UNITED STATES AIR FORCE
AIRCRAFT ACCIDENT INVESTIGATION
BOARD REPORT

MQ-1B T/N 08-3228
432D WING
CREECH AIR FORCE BASE, NEVADA

LOCATION: REPUBLIC OF DJIBOUTI

DATE OF ACCIDENT: 14 JANUARY 2011

BOARD PRESIDENT: LIEUTENANT COLONEL JEFFREY S SCHWOOB

Conducted IAW Air Force Instruction 51-503

Abbreviate Accident Investigation pursuant to Chapter 11

EXECUTIVE SUMMARY

ABBREVIATED AIRCRAFT ACCIDENT INVESTIGATION
MQ-1B T/N 08-3228, Republic of Djibouti
14 JANUARY 2011

On 14 January 2011, at 1617 Zulu (Z) time, the mishap remotely piloted aircraft (MRPA), a MQ-1B Predator, tail number (T/N) 08-3228, crashed in the Gulf of Aden while returning to an undisclosed base approximately nine and a half hours after takeoff. Destruction of the MRPA with two missiles was assessed to be a financial loss of $4,120,000. No injuries, damage to other government property, or damage to private property occurred as a result of the mishap.

The aircraft belonged to the 432d Wing at Creech Air Force Base (AFB), Nevada, but was deployed at the time in support of Operation HORN OF AFRICA. The crew flying the aircraft at the time of the mishap was from the 3rd Special Operations Squadron at Cannon AFB. Maintenance support was provided by the 49th Aircraft Maintenance Squadron, Holloman AFB.

After normal pre-flight checks, the MRPA taxied and departed a Forward Operating Base (FOB) at 0702Z. Handover procedures from the Launch and Recovery Element to the first Mission Control Element (MCE) were uneventful. At 1330Z the MRPA oil pressure became erratic with momentary deviations below 30 pounds per square inch with no other engine abnormalities. The MCE ran appropriate procedures and elected to return to the FOB. On the return leg no further abnormal engine indications were observed and the MCE crew swapped out with the mishap crew (MC). The MC began a descent from the cruise altitude into the approach control structure approximately 144 miles from the FOB. During an intermediate level off the MC noticed erratic and low oil pressure indications which prompted the MC to run the low oil pressure procedures. The MC then descended the MRPA to 12,500 feet, leveled off for approximately 25 minutes until a piston, piston ring, valve, valve spring, push-rod, or rocker-arm in cylinder #3 experienced a catastrophic failure. The cylinder head and piston were likely heavily damaged and pumped engine oil out of the cylinder. The wind-milling engine continued driving the oil pump, which pumped the remaining oil out of the tank until the oil tank was empty and the engine seized. The MRPA glided approximately 30 miles before making a forced water-landing three miles off-shore. The MRPA was a total loss and not recovered.

The Accident Investigation Board President determined by clear and convincing evidence that the cause of the mishap was engine failure. Specifically, the catastrophic failure of the #3 cylinder resulted in the depletion of the oil system and subsequent engine seizure. The Board President was not able to determine the cause of the cylinder failure since the MRPA's engine was not recovered.

Under 10 U.S.C. 2254(d), any opinion of the accident investigators as to the cause of, or the factors contributing to, the accident set forth in the accident investigation report 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 T/N 08-3228
14 JANUARY 2011

TABLE OF CONTENTS

COMMONLY USED ACRONYMS & ABBREVIATION

ACC	Air Combat Command	MCE	Mission Crew Element
AEW	Air Expeditionary Wing	ME	Mishap Engine
AIB	Accident Investigation Board	MIS	Maintenance Information System
AAIB	Abbreviated Accident Investigation Board	MP	Mishap Pilot
		MRPA	Mishap Remotely Piloted Aircraft
AF	Air Force	MS	Mishap Sortie
AFB	Air Force Base	MSL	Mean Sea Level
AFI	Air Force Instruction	MSO	Mishap Sensor Operator
AFTO	Air Force Technical Order	OG	Operations Group
AFSOC	Air Force Special Operations Command	PPSL	Predator Primary Satellite Link
		RPA	Remotely Piloted Aircraft
ATC	Air Traffic Control	RPM	Revolutions Per Minute
EGT	Exhaust Gas Temperature	RS	Reconnaissance Squadron
FOB	Forward Operating Base	RW	Reconnaissance Wing
GA	General Atomics	S/N	Serial Number
GCS	Ground Control Station	SOF	Special Operations Forces
HUD	Head-up Display	SOS	Special Operations Squadron
IMDS	Integrated Maintenance Data System	SATCOM	Satellite Communications
IAW	In Accordance With	TCTO	Time Compliance Technical Order
ISR	Intelligence, Surveillance and Reconnaissance	TO	Technical Order
		TV	Television
JBB	Joint Base Balad	USAF	United States Air Force
KIAS	Knots Indicated Airspeed	USAFCENT	United States Air Forces Central
L	Local Time	USCENTCOM	United States Central Command
LOS	Line of Sight	Z	Zulu or Greenwich Meridian Time (GMT)
LRE	Launch and Recovery Element		
MC	Mishap Crew		

