UNITED STATES AIR FORCE
ABBREVIATED AIRCRAFT ACCIDENT INVESTIGATION BOARD REPORT

MQ-1B, T/N 07-3201

27th Special Operations Wing (AFSOC)
Cannon AFB, New Mexico

LOCATION: Jalalabad Air Base, Afghanistan

DATE OF ACCIDENT: 24 July 2012

BOARD PRESIDENT: Lieutenant Colonel William F. Hardie

Conducted IAW Air Force Instruction 51-503

Abbreviated Accident Investigation pursuant to Chapter 11

EXECUTIVE SUMMARY

ABBREVIATED AIRCRAFT ACCIDENT INVESTIGATION
MQ-1B, T/N 07-3201, JALALABAD AIR BASE, AFGHANISTAN
24 JULY 2012

On 24 July 2012, at approximately 0310 zulu (Z) time, the mishap remotely piloted aircraft (MRPA), a MQ-1B Predator, tail number (T/N) 07-3201, operated by the 62 Expeditionary Reconnaissance Squadron (ERS) Detachment 1 (Det 1) crashed during takeoff while conducting Launch and Recovery Element (LRE) operations from Jalalabad Air Base, Afghanistan. During takeoff, the aircraft departed the runway surface and impacted a cement wall barrier and stopped against a sandbag-protected guardhouse along the left side of the runway. The MRPA's structure and mechanical components were destroyed resulting in a loss of $4,476,000.00. There were no injuries or damage to other government or private property.

After routine maintenance and aircrew preflight checks, the Mishap Crew (MC), consisting of the Mishap Pilot (MP) and the Mishap Sensor Operator (MSO), taxied the MRPA for departure. Both the MP and MSO had the Multi-spectral Targeting System (MTS) selected for taxi operations and displayed on their respective Heads Up Displays (HUDs). Neither the MP nor the MSO switched to the nose camera video feed prior to takeoff, as is standard practice. Upon being cleared for takeoff, the MRPA accelerated through 40 knots indicated airspeed (KIAS). At approximately 61 KIAS, the MTS ball, which is located under the nose radome of the aircraft and provides a 360 degree view for the aircrew, executed an uncommanded rotation upward of 20 degrees causing both the MP and MSO to lose forward visibility with the runway environment and horizon. Two seconds after the uncommanded rotation, at approximately 64 KIAS, the MP began to abort the takeoff by moving the throttle to idle and applying full brakes. Two seconds after commencing the abort, the MP disabled the Ground Data Terminal (GDT) uplink to send the MRPA "lost link." Lost link logic takes two seconds to take effect because it takes two seconds to rule out temporary signal dropouts. During this delay, the MRPA slowed to approximately 54 KIAS. The MRPA executed airborne lost link logic by applying full throttle, releasing the brake input and attempting to pitch up two degrees. The MRPA was unable to achieve the lost link heading and accelerate to rotation and lift off speeds prior to departing the runway and impacting the barrier wall on the left side of the runway.

The Abbreviated Accident Investigation Board (AAIB) President determined by clear and convincing evidence the cause of the mishap was the failure of the MP and MSO to use different video sources for takeoff. The uncommanded rotation of the MTS ball was a contributing factor to the mishap because it adversely impacted the crew's ability to launch the MRPA. Technicians were unable to determine what caused the MTS ball to roll uncommanded. Additional contributing factors include the conflicting 62 ERS commander and 62 ERS Det 1 commander's Operational Read File (ORF) directions for crew video source use for taxi and the lack of a specific step in the technical manual's "Pre-Takeoff" checklist to direct the aircrew to confirm video source selection before takeoff.

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.

SUMMARRY OF FACTS AND STATEMENT OF OPINION
MQ-1B, T/N 07-3201

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COMMONLY USED ACRONYMS & ABBREVIATIONS

AAIB	Abbreviated Accident Investigation Board
AB	Air Base
ACC	Air Combat Command
AEW	Air Expeditionary Wing
AF	Air Force
AFB	Air Force Base
AFCENT	Air Force Central Command
AFI	Air Force Instruction
AFIMT	Air Force Information Management Tool
AFMES	Air Force Medical Exam System
AFSC	Air Force Specialty Code
AFSOC	Air Force Special Operations Command
AFTO	Air Force Technical Order
AGM	Air-Ground Missile
AOA	Angle of Attack
AOR	Area of Responsibility
ARM	Aviation Resource Management
AMU	Aircraft Maintenance Unit
ATC	Air Traffic Control
AV	Audio Video
BP	Board President
BPO/PR	Basic PostFlight/PreFlight
C2	Command and Control
CAPS	Critical Action Procedure Steps
CC	Commander
CD	Compact Disc
CCSM	Control Console Serial Module
CFETP	Career Field Education Training Plan
CJSOAC	Combined Joint Special Operations Air Component
CL	Checklist
COM	Communication
CRM	Crew Resource Management
CSFDR	Crash Survivable Flight Data Recorder
Dash-1	1Q-1(M)B-1 Flight Manual
DET	Detatchment
DNIF	Duties Not to Include Flying
DO	Director of Operations
DoD	Department of Defense
DR	Deficiency Report
DVD	Digital Versitile Disc
EO	Electro-Optical
EM	Emergency Management
EP	Emergency Procedure
EPE	Emergency Procedure Exam
ERS	Expeditionary Reconnasiance Squadron
EU	Electronics Unit
FAE/HF	Functional Area Expert, Human Factors
FAE/MX	Functional Area Expert, Maintenance
FDP	Flight Duty Period
FOB	Forward Operating Base
FSR	Field Service Representative
FTU	Formal Training Unit
GA-ASI	General Atomics Aeronautical Systems, Incorporated
GCS	Ground Control Station
GDT	Ground Data Terminal
GIMDIS	Gimble Disable
GLS	Global Positioning Landing System
HARMS	Host Aviation Resource Management Systems
HUD	Heads Up Display
HDD	Heads Down Display
HFACS	Human Factors
IAW	In Accordance With
IC	Incorporating Change
IMDS	Integrated Maintenance Data Systems
IQT	Initial Qualification Training
IR	Infared
ISB	Interim Safety Board
ISR	Intelligence, Surveillance and Reconnaissance
JBAD	Jalalabad
KIAS	Knots Indicated Airspeed
L	Local Time
LA	Legal Advisor
LOS	Line of Sight

