UNITED STATES AIR FORCE ABBREVIATED AIRCRAFT ACCIDENT INVESTIGATION BOARD REPORT

MQ-1B Predator, T/N 04-3129

414TH EXPEDITIONARY RECONNAISSANCE SQUADRON
432D WING
CREECH AIR FORCE BASE, NEVADA

LOCATION: USCENTCOM AOR

DATE OF ACCIDENT: 2 FEBRUARY 2016

BOARD PRESIDENT: LT COL RICHARD C. ORZECHOWSKI

Abbreviated Accident Investigation, conducted pursuant to Chapter 11 of Air Force Instruction 51-503

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

OFFICE OF THE DEPUTY COMMANDER
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22 JAN 2018

ACTION OF THE CONVENING AUTHORITY

The Report of the Abbreviated Accident Investigation Board, conducted under the provisions of AFI 51-503, that investigated the 2 February 2016 mishap involving an MQ-1B, T/N 04-3129, 414th Expeditionary Reconnaissance Squadron, 432d Wing, Creech Air Force Base, Nevada, complies with applicable regulatory and statutory guidance; on that basis it is approved.

//Signed//

JOHN K. MCMULLEN
Major General, USAF
Deputy Commander

Agile Combat Power

EXECUTIVE SUMMARY
UNITED STATES AIR FORCE
ABBREVIATED AIRCRAFT ACCIDENT INVESTIGATION

MQ-1B Predator, T/N 04-3129
USCENTCOM AOR
2 FEBRUARY 2016

On 2 February 2016, at approximately 2322 Zulu time (Z), the mishap remotely piloted aircraft (MRPA), an MQ-1B Predator, tail number (T/N) 04-3129, forward deployed from the 432d Wing, Creech Air Force Base (AFB), Nevada, crashed after conducting a combat support mission. At the time of the mishap, the mishap launch and recovery element (MLRE) from the 414th Expeditionary Reconnaissance Squadron operated the MRPA from a deployed location in the Area of Responsibility (AOR). The MRPA experienced datalink problems, departed controlled flight, and crashed approximately 10 nautical miles south of the intended base of landing. The estimated cost of aircraft and munitions is $4.1 million. No one reported any injuries or deaths, only minor damages to a cultivated field.

At approximately 2314Z, the MLRE took handover of the MRPA from the mission control element. The MRPA was returning early due to a suspected engine malfunction. The handover was uneventful. Over the next six minutes, the MLRE confirmed that the engine was underperforming and began a descent for landing. In the descent, the MLRE experienced degraded video and telemetry, indicative of a degraded C-Band datalink. While troubleshooting the datalink problems, the MLRE received numerous warnings for angle of attack stalls with continually degrading telemetry and video.

Evidence showed that the MLRE lost usable C-Band downlink from the MRPA. Consequently, heads up display information was exceedingly unreliable to make informed control inputs to the MRPA. The MRPA never executed the emergency mission profile and continued to respond to mishap pilot's (MP) and mishap sensor operator's (MSO) commands. As the MRPA descended, MP inputs transmitted to the MRPA caused a left yaw and left roll, resulting in a departure from controlled flight. The MRPA entered an unrecoverable spin and the impact destroyed the aircraft.

The Abbreviated Accident Investigation Board (AAIB) President found by a preponderance of the evidence that the cause of the mishap was the failure to execute the checklist procedure for a loss of usable C-band downlink above 2000 feet above ground level, which resulted in ill-informed control inputs and a subsequent unrecoverable departure from controlled flight. The AAIB President also found by a preponderance of the evidence that the MRPA's underperforming turbocharger was a factor that substantially contributed to the mishap by causing a major distraction to the MLRE.

SUMMARY OF FACTS AND STATEMENT OF OPINION
MQ-1B PREDATOR, T/N 04-3129
2 FEBRUARY 2016

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ACRONYMS AND ABBREVIATIONS

12 AF	12th Air Force
46 EATKS	46th Expeditionary Attack Squadron
414 ERS	414th Expeditionary Reconnaissance Squadron
432 WG	432d Wing
A/C	Aircraft
AAIB	Abbreviated Accident Investigation Board
ACC	Air Combat Command
AF	Air Force
AFB	Air Force Base
AFE	Air Flight Equipment
AFI	Air Force Instruction
AFTO	Air Force Technical Order
AGL	Above Ground Level
AGM	Air-to-Ground Missile
AAIB	Abbreviated Accident Investigation Board
AIB	Accident Investigation Board
ANG	Air National Guard
AOA	Angle of Attack
AOR	Area of Responsibility
ATO	Air Tasking Order
CAP	Critical Action Procedure
DoD	Department of Defense
E-Mission	Emergency Mission
EP	Emergency Procedures
GA-ASI	General Atomics Aeronautical Systems, Inc.
GCS	Ground Control Station
GDT	Ground Data Terminal
HG	Mercury (Element)
HMU	Hot Mockup
HUD	Heads-Up Display
IAW	In Accordance With
IFF	Identification Friend or Foe