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 15 February 2011, Lieutenant General William J. Rew, Vice Commander Air Combat Command, appointed Lieutenant Colonel Jeffrey S. Schwoob as the Abbreviated Accident Investigation Board (AAIB) President to investigate the 14 January 2011 crash of an MQ-1B Predator aircraft, tail number T/N 08-3228. An abbreviated AIB was conducted at Nellis Air Force Base (AFB), Nevada, from 23 February 2011 to 10 March 2011, 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 pilot, doctor, and maintenance officer were detailed as Functional Area Experts. (Tab Y-3, Y-4)

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

After preflight checks, the MRPA taxied and departed from a Forward Operating Base (FOB) in the Republic of Djibouti, at 0702Z. Approximately nine hours into the flight, the MRPA experienced a catastrophic oil leak causing the engine to seize. The MRPA was beyond glide distance to any suitable landing location and crashed approximately three miles off the coast of the Republic of Djibouti in the Gulf of Aden. The aircraft was totally destroyed upon impact with the loss valued at $4,120,000. There were no injuries or damage to personal property. (Tabs P-3 and DD-6, DD-7, GG-5)

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 67,000 active duty members, 13,500 civilians, and when mobilized, 50,000 Air National Guard and Reserve members compose ACC, and its units operate 1,800 aircraft. (Tab CC-5, CC-6, CC-7)

(2) Air Force Special Operations Command (AFSOC)

AFSOC is headquartered at Hurlburt Field, FL, and is one of ten major Air Force commands. AFSOC provides Air Force special operations forces for worldwide deployment and assignment to regional unified commands. The command's Special Operations Forces (SOF) are composed of highly trained, rapidly deployable Airmen conducting global special operations missions ranging from precision application of firepower, to infiltration, ex-filtration, resupply and refueling of SOF operational elements. (Tab CC-8, CC-9, CC-10)

(3) 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. It manages all Air Force assets and personnel in the AFSOUTH AOR, which includes Central and South America. 12th Air Force has worked closely with nations in the Caribbean, Central and South America in the Global War on Terrorism by providing forces to OEF, OIF, and Operation NOBLE EAGLE, and it also has supported efforts to stem the flow of illegal drugs into the U.S. and neighboring countries. 12th Air Force directs 10 active duty wings and one direct reporting unit as well as 13 gained wings and other units of the Air National Guard and Reserve. (Tab CC-11, CC-12)

(4) 432d Wing (432 WG)

The 432d Wing (432 WG), stationed at Creech AFB, Nevada, flies the MQ-1B Predator and MQ-9 Reaper 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 a maintenance squadron. The wing and its subordinate units are components of the Air Force's ACC and 12 AF. (Tab CC-15)

(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 CC-15)

(6) 3rd Special Operations Squadron (3 SOS)

The 3rd SOS accomplishes global special operations tasking as a member of the Air Force component of United States Special Operations Command. It directly supports theater commanders by providing precision weapons employment and persistent intelligence, surveillance, and reconnaissance. It also plans, prepares, and executes MQ-1B Predator missions supporting special operations forces. (Tab CC-13, CC-14)

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 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. (Tab CC-3, CC-4)