LRE	Launch and Recovery Element
MAP	Manifold Air Pressure
MC	Mishap Crew
MCE	Mission Control Element
METAR	Meteorological Aerodome Report
MIC	Mission Intelligence Coordinator
MIRC	Mardem-Bey Internet Relay Chat
MP	Mishap Pilot
MRPA	Mishap Remotely Piloted Aircraft
MSO	Mishap Sensor Operator
MTS	Multi-spectral Targeting System
MUX	Multiplexer (video)
NM	Nautical Miles
OG	Operations Group
ORF	Operational Read File
OS	Operations Supervisor
OSS	Operational Support Squadron
OTI	One Time Inspection
PCL	Point and Click Loiter
PHA	Periodic Health Assessment
PMATS	Predator Mission Aircrew Training System
PPSL	Predator Primary Satellite Link
P/N	Part Number
Q-2	Qualification 2
REC	Recorder
RL	Receive Link
ROE	Rules of Engagement
RPA	Remotely Piloted Aircraft
RPM	Revolutions Per Minute
RS	Reconnaissance Squadron
RW	Reconnaissance Wing
SATCOM	Satellite Communications
SE	Safety
SIB	Safety Investigation Board
SO	Sensor Operator
SOF	Special Operations Forces
SOG	Special Operations Group
SOS	Special Operations Squadron
SOW	Special Operations Wing
STAN/EVAL	Standardization & Evaluation
SEPT	Situational Emergency Procedures Test
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
USC	United States Code
VFR	Visual Flight Rules
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 V).

SUMMARY OF FACTS

1. AUTHORITY AND PURPOSE

a. Authority.

On 13 September 2012, Brigadier General Michael J. Kingsley, Vice Commander Air Force Special Operations Command (AFSOC) appointed Lieutenant Colonel William F. Hardie as President of an Abbreviated Accident Investigation Board (AAIB) to conduct an aircraft investigation of the 24 July 2012 crash of an MQ-1B aircraft, tail number (T/N) 07-3201 at Jalalabad Air Base, Afghanistan. The AAIB was convened under Air Force Instruction (AFI) 51-503, *Aerospace Accident Investigations*, Chapter 11, at Hurlburt Field, Florida, from 17 September 2012 through 16 October 2012. Board members included the Board President (BP), Pilot Member (Pilot), Legal Advisor (LA), and Recorder (REC). Functional Area Experts in Human Factors (FAE/HF) and Maintenance (FAE/MX) assisted the board members (Tabs Y3-Y5).

b. Purpose.

This is a legal investigation convened to inquire into the facts surrounding the aircraft 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

On 24 July 2012, at approximately 0310 zulu (Z) time, an MQ-1B Predator Remotely Piloted Aircraft (RPA), T/N 07-3201, crashed during takeoff while conducting Launch and Recovery Element (LRE) operations from Jalalabad Air Base, Afghanistan (Tab B-3). During takeoff, both the mishap pilot (MP) and mishap sensor operator (MSO) had the Multi-spectral Targeting System (MTS) selected on their respective Heads Up Displays (HUDs) (Tab V-2.3). At approximately 61 knots indicated airspeed (KIAS), the MTS ball rolled uncommanded 20 degrees upward causing both the MP and MSO to lose forward visibility with the runway (Tabs B-3, C-3,V-2.3, Z-8, AA-5, DD-4). After the MP's unsuccessful attempt to abort the mishap remotely piloted aircraft (MRPA) and then send it lost link, the MRPA impacted a cement wall barrier and stopped against a sand-bag protected guardhouse along the left side of the runway (Tabs B-3, C-3, S-3-S-2, V-2.3, DD-4). Upon impact, the MRPA was damaged with a loss valued at $4,476,000.00 (Tabs P-2, FF-3). There were no injuries or damage to other government or private property (Tabs B-3, C-3).

3. BACKGROUND

a. Units and Organizations

(1) Air Force Special Operations Command (AFSOC)

AFSOC is headquartered at Hurlburt Field, Florida, and is one of ten major Air Force commands. AFSOC provides Air Force special operations forces (SOF) for worldwide deployment and assignment to regional unified commands. The command's SOF are composed of highly trained, rapidly deployable Airmen, conducting global special operations missions (Tab CC-3).

(2) Air Combat Command (ACC)

Air Combat Command (ACC) is the primary force provider of combat airpower to America's war-fighting 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-4).

(3) 23d Air Force (23 AF)

The Twenty-third Air Force (23 AF) is the only numbered air force in AFSOC, and is designated as AFSOC's unit of execution to special operations command. It was established January 1, 2008, at Hurlburt Field, Florida. The mission of 23 AF is to provide highly trained special operations command and control, intelligence, weather and reach-back support forces to deployed air commanders for execution of assigned missions (Tab CC-5).

(4) 27th Special Operations Wing (27 SOW)

The 27th Special Operations Wing (27 SOW) at Cannon Air Force Base, New Mexico, is one of two Air Force active duty special operations wings within AFSOC. The primary mission of 27 SOW is to plan and execute specialized and contingency operations using advanced aircraft, tactics, and air refueling techniques to infiltrate, exfiltrate, and resupply special operations forces and provide intelligence, surveillance and reconnaissance (ISR), and close air support in support of special operations forces (Tabs CC-6).

