 April 2012, an MQ-1B (T/N 7-3220) suffered an engine failure 87 minutes into the mission from which the Mishap Crew (MC) could not recover and the MRPA impacted the ground approximately 20 nautical miles (nm) short of the intended landing airfield. Review of the mission data logs, interviews with the MC and the crew operating the MRPA prior to the incident, and review of the MRPA HUD and voice recordings revealed no issues with the engine prior to the first indication at 03:20:24Z. The engine never recovered and failed to respond to MC inputs throughout the remainder of the flight.

General Atomics (GA) analyzed the mission data logs and tested the Secondary Control Module (SCM) from the MRPA to construct their Contractor Report. Their analysis of the data suggests that the engine failure was caused by a single point failure of the aircraft ignition system. Further analysis led GA to concentrate on where the two separate ignition circuits came together, as the mission data logs showed that both circuits failed simultaneously. Due to redundancy upgrades to the ignition circuits on this particular airframe, the possible failure points were limited to three - the engine kill switch in the Ground Control Station (GCS), the engine kill switch on the exterior of the aircraft, and the unique data and power cable. Data logs confirmed that the engine kill switch in the GCS was never used by the MC and therefore was ruled out as the cause of the ignition failure. The engine kill switch on the exterior of the aircraft is for ground use only and uses a knots indicated airspeed (KIAS) lockout switch (the engine kill switch is rendered useless when the aircraft is operating above a specific KIAS). Since the MRPA was operating above the specified KIAS at the time of the failure, GA deemed it unlikely

that this switch was the cause of the failure. This led GA to conclude that the cable was most likely the cause of the failure.

A thorough review of aircraft maintenance forms and maintenance personnel qualifications showed no anomalies in the forms and revealed no deficiencies in maintenance personnel qualifications. Because this incident was caused by an engine failure and specifically an engine ignition failure, any maintenance performed on these systems immediately prior to the incident was examined. At the beginning of the flight on 14 April 2012, the engine had 55.5 total hours. The only ignition-related maintenance function was to replace the spark plugs. Based on the GA report and witness testimony, this was deemed to have any impact on the mishap.

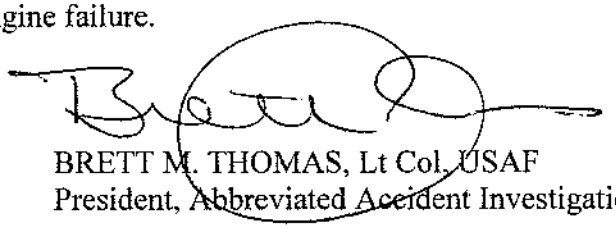
I reviewed the actions of the aircrew operating the MRPA prior to the engine failure and the operations supervision, to determine if the actions by these individuals had any negative effects on the mishap. Operations supervision coordinated between the aircrew and the 432d WOC Director, gathering guidance on what the MC's course of action should be in recovering the MRPA. Operations supervision had a positive impact on the scenario by interjecting with possible courses of action based on numerous years of aviation experience. The crew that operated the MRPA prior to the engine failure followed all current technical orders and operated the MRPA in accordance with current guidance. They reported no aircraft anomalies and performed adequate crew briefings with the MC.

Finally, I investigated the actions of the MC. The MSO noticed that the aircraft was descending and brought this to the MP's attention at 03:20:47Z. Because the engine only partially rolled back, the MP diagnosed the descent as an uncommanded action versus an engine failure. The MP made several inputs to the MRPA based on this diagnosis. At 03:22:58Z, the Operations Supervisor suggested disengaging the autopilot to manually return the MRPA back to the assigned altitude. The MP disengaged the autopilot and attempted to advance the throttle. When the engine did not respond to the throttle inputs, the MP turned the MRPA towards the airbase, diagnosing the situation as an engine failure. The MC ran the appropriate checklists for the scenario covering all steps. The MC, along with inputs from operations supervision, attempted to get the engine to respond while recovering the MRPA to the airbase. At 03:30:00Z it was determined that the MRPA would not be able to return to base and the MRPA impacted the ground at 03:41:13Z, 20nm short of the airbase.

While the MC continued their analysis of the engine rollback, the MRPA continued to descend and travel further away from the LRE. I determined that earlier diagnosis of the mishap as an engine failure, as compared to the MC believing it was an uncommanded descent, would not have resulted in a successful recovery of the aircraft. I find, given the distance from the airbase that when the MRPA's engine initially showed abnormal operation, that the MRPA was unrecoverable even from that point. Therefore, the actions of the MC were not causal or contributory to the mishap.

I find by clear and convincing evidence the cause of the mishap was an engine failure. By a preponderance of the evidence I find specifically that a single point failure in the ignition system caused the simultaneous loss of both ignition control circuits. Due to the physical

distance from the airbase at the time of the engine failure, the MRPA could not be recovered at the point of first indications of engine failure.



6 August 2012

BRETT M. THOMAS, Lt Col, USAF
President, Abbreviated Accident Investigation Board

Under 10 U.S.C. 2254(d), the opinion of the accident investigators 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.