Figure 1. Fully Armed MQ-1B Predator Taxiing

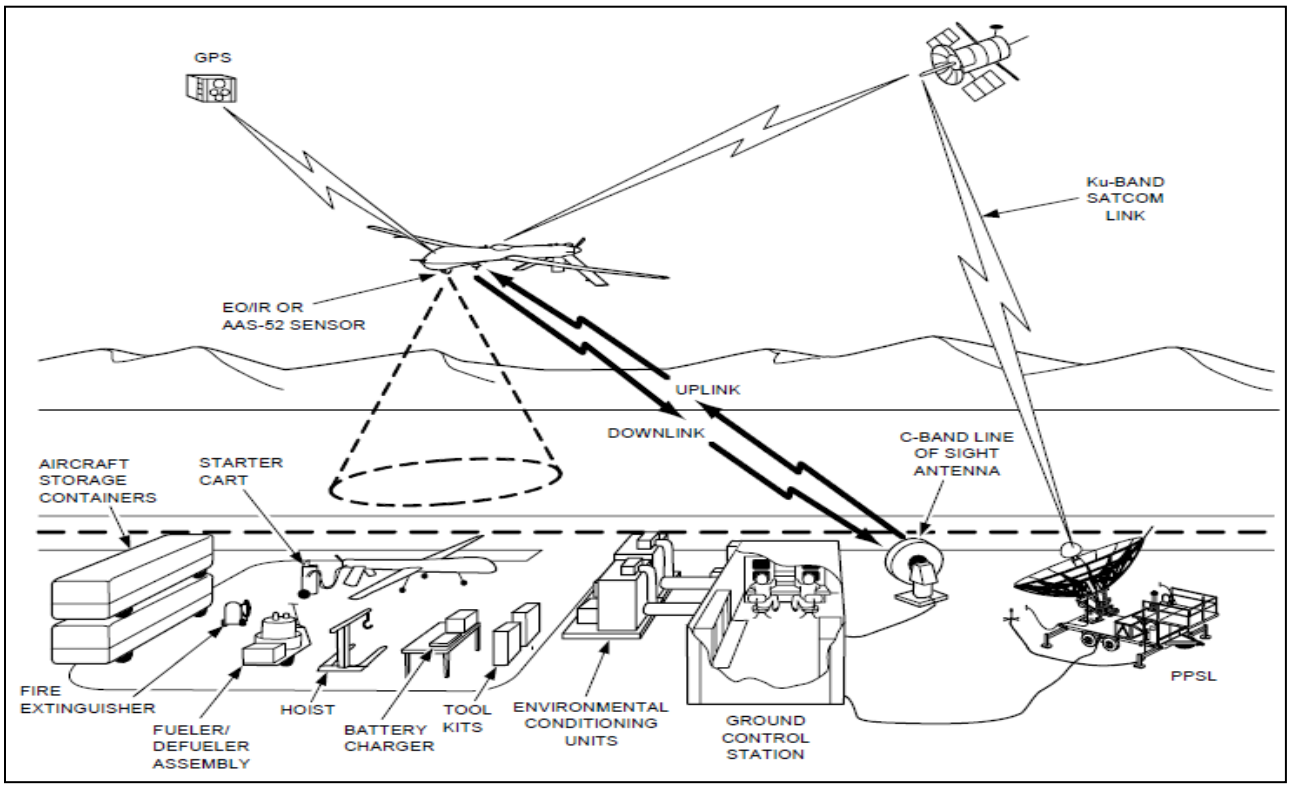

Figure 2. Typical Components of the MQ-1B System

Figure 3. Inside View of Ground Control Station

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 CC-3, CC-4)

The aircraft is initially controlled by a launch and recovery element (LRE), which consists of a crew in a GCS at the same airfield as the aircraft, using line-of-sight data link connections between the aircraft and ground data terminal, which is a radio antenna at the same airfield. The LRE is typically deployed in a theater of operations, where it will launch the aircraft, get it to a specified altitude, accomplish a systems check, and via either multi-user internet relay chat or a phone call, hand the aircraft off to a stateside GCS in what is called remote split operations. The stateside GCS crew will control the aircraft via Ku-band satellite data link and performs the designated mission until the aircraft is ready to land at which time control is returned to the LRE. Some missions, however, such as local base defense missions, are performed entirely by the LRE using the line-of-sight data link with the aircraft. (Tab CC-3, CC-4)

4. SEQUENCE OF EVENTS

a. Summary of Previous Missions.