(5) 27th Special Operations Group (27 SOG)

The 27th Special Operations Group (27 SOG), located at Cannon Air Force Base, New Mexico, is one of four groups assigned to the 27 SOW. The group accomplishes global special operations taskings as an Air Force component member of the special operations command. It conducts infiltration/exfiltration, combat support, tilt-rotor operations, helicopter aerial refueling, close air support, unmanned aerial vehicle operations, non-standard aviation, and other special missions. It directs the deployment, employment, training, and planning for squadrons that operate the AC-130H, AC-130W, PC-12, DO-328, M-28, CV-22, MC-130J, MQ-1, MQ-9. It also provides operational support to flying operations (Tab CC-7).

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

The 3d Special Operations Squadron (3 SOS) accomplishes global special operations tasking as a member of the special operations command. It directly supports theater commanders by providing precision weapons employment and persistent ISR. It also plans, prepares, and executes MQ-1B Predator missions supporting special operations forces. The 3 SOS is located at Cannon Air Force Base, New Mexico. The squadron is the first RPA squadron within AFSOC (Tab CC-8).

(7) 11th Reconnaissance Squadron (11 RS)

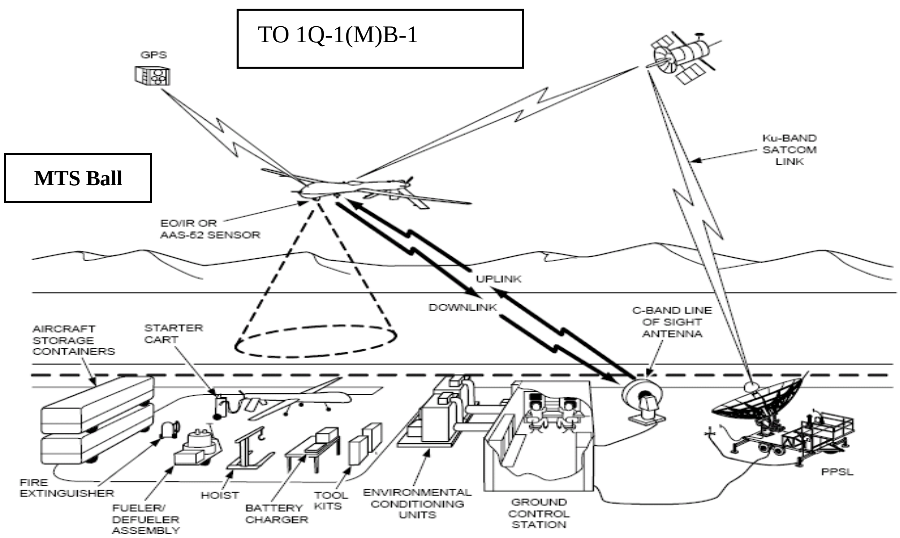
The 11th Reconnaissance Squadron (11 RS) is the Air Force's first MQ-1B Predator formal training unit (FTU) that conducts 5 basic and advanced training courses: Initial Qualification, Instructor Upgrade Training, Foreign Officer Course , Senior Officer Course , and Launch & Recovery Course (Tab CC-9).

(8) 15th Reconnaissance Squadron (15 RS)

The 15th Reconnaissance Squadron (15 RS) is one of the first armed RPA squadrons. The squadron provides combatant commanders with persistent ISR, full-motion video, and precision weapons employment. 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 CC-10).

b. MQ-1B Predator

The MQ-1B Predator aircraft is a medium-altitude, long endurance RPA. Its primary mission is conducting armed reconnaissance and interdiction against critical perishable targets. When the MQ-1B is not actively pursuing its primary mission, it augments the MQ-9 Reaper as a Joint Forces Air Component Commander-owned theater asset for reconnaissance, surveillance and target acquisition in support of the Joint Forces Commander (Tab CC-11).



The MQ-1B Predator is a system, not just an aircraft. A fully operational system consists of four aircraft (with sensors), a ground control station (GCS), a Predator Primary Satellite Link (PPSL), along with operations and maintenance crews for a sustained 24-hour combat orbit (Tab CC-11).

The basic crew for the Predator is a pilot and sensor operator (SO). They fly the aircraft from inside the GCS via a line-of-sight (LOS) data link or a satellite (SATCOM) data link for beyond LOS flight. The aircraft is equipped with a color nose camera (generally used by the pilot for flight control), a day variable-aperture TV camera, a variable-aperture infrared (IR) camera (for low light/night), and other sensors as the mission requires. The cameras produce full-motion video (Tab CC-11).

The MQ-1B Predator carries the MTS ball, which is located under the nose radome, integrates electro-optical (EO) infrared (IR), laser designator and laser illuminator into a single sensor package. The aircraft has two weapons pylons and can employ two laser-guided AGM (Air-Ground Missile)114 Hellfire missiles from the pylon rails (Tab CC-11).

The system is composed of four major components, which can be deployed for worldwide operations. The Predator aircraft can be disassembled and loaded into a single container for transport. The GCS is transportable in a C-130 Hercules (or larger) transport aircraft or installed in a fixed facility. The Predator can operate on a 5,000 by 75 foot (1,524 meters by 23 meters) hard surface runway with clear LOS. The ground data terminal (GDT) antenna provides LOS communications for takeoff and landing. The PPSL provides over-the-horizon communications for the aircraft (Tab CC-11).

When deployed to a forward location, the MQ-1 Predator aircraft is operated by an LRE crew via LOS operations. The LRE crew conducts takeoff and landing operations at the forward deployed location while the Continental United States-based GCS conducts the mission via extended satellite communication links (Tab CC-12).

4. SEQUENCE OF EVENTS

a. Mission.