On 7 January 2011 the mishap engine (ME), serial number 6773403, was installed onto the mishap remotely piloted aircraft (MRPA) in order to perform periodic maintenance on the replaced engine. On its first three flights, 10 January, 11 January and 12 January 2011, the MRPA air aborted for low oil quantity. As evidenced by the sortie durations for these three flights, 15.6 hours, 17.8 hours and 17.1 hours respectively, the indications that triggered the decision to return early were encountered late in the mission profile. (Tab D, Tab DD-8) Post flight maintenance on the first sortie included a calibration of the oil sensor. On the second abort, there was visible fluid leaking from the back of the MRPA. Maintenance corrective action included the replacement of the #4 cylinder head O-ring. On the third air abort, a leak in the turbo oil sensor was identified and corrected and the oil level sensor was replaced and calibrated. On 13 January, the MRPA flew a 17.4 hour sortie and landed at 0031 Zulu (Z) on 14 January 2011, without incident. The mishap sortie launched at 0702Z on 14 January 2011. (Tab K-5)

b. Planning.

The mishap crew (MC), functioning as the second Mission Crew Element (MCE), was assigned to the 3 SOS, Cannon AFB, and the MRPA was assigned to the 432 Wing at Creech AFB.

The MRPA launched from the Republic of Djibouti at 0702Z by the LRE using line of sight (LOS) C-Band transmitters then handed off at 0722Z to the first MCE crew via Ku Band satellite transmissions. (Tab K-5, Tab V-2.2 through V-2.4)

The MC accomplished all preflight mission requirements and briefed in accordance with standard operating procedures. (Tab V-2.4) This was their first sortie of the day and the third crew to pilot the MRPA, including the Launch and Recovery Element (LRE). (Tab K-5, Tab V-2.2) The MC assumed control of the MRPA on its return leg, approximately 7 hours and 28 minutes into the flight. (Tab T-3)

c. Preflight.

The LRE conducted a normal preflight, launch, and handoff. (Tab V-3.3)

d. Summary of Accident.

Prior to the MCE crew handoff, the LRE did not notice any anomalies with the MRPA and did not pass any information of abnormal indications to the MCE crew. (Tab V-3.3) The first MCE crew to pilot the MRPA gained control at 0722Z. (Tab K-5) No other anomalies were reported during the climb out, transit and mission execution. Approximately six hours into the mission, the MCE crew noticed three momentary spikes of low oil pressure over the course of three to five. The oil pressure went from the normal operating range of 32-90 pounds per square inch (psi) to below the minimum of 28 psi for four to five seconds then returned to normal. The MCE

crew ran the Low Oil Pressure Checklist and referenced the expanded T.O. 1Q-1(M)B-1, which prompted the decision to return to base (RTB) at approximately 1330Z (Tab K-5, Tab V-3.3 through V-3.4, and Tab DD-3). The initial portion of the RTB was flown at 18,000 feet and 71 knots (Tab DD-5 through DD-6).

At 1430Z, the MC assumed control of the MRPA per scheduled handover. The MCE crew briefed the MC regarding the RTB plan and the need to monitor the oil system (Tab V-1.3, and V-2.2). At 1502Z the MC began a descent from 18,000 to 15,500 feet. A few minutes after the MRPA leveled off, the oil pressure began fluctuating between 40-80 psi with momentary spikes into the 20s, which continued until complete engine failure (Tab DD-3). The MC ran the Low Oil Pressure Checklist and referenced the expanded T.O. 1Q-1(M)B-1(Tab V-1.4 and V-2.3). At 1518Z the MC descended from 15,500 to 12,500 feet, and leveled off at 1524Z. (Tab DD-5 through DD-6) At 1546Z the engine became very erratic but maintained between 4400 and 5000 revolutions per minute (RPM) (Tab DD-5 through DD-6). Two minutes later the RPM jumped into the low 5000s and the Exhaust Gas Temperature on cylinder #3 dropped to 574° F (Tab DD-3, Tab DD-5 through DD-6). At 1550Z the RPM fell to 1000 and stabilized for 2 minutes. During this time the Mishap Sensor Operator (MSO) turned the camera aft and confirmed the propeller was windmilling. (Tab V-2.3 and Tab DD-5 through DD-6) Windmilling refers to the propeller being driven by air stream rather than engine power. The RPM went back into normal operating range for about thirty seconds before engine seizure at 1552Z (Tab DD-5 through DD-6). Without power, the MC followed engine failure procedures and established the best rate of glide toward the FOB. As the MQ-1B was beyond glide distance from a suitable landing site, the MC performed a forced water-landing (Tab V-2.3, and Tab DD-5 through DD-6).

e. Impact

At 1617Z, the MRPA impacted the water approximately 3 miles from the shore and 52 miles from the FOB (Tab DD-5 through DD-6). Other RPA assets and rescue personnel were employed to search for the MRPA shortly after impact (Tab DD-3). The MRPA wreckage, including the attached missiles, was not recovered. The total cost for the MRPA and equipment is estimated at $4,120,000.00.

f. Egress and Aircrew Flight Equipment.

This section is not applicable for mishaps involving RPA.

g. Search and Rescue.

This section is not applicable for mishaps involving RPA.

h. 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 (IAW) 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 only had three outstanding issues; a 28-day battery check for the #1 battery, a 28-day battery check for the #2 battery, and a required satellite communications radome removal documentation entry. (Tab D-12) No delayed discrepancies were noted on the AFTO Form 781K, and the production superintendent, the maintainer who ultimately approves the aircraft for flight, approved the aircraft for flight after reviewing all forms. The production superintendent certified the aircraft for flight. (Tab D-25)

A 30-day pre-mishap history check in Maintenance Information System (MIS) and AFTO 781-series forms, revealed several maintenance issues in the seven days leading up to the mishap. (Tab DD-8) On 7 January 2011, the ME was installed onto the MRPA. The ME had all required operational checks performed and documented in the AFTO 781-series forms. The ME underwent a 360/720-hour inspection completed 15 December 2010. (Tab D-199) On 10 January 2011, the MRPA air aborted due to a low oil quantity indication with the oil level decreasing to 36% in descent with 53% observed in level flight. (Tab DD-8) Upon return maintenance calibrated the oil level sensor IAW applicable maintenance guidance and serviced the engine with 3 quarts of oil. A ground engine run and oil servicing check was performed with no defects noted. (Tab D-166) On 11 January 2011, the MRPA air aborted a second time due to a low oil quantity indication, with the oil level decreasing to 33% in a descent with 53% observed during level flight. Upon return, maintenance identified a leak from the #4 cylinder O-ring seals. The O-ring seals were replaced IAW applicable maintenance guidance and the ME was serviced with 9 quarts of oil followed by a ground run with no defects noted. (Tab D-71) On 12 January 2011, the MRPA air aborted for a third time due to low oil quantity indication with oil level decreasing to 46%. Upon return, maintenance tightened the turbo oil temperature sensor and oil drain port. During a subsequent engine run, the discrepancy continued. Maintenance replaced the oil level sensor and performed calibration and operational checkout procedures IAW applicable maintenance guidance. At the same time, maintenance elected to perform the 150-hour airframe and 60-hour engine inspection. No defects were noted during either inspection. An in-flight operational check for the oil quantity system was performed with no defects on 13 January 2011. On 14 January 2011, maintenance performed a thru-flight inspection, serviced fuel and launched the aircraft on the mishap sortie. (Tab D-83, Tab D-86, and Tab D-98)

b. Inspections.

All required inspections were accomplished on the MRPA, and there were no overdue Aircraft Time Compliance Technical Orders directing the modification of the aircraft or the performance of any inspection for the aircraft. The MRPA's next scheduled inspection was a 28-day battery check due 15 January 2011 and a 60-hour engine inspection due in 41 flying hours. (Tab D-5 through Tab D-35)

c. Maintenance Procedures.

Review of maintenance procedures noted the following discrepancies.

1. The second air abort for low oil quantity was a repeat discrepancy. Air Force Instruction (AFI) 21-101 Holloman AFB Sup 1, 6 October 2010 paragraph 4.7.6.1 states "All repeat/recurs are identified on automated debriefing sortie recaps and in the AFTO Form/IMT 781A by automated method, stamp, pen, marker, etc." (Tab BB-3) The AFTO 781As were not documented IAW this paragraph.

2. As a result of the failure to correctly identify the discrepancy as a repeat, the discrepancy was signed off at the wrong level as required by AFI 21-101 Holloman AFB Sup 1. (Tab BB-3)

3. Similarly, the third air abort should have been written up as a second repeat IAW the AFI. This discrepancy should have been reviewed by AMU supervision IAW the same supplement, paragraph 4.7.6.1.1. (Tab BB-3) These requirements are mirrored by 380 AEWI 21-101, 28 September 2009 paragraph 6.10.1.1. (Tab BB-5) Although this review was not documented, it was not considered causal or contributory to this accident. (Tab DD-8)