The mishap sortie was in support of an ISR mission at the time of mishap (Tab B-3, C-3). The MC consisted of the MP and the MSO (Tabs B-3, V-2.3). The MRPA's profile consisted of an LRE crew from Jalalabad Air Base, Afghanistan (Tab V-3.1). The LRE's primary mission was to fly the MRPA to a point to transfer control to the Mission Control Element (MCE) (Tab V-3.1).

b. Planning.

At the time of the mishap, it was not standard practice in the unit to accomplish a pre-mission brief with the LRE crews (i.e. mass brief, step brief) (Tabs V-2.4, V-3.1). There was no evidence to suggest mission planning was a factor in the mishap.

c. Preflight.

All preflight requirements for crew and aircraft were met. The MC performed engine start without incident. The MC experienced intermittent loss of signal strength from one of the two GDT receivers after engine start, while still in the chocks, and during taxi. This problem was resolved prior to takeoff (Tabs V-3.1, AA-4). The temporary loss of signal strength was not a factor in the mishap.

d. Summary of Accident

On 24 July 2012, at approximately 0310 Z, the MRPA conducted LRE operations from Jalalabad Air Base, Afghanistan (Tab B-3). Upon being cleared for takeoff, the MP accelerated the MRPA down the runway through 40 KIAS uneventfully (Tabs B-3, N-6, Z-7). At approximately 61 KIAS, the MTS ball executed an uncommanded rotation upward of 20 degrees and caused both the MP and MSO to lose sight of the runway. The MP and MSO had the MTS displayed on their respective HUDs. Neither of them had the nose camera view selected (Tabs B-3, C-3, V-2.3, Z-8, AA-54, DD-4). Two seconds after the MTS rotated upward, at approximately 64 KIAS, the MP attempted to abort the takeoff by moving the throttle to idle and applying full brakes (Tab AA-5, DD-4). After the attempt to abort the takeoff, the MP disabled the GDT uplink and sent the MRPA lost link (Tabs B-3, C-3, V-2.3, Z-8-Z-9, AA-5, DD-4). During the abort, the MRPA moved left of runway centerline with a one degree left yaw rate. Yaw rate is the change in direction of motion of the MRPA along the vertical axis (Tab AA-5).

While in lost link mode, the aircraft operates automatically without the assistance of the aircrew. It takes two seconds for lost link to take effect because the MRPA requires this amount of time to rule out temporary signal dropouts. In this case, the MRPA slowed to 54 KIAS during the two second interval. Then the MRPA executed the lost link logic by applying full throttle and releasing the brake input. The MRPA was left of of the runway heading by approximately four (4) degrees when it began executing lost link logic (Tab DD- 4- DD-6). Unable to achieve lost link heading or liftoff speed, the MRPA departed the runway, impacted a cement wall barrier and stopped against a sandbag-protected guardhouse along the left side of the runway damaging its structure and mechanical components at a total loss of $4,476,000.00. There were no injuries or damage to other government or private property (Tabs B-3, C-3, P-2, S-3-S-12, AA-5, FF-5).

e. Impact.

The MRPA impacted the left side barrier wall of the runway and came to rest half way down the runway at approximately 0310 Z on 24 July 2012 at the LRE location (Tabs B-3, C-3). The MRPA was damaged upon impact, but there were no injuries or damage to other government or private property (Tabs C-3, S-3-S-12).

f. Egress and Aircrew Flight Equipment.

Not applicable for this mishap.

g. Search and Rescue.

Not applicable for this mishap.

h. Recovery of Remains.

Not applicable for this mishap.

5. MAINTENANCE

a. Forms Documentation.

A review of the MRPA's maintenance documentation, recorded in the Air Force Technical Order (AFTO) 781 series and Integrated Maintenance Data System (IMDS) revealed no contributing factors to the mishap.

A review of the AFTO Form 781H and 781A, revealed no maintenance discrepancies, only the standard preflight maintenance activities and the accomplishment of the 30 day document records review (Tabs D5-D9, U-3).

A review of the AFTO Form 781J for 23 July 2012 revealed total MRPA airframe time at 8511.4 with total engine time at 396 hours and 466 total landing gear cycles (Tabs D-10, U-3). Maintenance discrepancies were not a factor in this mishap.

b. Inspections.

The MRPA's AFTO Form 781K did not indicate any inspections were overdue. No Time Compliance Technical Orders (TCTOs) or One Time Inspections (OTIs) restricted the MRPA from flying (Tab D-5, D-12). Prior to the mishap flight, the MRPA underwent a required 60 hour inspection IAW technical order (T.O) 1Q-(M)B-6WC-2. No defects were noted upon completion of this inspection (Tab D-11). The most recent basic postflight/ preflight (BPO/PR) inspection was performed on 23 July 2012 at 0400. No discrepancies were indicated (Tab D-5).

c. Maintenance Procedures.

The preflight inspection, servicing operations, and launch procedures were accomplished without incident (Tab R-3-R-6). Four hundred flight hours inspections for the left and right ailerons were performed on the MRPA prior to the mishap. No defects were noted after the completion of this procedure (Tab U-3).

d. Maintenance Personnel and Supervision.

The MRPA was maintained at Jalalabad Air Base, Afghanistan, by personnel from the 62 ERS (Tabs R3-R6, U-3). Aircraft maintenance records and statements provided by maintenance personnel indicated all preflight maintenance and supervisory activities were performed without error (Tabs R-3-R-6, U-3). A review of Battlespace's maintainance training records indicated all maintenance personnel had adequate training and experience to complete assigned tasks (Tab U-10-U-29). There are no indications maintenance personnel or supervision were factors in the mishap.

e. Fuel, Hydraulic and Oil Inspection Analyses.

The documented forms show correct levels of fluids in the aircraft at takeoff. Maintenance personnel properly serviced the fuel tank IAW technical data. The MQ-1B does not have a hydraulic system. No post-accident fluid samples were obtained from the MRPA. There is no evidence to suggest fuel and oil were factors in the mishap (Tabs D-20, U-3).

f. Unscheduled Maintenance.

The last documented unscheduled maintenance was the replacement of the MRPA's engine cowl flap upper arm which was loose at the time. This item was serviced by a member of maintenance support at Jalalabad Air Base, Afghanistan, on 8 July 2012, 16 days prior to the mishap (Tab U-3). There is no evidence that unscheduled maintenance was a factor in the mishap.

6. AIRFRAME, MISSILE, OR SPACE VEHICLE SYSTEMS

a. Structures and Systems.

All systems were operating normally prior to the mishap (Tabs AA-5, DD-8). The MQ-1B's design is such that it captures and retains system information throughout every flight by means of a data logger system. While the MQ-1B is airborne, it continually transmits the status of onboard electrical systems and other electronic sensors to the GCS, where the data is recorded against a time stamp (in seconds) that begins during aircraft preflight when the aircrew powers on the recorders. General Atomics Aeronautical Systems, Incorporated (GA-ASI), the subject matter expert on this weapon system, reviewed data logs of the MRPA's systems. The data logger systems provided no indication of unusual behavior prior to impact (Tabs DD-8, AA-5).

b. Evaluations and Analysis.

GA-ASI and Raytheon could not determine why the MTS ball moved uncommanded during takeoff (Tab AA-5). Deficiency reports pulled for the MTS ball did not indicate a past history of this particular event during ground operations or takeoff (Tab DD-15-DD-29). Using the ramp weight of the MRPA (2544 pounds) and appropriate performance charts, the MRPA's rotation and liftoff speeds were calculated. Rotation speed was calculated to be approximately 63 KIAS and liftoff speed was calculated to be approximately 74 KIAS (Tabs AA-5, U6-U9, Z7-Z9). The uncommanded movement of the MTS ball occurred at 61 KIAS (Tabs U, Z-8, AA-5, FF-5.1). A thorough review of the datalogger system files confirmed that, after the MTS ball unexpectedly rolled upward, the MP slowed the aircraft by retarding the throttle and applied full brakes prior to severing data link with the aircraft (Tab U-6-U-9).

By beginning the abort procedure, then sending the aircraft lost link, the MP created a situation where the MRPA decelerated, then was commanded to accelerate once again for takeoff. However, due to the added time and distance required to accelerate after the temporary deceleration, the MRPA departed the runway and crashed prior to obtaining flight (Tabs N-7, AA-5, DD-4, FF-7).

The repair depot for the MQ-1B system analyzed the GCS involved in the aircraft mishap and determined that the system was working properly. Therefore, it was returned to service (Tab DD-13- DD-15).

7. WEATHER

Forecasted and observed weather did not contribute to this mishap. At the time of the mishap, the Meteorological Aerodome Report (METAR) and tower reported calm winds (Tabs F-2, N-7, FF-5).

8. CREW QUALIFICATIONS

The MP and MSO were both current and qualified on the MQ-1B (Tab AA-4). There is no evidence the MC's qualifications were a factor in this mishap.

a. Mishap Pilot.

The MP had 756.9 flying hours in the MQ-1B at the time of the mishap. The MP's most recent flight evaluation for launch and recovery operations was a Qualification-2 (Q-2) grade. The MP was required to receive additional training in the area of aircraft launch, five months prior to the mishap. There is no evidence subpar performance on the most recent flight evaluation or the qualification of the MP was a factor in this mishap (Tabs G-3, G-38, T-4, AA-4).

Recent flight time for the MP is as follows: (Tabs G-3, T-8).

	Hours	Sorties
30 days	13.5	60
60 days	28.4	113
90 days	47.0	157

b. Mishap Sensor Operator.

The MSO had 510.6 flying hours in the MQ-1B at the time of the mishap. There is no evidence to suggest the qualification of the MSO contributed to this mishap (Tabs G-30-G-31, G-39, AA-4).

Recent flight time for the MSO is as follows: (Tabs G-32-G-33).

	Hours	Sorties
30 days	17.4	63
60 days	21.9	81
90 days	38.6	90

9. MEDICAL

a. Qualifications.

The MP and MSO were both medically qualified for flight duty at the time of the mishap. Both had current Air Force information management tool (AFIMT) 1042s (Medical Recommendation For Flying Or Special Operational Duty) (Tab EE-7-EE-9).

b. Health.

The MP and MSO's medical records were reviewed and no abnormalities were identified. Both had current Periodic Health Assessments (PHA), both individuals were in good health, and neither had significant medical or mental health issues prior to the mishap. Post-mishap medical exams were conducted for both the MP and MSO. Coupled with the respective interviews of the MP and MSO, there were no data indicating evidence of any underlying psychological or medical conditions that could have been a factor in the mishap. Both post-mishap medical exams found that neither the MP nor the MSO had any significant medical or mental health findings upon interview, and both members were recommended to remain on flight status (Tab EE-9).

c. Toxicology.

Blood and urine samples were collected within two to four hours of the mishap and submitted to the Department of Defense Armed Forces Medical Examiner System (DoD AFMES) for toxicological analysis. All toxicology testing was normal and not a factor in the mishap (Tab EE-6).

d. Lifestyle.

Based on a review of the MP and MSO's 14-day histories, medical records, and interviews, there is no evidence to suggest any significant or unusual habits, behaviors, or stressors were factors in the mishap (Tabs V-2.4, EE-7).

e. Crew Rest and Crew Duty Time.