4. Finally, the MIS debrief recap for the flight prior to the mishap shows a take-off time of 2310Z and a land time of 1631Z. The AFTO 781 reflects a take-off time of 0710Z and a land time of 0031Z. (Tab T-3) Thru-flight inspection documentation corroborates the AFTO 781 documented time as being correct, therefore the debrief entry time was made in error. (Tab T-3)

d. Maintenance Personnel and Supervision:

Aircraft maintenance records and statements provided by maintenance personnel indicated all preflight maintenance and supervisory activities were normal. (Tab DD-8) A thorough review of the training records provided and special certification rosters of those who performed maintenance on the MRPA were accomplished. Absent above discrepancies, all individual training records indicate they were trained and qualified. Maintenance personnel qualification and proficiencies were not a factor in this mishap. (Tab DD-8)

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. The "Info Note" page correctly reflected the 3 to 2 ratio in the forward and aft fuel tanks per the applicable technical order. (Tab D-7, and Tab D-25). Fuel and oil samples were not performed due to the wreckage being unrecoverable. The General Atomics (GA) report lists as a possible factor poor fuel quality may have caused damaged pistons or cylinder walls, however, fuel could not be tested and numerous sorties from same location have been flown without incident. (Tab EE- 7) The GA report also listed debris in the oil system as a possible cause; however, no oil was recovered for testing. (Tab EE-8)

f. Unscheduled Maintenance.

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

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

a. Structures and Systems.

The MRPA impacted the water and was not recovered. The ground control station (GCS) was immediately sequestered for test and evaluation. (Tab GG-7 and Tab GG-8)

b. Engineering Evaluations and Analyses.

GA analyzed the data logger files from the GCS since the MRPA was not recovered. The GA report concluded that the turbocharger, propeller, and throttle assemblies were working properly up to the time of engine failure. The first indication of engine problem noted by the report is a drop in the #3 cylinder exhaust gas temperature (EGT), an increase in Manifold Absolute Pressure (MAP), engine speed and oil pressure. GA concluded the mishap was most likely caused by a failed piston, piston ring, valve, valve spring, push-rod, or rocker-arm in cylinder #3. The report indicated that either debris in the oil system or a collapsed oil feed line most likely caused the failure of a component in the cylinder. It further states that failure to remove an old O-ring when replacing it could lead to fragmentation of any extruding rubber thereby introducing the debris into the oil system. (Tab EE-8)

7. WEATHER

a. Forecast Weather.

The forecasted weather for the FOB at the time of the incident was winds out of 110 degrees at 9 knots, visibility of 7 statute miles and few clouds at 3000 feet above the ground. The transit forecast was few clouds from 2000 to 6000 Mean Sea Level (MSL) and few clouds from 15000 to 17000 MSL. The freezing level was expected to be at 14000 MSL, and there were no other significant weather issues in the forecast.

b. Observed Weather.

Satellite imagery for the mishap location and where the aircraft was operating is classified. Also, no weather observations were able to be obtained for the mishap date.

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)

8. CREW QUALIFICATIONS

a. MCE crew Pilot

(1) Training

MCE crew pilot was qualified in the MQ-1B as a pilot since 6 March 2008.

(2) Experience

The MCE crew pilot had a total flight time of 3402.6 hours, with 1475.8 hours in the MQ-1B. The MQ-1B was the MCE crew pilot's second assigned aircraft after the KC-10. The MCE crew pilot was designated as an "Experienced" crewmember in the MQ-1B (had more than 500 hours flying the aircraft). The MCE crew pilot's flight time during the 90 days before the mishap was as follows:

	Hours	Sorties
30 days	53.4	23
60 days	95.7	51
90 days	126.5	80

(Tabs G-4 through G-34 and G-98)

b. MCE Sensor Operator

(1) Training

The MCE SO has been a qualified MQ-1B sensor operator since 10 August 2010.

(2) Experience

The MCE SO had a total flight time of 235.9 hours, all in the MQ-1B. The MQ-1B was the MCE SO's first flight operations assignment. Prior to becoming a MQ-1 B sensor operator, the MCE SO was in a non-aviation career field. The MCE SO was not designated as an "Experienced" crewmember in the MQ-1B. The MCE SO's flight time during the 90 days before the mishap was as follows:

	Hours	Sorties
30 days	108.5	16

60 days	224.1	46
90 days	235.9	49

(Tabs G-36 through G-54 and G-99)

c. Mishap Pilot

(1) **Training**

MP was qualified in the MQ-1B as a pilot since 3 November 2009.