Air Force Instruction (AFI)11-202, Volume 3, chapter 9.4.5, *General Flight Rules*, dated 22 October 2010, defines the Flight Duty Period (FDP) as beginning when an aircrew member reports for a mission briefing, or other official duty and ending when engines are shut down at the end of the mission, mission leg, or a series of missions. Moreover, the FDP for an RPA ends at final engine shut down, final in-flight handover briefing, or final crew swap, whichever occurs last.

AFI 11-202, Volume 3, chapter 9.4.5 defines the Crew Rest Period as normally a minimum 12-hour non-duty period before the FDP begins. Its purpose is to ensure the aircrew member is adequately rested before performing flight or flight related duties. Crew rest is free time, and includes time for meals, transportation, and rest. Rest is defined as a condition that allows an individual the opportunity to sleep.

Lastly, chapter 9.8 of the aforementioned AFI, requires aircrews to be given at least 10 continuous hours of restful activities, including an opportunity for at least eight hours of uninterrupted sleep, during the 12 hours immediately prior to the FDP.

A review of the MP and MSO's rest and sleep cycles in the 14 day period leading up to the mishap indicate each received adequate crew rest. There is no evidence to suggest that crew rest or crew duty time requirements were violated or that these were factors in this mishap (Tabs V-2.4, EE-7).

10. OPERATIONS AND SUPERVISION

a. Operations.

The 62 ERS operations tempo was moderate at the time of the mishap (Tab V-2.6). The MP and MSO were both current and qualified on the MQ-1B. There is no evidence to suggest that operations tempo was a factor in the mishap (Tab FF-5).

b. Supervision.

Day to day supervision of LRE operations was not a factor in the mishap.

11. HUMAN FACTORS ANALYSIS

a. Introduction.

Human factors analysis is an important piece of any aviation mishap investigation. In 2003, the DoD developed a standardized mishap investigation and data analysis tool known as the Department of Defense Human Factors Analysis and Classification System (DoD HFACS). This tool describes four main tiers of failures or conditions that may contribute to a mishap: 1) Organizational Influences, 2) Supervision, 3) Preconditions, and 4) Acts. Organizational Influences are factors in a mishap if communications, actions, policies or significant omissions by upper-level management directly or indirectly affect practices, conditions or actions of the operators resulting in system failure, human error or an unsafe situation. Supervision is another important tier, as a mishap event may often be traced back to unsafe conditions within the supervisory chain of command. Preconditions such as environmental factors, personnel factors or conditions of the operator may affect practices or actions, thus resulting in human errors or an unsafe situation. Acts are those factors that are most closely tied to the mishap, and can be described as failures or actions committed by the operator that result in human error or an unsafe situation. Factors relevant to this mishap were evaluated using the taxonomy and definitions set forth in the DoD HFACS guide, with the corresponding codes displayed for further reference as needed (Tab BB-15-BB-27).

b. Applicable Factors.

(1) Organizational Influences: Procedural Guidance/Publications (OP003) is a factor when written direction, checklists, graphic depictions, tables, charts or other published guidance is inadequate, misleading or inappropriate and this creates an unsafe situation (Tab BB -46).

While there was guidance in place that RPA pilots and SOs use different video sources during takeoff, this direction is not incorporated into a formal checklist step that mission crews would be sure to accomplish before every takeoff (Tabs AA-3, FF-5). When asked how pilots and SOs ensure they are both on separate video sources before takeoff, one pilot confirmed there was no checklist step and further stated, “It’s just experience” (Tab V-7.9). The absence of a formal checklist step directing aircrews to use different video sources during takeoff was a contributing factor to this mishap (Tab EE-4).

(2) Preconditions: Negative Transfer (PC105) is a factor when the individual reverts to a highly learned behavior used in a previous system or situation and that response is inappropriate or degrades mission performance (Tab BB-31).

On 14 January 2012, the 62 ERS/CC published a memorandum for all 62 ERS aircrew stating that, “MQ-1/MQ-9 crews will use different video sources for taxi, takeoff, and landing” (Tab AA-3). This guidance meant that aircrews needed to agree upon and set their respective video sources only once before taxi (Tab AA-3). For the remainder of the mission, they could be assured they were in compliance with the memorandum for all phases of aircraft operation. However, there is no taxi checklist step directing aircrews to accomplish the task of ensuring different video sources (Tabs AA-3, FF-5). This makes it necessary for aircrews to commit this step to memory.

Individual Flight Records indicate that the MP flew no fewer than 190 sorties over a period of 14 weeks under this guidance (Tab G-20-G-28). The MSO flew 65 sorties over a period of five weeks under this guidance (Tab T-19). The MP and the MSO had flown over one 100 missions together before the mishap (Tab V-2.6). This gave both aircrew members ample opportunity to develop individual and coordinated habit patterns of ensuring they were both on separate video sources before taxi. Moreover, because they needed to remain on separate video sources for takeoff and landing, this meant they did not need to concern themselves with video sources after ensuring they were on separate feeds before taxi (Tab EE-4).

On 13 July 2012, the 62 ERS, Det 1/CC published a memorandum for record directing that, “Both crewmembers will use a MTS camera as the primary source for taxi operations” (Tab O-3). In order for aircrews to be in full compliance with local guidance after 13 July 2012, they needed to ensure both pilot and SO were on the MTS for taxi, then switch to different video feeds after taxi and before takeoff (Tab O-3). As with the taxi checklist, the pre-takeoff checklist contains no step directing aircrews to accomplish the task of ensuring separate video feeds (Tabs V-2.12-V-2.13, FF-6).

After 13 July 2012, the MP and MSO had to repress their habit patterns of switching to different video sources for taxi. Furthermore, they had to memorize the additional step of switching to different video sources after taxi and before takeoff. Prior to the memorandum from the Det 1/CC, they did not need to concern themselves with video sources after taxi (Tab EE-4). They would simply follow the pre-takeoff checklist, which did not mention switching to separate video sources (Tabs V-2.1, FF-6). The new memorandum had only been published for 11 days at the time of the mishap (Tab O-3). Eleven days does not yield sufficient time for the MP and MSO to break their ingrained habit patterns of simply running the pre-takeoff checklist after taxi without comparing video sources. Due to negative transfer, the MP and MSO reverted to their highly learned behavior of completing the pre-takeoff checklist without switching to separate video sources (Tab EE-5).

(3) Preconditions: Cross-Monitoring Performance (PP102) is a factor when crew or team members failed to monitor, assist or back-up each other's actions and decisions (Tab BB- 38).

The 62 ERS/CC memorandum directed aircrews to use separate video sources for takeoff after 14 January 2012 (Tab AA-3). The MP and MSO would have been operating under that guidance for their entire time in the area of responsibility (AOR). It is therefore reasonable to expect that they would have been occasionally cross-monitoring each other’s video sources in accordance with good flight discipline and crew resource management (CRM) as well as to ensure they were in compliance with local direction. Consequently, cross-monitoring performance was a factor in this mishap (Tab EE-5).

12. GOVERNING DIRECTIVES AND PUBLICATIONS

a. Primary Operations Directives and Publications

(1) AFI 11-2MQ-1, Volume 1, MQ-1 Crew Training, 12 January 2012
(2) AFI 11-2MQ-1, Volume 2, MQ-1 Crew Training, 28 November 2008
(3) AFI 11-2MQ-1, Volume 3, MQ-1 Crew Training, 29 November 2007
(4) AFI 11-2MQ-1, Volume 3, 3 SOS, Chapter 8, MQ-1 Operations Procedures, 6 June 2012
(5) MQ-1 Ready Aircrew Program Tasking Memorandum (RTM), 004-2012, 28 February 2012
(6) AFI 11-202, Volume 3, General Flight Rules, 22 October 2010, AFSOC Sup 11 July

2012

(7) AFI 11-401, Aviation Management, 10 December 2010, AFSOC Sup 19 January 2012
(8) AFI 11-418, Operations Supervision, 15 September 2011
(9) T.O. 1Q-1(M)B-1, USAF Series MQ-1B and RQ-1B Systems, 13 December 2010, incorporating Change 3, 11 January 2012
(10) T.O. 1Q-1(M)B-1CL-1, USAF Series MQ-1B and RQ-1B Systems Flight Checklist, 13 December 2010 incorporating Change 3, 11 January 2012
(11) T.O. 1Q-1(M)B-1-1, UASF Series MQ-1B System, Performance Data, 29 November 2010

b. Maintenance Directives and Publications

(1) AFI 21-101, Aircraft and Equipment Maintenance Management, 26 July 2010, incorporating Change 1, 16 August 2011
(2) T.O. 00-20-1, Aerospace Equipment Maintenance Inspection, Documentation, Policies, and Procedures, 30 April 2003, incorporating Change 4, 1 September 2010

The AFIs listed above are available digitally on the AF Departmental Publishing Office internet site at: http://www.e-publishing.af.mil.

c. Known or Suspected Deviations from Directives or Publications

The 62 ERS ORF 12-3, 14 January 2012, codified operation procedures, “MQ-1/MQ-9 crews will use different video sources for taxi, takeoff, and landing”(Tab AA-3). The MP and MSO deviated from this directive procedure during the takeoff on the day of the mishap (Tab V-2.3). However, the 62 ERS, Det 1/CC’s local operating memorandum, dated 13 July 2012, Taxi Procedures and Taxi-back Policy, directed “Both crewmembers will use a Multi-spectral targeting System (MTS) camera as the primary source of taxi operations” (Tab O-3). The memo went further to state: “Strict adherence to this policy is mandatory” (Tab O-3). The MC did not reconfigure the MTS video sources at their respective HUDs in compliance with the parent squadron’s ORF procedures (Tabs V-2.3, FF-6). The conflicting procedures were a contributing factor in the mishap.

13. ADDITIONAL AREAS OF CONCERN

There are no additional areas of concern.

16 October 2012

WILLIAM F. HARDIE, Lt Col, USAFR
President, Abbreviated Accident Investigation Board

STATEMENT OF OPINION

MQ-1B, T/N 07-3201
JALALABAD AIR BASE, AFGHANISTAN
24 JULY 2012

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 may not be considered as evidence in any civil or criminal proceeding arising from an aircraft 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:

I find by clear and convincing evidence that the cause of the mishap was the failure of the Mishap Pilot (MP) and Mishap Sensor Operator (MSO) to use different video sources during takeoff. Both the MP and MSO relied on the Multi-spectral Targeting System (MTS) video source during takeoff procedures. I find by a preponderance of the evidence that a substantially contributing factor to the mishap was the uncommanded rotation of the MTS ball. This action adversely impacted the crew's ability to launch the MRPA. There was insufficient evidence presented to determine what caused the MTS ball to roll uncommanded. Further, I find that a substantially contributing factor to the mishap was conflicting Operational Read File (ORF) guidance from the parent squadron and the squadron detachment concerning the aircrew's use of MTS video source set-up for taxi, takeoff and landing operation. Lastly, I find the lack of a step in the technical manual's "Pre-Takeoff" checklist to direct the aircrew to confirm video source selection before takeoff is a substantially contributing factor to the mishap.

2. DISCUSSION OF OPINION:

a. Background

On 24 July 2012, at approximately 0310 zulu (Z) time, an MQ-1B Predator, tail number (T/N) 07-3201, operated by the 62 Expeditionary Reconnaissance Squadron (ERS) Detachment 1 (Det 1) crashed during takeoff while conducting Launch and Recovery Element (LRE) operations from Jalalabad Air Base, Afghanistan. The aircraft departed the runway surface and impacted a cement wall barrier and stopped against a sandbag-protected guardhouse along the left side of the runway. The MRPA's structure and mechanical components were damaged with a loss of $4,476,000.00. There were no injuries or damage to other government or private property.