(2) **Experience**

MP had a total flight time of 2770.8 hours, with 760.4 hours in the MQ-1B. The MQ-1B was MP's second assigned aircraft after the UH-1N. MP was designated as an "Experienced" crewmember in the MQ-1B. The MP's flight time during the 90 days before the mishap was as follows:

	Hours	Sorties
30 days	40.7	11
60 days	77.1	32
90 days	102.3	63

(Tabs G-55 through G-81 and G-100)

d. Mishap Sensor Operator

(1) **Training**

MSO has been a qualified MQ-1B sensor operator since 7 September 2010.

(2) **Experience**

MSO had a total flight time of 127.4 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 not designated as an "Experienced" crewmember in the MQ-1B. The MSO's flight time during the 90 days before the mishap was as follows:

	Hours	Sorties
30 days	79.4	12
60 days	102.9	18
90 days	102.9	18

(Tabs G-82 through G-96 and G-101)

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 DD-11)

b. Health.

No health issues for the mishap crew members were relevant to the cause of the mishap.

c. Pathology.

Pathology was not applicable to this mishap.

d. Lifestyle.

No lifestyle factors were found to be relevant to this mishap.

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 DD-11)

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

a. Primary Operations Directives and Publications.

(1) T.O. 1Q-1(M)B-1, USAF Series MQ-1B and RQ-1B Systems, 1 November 2003, incorporating change 13, 8 April 2009
(2) T.O. 1Q-1(M)B-1CL-1, USAF Series MQ-1B and RQ-1B Systems Flight Checklist, 1 November 2003, incorporating Change 15, 8 April 2009
(3) AFI 11-2MQ-1, Volume 1, MQ-1 Aircrew Training, 21 January 2010
(4) AFI 11-2MQ-1, Volume 2, MQ-1 Crew Evaluation Criteria, 28 November 2008
(5) AFI 11-2MQ-1, Volume 3, MQ-1 Operations Procedures, 29 November 2007
(6) AFI 11-418, Operations Supervision, 21 October 2005, incorporating Change 1, 20 March 2007
(7) AFI 11-401, Aviation Management, 7 March 2007, incorporating through Change 2, 18 May 2009
(8) AFI 11-202, Volume 3, General Flight Rules, 22 October 2010

b. Maintenance Directives and Publications.

(1) T.O. 1Q-1(M)B-2-93GS-00-1, General System Surveillance, 8 February 2010
(2) T.O. 1Q-1(M)B-5-1, Basic Weight Checklists, USAF Series, MQ-1B Remotely Piloted Aircraft, 26 March 2010
(3) T.O. 00-20-1, Aerospace Equipment Maintenance Inspection, Documentation, Policies, and Procedures, 1 September 2010
(4) T.O. 1Q-1(M)B-2-48JG-00-1, Job Guide, Communication/Navigation/Identification, General, USAF Series, MQ-1B Remotely Piloted Aircraft, 09 October 2009
(5) T.O. 1Q-1(M)B-2-32JG-10-1, Job Guide, Landing Gear, Main Gear, Extension/Retraction, USAF Series, MQ-1B Remotely Piloted Aircraft, 2 January 2010
(6) T.O. 1Q-1(M)B-2-32JG-10-1, Job Guide, Landing Gear, Main Gear, Extension/Retraction, USAF Series, MQ-1B Remotely Piloted Aircraft, 2 January 2010
(7) T.O. 1Q-1(M)B-2-05JG-10-1, Ground Handling USAF Series, MQ-1B Remotely Piloted Aircraft, 9 Jun 2009, thru change 5 21 July 2010
(8) T.O. 1Q-1(M)B-6WC-1, Preflight, Thruflight, Basic Postflight, Combined Basic Postflight/Preflight inspection requirements, ASAF Series, MQ-1B Remotely Piloted Aircraft, 21 January 2010
(9) T.O. 1Q-1(M)B-6WC-2, Aircraft Periodic Inspections and Maintenance Requirements, USAF Series, MQ-1B Remotely Piloted Aircraft, 21 January 2010

(10) T.O. 1Q-1(M)B-2-72JG-00-2, Job Guide Engine Reciprocating General Volume II, USAF Series MQ-1B and RQ-1B Remotely Piloted Aircraft, 08 June 2010
(11) T.O. 1Q-1(M)B-6, Aircraft Scheduled Inspection and Maintenance Requirements, USAF Series MQ-1B Remotely Piloted Aircraft, 21 January 2010
(12) AFI 21-101, Aircraft and Equipment Maintenance Management, 26 July 2010
(13) AFI 21-101, Holloman AFB Supplement 1, Aircraft and Equipment Maintenance Management, 6 October 2010
(14) 380 AEWI 21-101, Aircraft and Equipment Maintenance Management, 28 September 2009

c. Known or Suspected Deviations from Directives or Publications.

There are deviations noted in section 5 Maintenance. Please see above. These deviations were found not to be causal or contributory.

13. ADDITIONAL AREA OF CONCERN

The MC elected to descend from cruise altitude at a distance that was not within engine out glide range from the FOB. This decision was based off the MRPA having normal engine indications at the time of the descent and Air Traffic Control let down procedures to the FOB. The first time the MC reviewed the Low Oil Pressure procedure was during the level-off at 15,500 feet and in response to the first indications they encountered for low oil pressure. At the time of the engine seizure the aircraft was below engine out glide range from the FOB. The Low Oil Pressure procedure was changed in December of 2010 but due to reproduction limitations and logistical challenges associated with MQ-1 locations, was not released to the units until February of 2011. This change incorporated a "warning" to the Low Oil Pressure procedure that stated "Minimize power setting changes". A "warning" is an operating procedure, technique, etc., which could result in personal injury and/or loss of life if not carefully followed.

9 March 2011

JEFFREY S. SCHWOOB, Lt Col, USAF
President, Accident Investigation Board

STATEMENT OF OPINION
MQ-1B T/N 08-3228 ACCIDENT
14 JANUARY 2011

Under 10 U.S.C. 2254(d), any 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 maintenance records, interviews with the individuals involved in the maintenance accomplished prior to the crash, interviews with the MCE crew and MC, the GA report and information provided by the functional area experts, I find by clear and convincing evidence that the cause of the mishap was engine failure. This failure was most likely caused by a catastrophic malfunction in the #3 cylinder. This malfunction could have been the result of material failure of the cylinder parts, debris in the oil system or oil feed line collapse; none of which could be conclusively labeled as causal since the recovery of the MRPA was not possible.

3. DISCUSSION OF OPINION:

On 14 January 2011, an MQ-1B (T/N 08-3228) suffered catastrophic engine seizure due to loss of oil and crashed 3 miles off the coast of the Republic of Djibouti. The aircraft's engine was replaced on 7 January 2011 and flew four times prior to the crash. Three of the previous flights were aborted early due to low oil quantity readings. On the sortie prior to the mishap, the aircraft flew an uneventful 17.4 hour sortie indicating that previous maintenance solved the low oil quantity problem.

During the mishap sortie, the MCE crew returned to the FOB because of low oil pressure. The MCE crew swapped out with the MC at approximately 1430 hours. When the MRPA descended to 15,500 feet, the MC noticed the low #3 EGT indication, this was followed shortly by the seizure of the engine. This was confirmed by the GCS data logger, as well as the HUD tape. The GA Report concluded the failure of the #3 cylinder could have been caused by debris in the oil system. The extensive maintenance accomplished on the MRPA from the time the ME was placed into service to the mishap sortie suggests that several opportunities existed for debris to enter the oil system. However, since all maintenance tasks were IAW with procedures and the aircraft flew in excess of 24 hours prior to exhibiting the first low oil pressure indication, I find that the preponderance of the evidence suggests that debris in the oil system was not a contributing factor to the engine seizure.

Further, the fact that the AFTO 781 repeat write-ups were not signed off by the appropriate level did not mean that the corrective actions did not fix the original low oil quantity problems. I concluded these maintenance discrepancies were neither causal nor contributory to this accident.

The "warning" applicable to the low oil pressure procedure was not available to the MC at the time of the mishap. As such, the actions of the MC were considered IAW standard operating procedures. Further, the board could not find by either clear and convincing or a preponderance of the evidence that the MRPA would have reached the FOB if the MC had made a different decision. Therefore, these actions were not causal or contributory to the mishap.

My review of the facts presented determined that the engine failure was not caused by maintenance actions or operator error, and that clear and convincing evidence shows that the cause of the mishap was a catastrophic failure of the #3 engine cylinder resulting in engine seizure.

9 March 2011

JEFFREY S. SCHWOOB, Lt Col, USAF
President, Accident Investigation Board

Under 10 U.S.C. 2254(d), any 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.