After uneventful maintenance and aircrew preflight checks, the mishap crew (MC), consisting of the MP and MSO, taxied the MRPA for departure. Both the MP and MSO had the MTS selected for taxi operations and displayed on their respective Heads Up Displays (HUDs). Neither the MP nor the MSO switched to the nose camera video feed prior to takeoff. Upon being cleared for takeoff, the MRPA accelerated through 40 knots indicated airspeed (KIAS). At approximately 61 KIAS, the MTS ball, which is located under the nose radome of the aircraft and provides a 360 degree view for the aircrew, executed an uncommanded rotation upward 20 degrees causing both the MP and MSO to lose sight of the runway. Two seconds after the uncommanded rotation, at approximately 64 KIAS, the MP began to abort the takeoff by moving the throttle to idle and applying full brakes. Two seconds after commencing the abort, the MP disabled the Ground Data Terminal (GDT) uplink to send the MRPA "lost link." Lost link logic takes two seconds to take effect because it takes two seconds to rule out temporary signal dropouts. During this delay, the MRPA slowed to approximately 54 KIAS. The MRPA executed airborne lost link logic by applying full throttle, releasing the brake input and attempting to pitch up two degrees. Lost link logic attempts to maintain the lost link heading command via aircraft roll commands and does not use nose wheel steering for directional control. The MRPA was unable to achieve the lost link heading before departing the runway; therefore, it could not accelerate to rotation and liftoff speeds prior to impacting the barrier wall on the left side of the runway.

b. Analysis

The mishap occurred due to the MP and MSO selecting and maintaining one video source on their respective HUDs during takeoff. Maintaining one video source precluded the MP from recognizing the MRPA's location relative to the runway centerline during the takeoff abort execution after the MTS ball rolled upward uncommanded.

Once cleared, the MP increased the power to takeoff setting and released the brakes. The MRPA accelerated down runway centerline uneventfully through 40 KIAS. Approximately 14 seconds later at 60 KIAS, the MTS ball executed a rapid uncommanded upward rotation of 20 degrees, causing the MP and MSO to lose reference with the runway and horizon at this time. Approximately two seconds after the MTS rotated upward, the MP attempted to abort the takeoff by reducing the throttle to idle and applying full brakes. Because the MP lacked the ability to see or maintain centerline during the braking action, the MP immediately disabled the power to the Ground Data Terminal (GDT) sending the MRPA "lost link."

Lost link logic takes two seconds to take effect to rule out temporary signal dropouts. During this two second period,the aircraft will maintain the latest pilot commands. If the aircraft is more than 200 feet below the lost link altitude and the speed is greater than 40 KIAS, or "flying airspeed," the MRPA will execute airborne lost link logic. The MP's braking actions occurred at 64 KIAS, and the MRPA began decelerating when the GDT was disabled. The lost link delay allowed the MRPA to continue to slow to approximately 54 KIAS which is approximately 10 knots below rotation speed (64 KIAS) and 20 knots below takeoff speed (74 KIAS). At the time lost link was initiated, the MRPA was tracking with a 1 degree left yaw rate. Yaw rate is the left or right change in direction of motion of the MRPA along the vertical axis. The MP's braking action induced left directional yaw and the subsequent lost link logic delay caused the MRPA to drift approximately four degrees left of runway centerline heading. The MRPA was unable to achieve the lost link heading and accelerate to lift off speed. Consequently, it crashed into a cement wall barrier and stopped against a sandbag-protected guardhouse along the left side of the runway. The uncommanded rotation of the MTS ball was a substantially contributing factor to the mishap.

Air Force Instruction 11-2MQ-1, Volume 3, *Normal Operating Procedures,* dated 29 November 2007, paragraph 3.3.1 states two separate video sources are required for takeoff. However, Volume 3 does not direct the aircrews to set a specific video source on their HUDs. On 14 January 2012, the 62 Expeditionary Reconnaissance Squadron (ERS) commander created an ORF which stated, "MQ-1 crews will use different video sources for taxi, takeoff, and landing." The ORF requires the use of both the MTS and nose camera during takeoff. Eleven days before the mishap, the 62 ERS Detachment 1 (Det 1) commander established a standardized policy through a Memorandum For Record (MFR), dated 11 July 2012, directing aircrews to use the MTS camera as the primary source for taxi operations. The MFR stated,"Both crewmembers will use a Multi-spectral Targeting System (MTS) camera as the primary source for taxi operations." On the day of the mishap, the MP and MSO selected the MTS on their respective HUDs for taxi. Prior to takeoff, the MP and MSO failed to switch either of their HUDs to the nose camera feed. The conflicting guidance was a substantially contributing factor to the mishap.

The absence of detailed actions for the pilot in the Pre-takeoff checklist was a factor in this mishap. The Pre-takeoff checklist does not direct either the MP or MSO to confirm video source configuration. Additionally, the Pre-takeoff checklist does not include video source configuration as a briefing item prior to departure and takeoff. The lack of direction for the aircrews to reconfirm HUD video sources was a substantially contributing factor to the mishap.

I arrived at my opinion by examining the recorded MRPA flight data logs and video capture, GA-ASI Contractor Report and witness testimony. All evidence led to my conclusion that the mishap was caused by the MP and MSO's failure to use different video sources for takeoff. The impact of the uncommanded movement of the MTS ball was a contributing factor in the mishap because it caused both the MP and MSO to lose sight of the runway. The absence of specific direction in the squadron detachment commander's memo and the lack of a step in the aircrew checklist to confirm video sources for takeoff were substantially contributing factors to the mishap.

16 October 2012

WILLIAM F. HARDIE, Lt Col, USAFR
President, Abbreviated Accident Investigation Board

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