K	Thousand
KIAS	Knots Indicated Airspeed
LNO	Liaison Officer
LOS	Line-of-Sight
LR	Launch and Recovery
LRE	Launch and Recovery Element
Lt Col	Lieutenant Colonel
MAJCOM	Major Command
MAP	Manifold Absolute Pressure
MFW	Multifunction Workstation
MCE	Mission Control Element
MLRE	Mishap Launch and Recovery Element
MP	Mishap Pilot
MPCM	Mishap Primary Control Module
MRPA	Mishap Remotely Piloted Aircraft
MSO	Mishap Sensor Operator
MSL	Mean Sea Level
MTS	Multi-Spectral Targeting System
NOTAMs	Notices to Airmen
ORM	Operational Risk Management
PTP	Production Test Procedure
RF	Radio Frequency
RL	Return Link
RPA	Remotely Piloted Aircraft
RPM	Revolutions Per Minute
SAR	Search and Rescue
T/N	Tail Number
TO	Technical Order
USC.	United States Code
USCENTCOM	United States Central Command
VVI	Vertical Velocity Indication
WSO	Witness Sensor Operator
WP	Witness Pilot
Z	Zulu

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

SUMMARY OF FACTS

1. AUTHORITY AND PURPOSE

a. Authority

On 1 August 2017, Major General John K. McMullen, Vice Commander, Air Combat Command, appointed Lieutenant Colonel Richard C. Orzechowski as the Abbreviated Accident Investigation Board (AAIB) President to investigate the 2 February 2016 accident involving an MQ-1B Predator aircraft (A/C), tail number (T/N) 04-3129 (Tab Y-3 to Y-4). An AAIB was conducted at Creech Air Force Base (AFB), Nevada, from 3 August 2017 to 18 August 2017, in accordance with the provisions of the Air Force Instruction (AFI) 51-503, *Aerospace Accident Investigations*, Chapter 11 (Tab Y-3 to Y-4). A legal advisor and a recorder were also appointed to the AAIB (Tab Y-3).

b. Purpose

In accordance with AFI 51-503, *Aerospace and Ground Accident Investigations*, this accident investigation board conducted a legal investigation to inquire into all the facts and circumstances surrounding this Air Force ground accident, prepare a publicly releasable report, and obtain and preserve all available evidence for use in litigation, claims, disciplinary action, and adverse administrative action.

2. ACCIDENT SUMMARY

On 2 February 2016, at approximately 2322 Zulu time (Z), the mishap remotely piloted aircraft (MRPA), an MQ-1B Predator, T/N 04-3129, forward deployed from the 432d Wing, Creech AFB, Nevada, conducted a combat support mission in the United States Central Command (USCENTCOM) area of responsibility (AOR) (Tabs AA-3, EE-4, and EE-33). At the time of the mishap, the mishap launch and recovery element (MLRE) from the 414th Expeditionary Reconnaissance Squadron operated the MRPA from a deployed location (Tabs V-3.2, V-4.17, V-5.3 to V-5.4, and AA-3). The MRPA experienced datalink problems, departed controlled flight, and crashed in an area south of the intended base of landing (Tabs EE-4 to EE-5, EE-9, and EE-33). The estimated cost of aircraft and munitions is $4.1 million (Tab P-4). No one reported any injuries or deaths, only minor damages to a cultivated field (Tab P-3).

3. BACKGROUND

a. Air Combat Command (ACC)

To support global implementation of national security strategy, ACC operates fighter, bomber, reconnaissance, battle-management and electronic aircraft (Tab CC-3). It also provides command, control, communications and intelligence systems, and conducts global information operations (Tab CC-3). As a force provider and Combat Air Forces lead agent, ACC organizes, trains, equips and maintains combat-ready forces for rapid deployment and employment while ensuring strategic air defense forces are ready to meet the challenges of peacetime air sovereignty and wartime air defense (Tab CC-3). Additionally, ACC develops strategy, doctrine, concepts, tactics, and procedures for air and space-power employment (Tab CC-3). The command provides conventional and informational warfare forces to all unified commands to ensure air, space, and information superiority for warfighters and national decision-makers (Tab CC-3). The command can also be called upon to assist national agencies with intelligence, surveillance, and crisis response capabilities (Tab CC-3). ACC numbered air forces provide the air component to U.S. Central, Southern and Northern Commands, with Headquarters ACC serving as the air component to Joint Forces Commands (Tab CC-3). ACC also augments forces to United States European, Pacific, Africa-based and Strategic Commands (Tab CC-3).

b. Twelfth Air Force (12 AF)

12 AF is responsible for the combat readiness of seven active-duty wings and one direct reporting unit (Tab CC-8). The subordinate commands operate more than 360 aircraft with more than 20,300 uniformed and civilian Airmen (Tab CC-8). The command is also responsible for the operational readiness of 17 AF-gained wings and other units of the Air Force Reserve and Air National Guard (ANG) (Tab CC-8).

c. 432d Wing (432 WG)

The 432 WG "Hunters" consists of combat-ready Airmen who fly remotely piloted aircraft (RPA) in direct support of the joint warfighter (Tab CC-13). The Hunters conduct RPA training for aircrew, intelligence, weather, and maintenance personnel (Tab CC-13). The 432 WG flies and maintains the MQ-1B Predator and MQ-9 Reaper RPAs to support the joint forces warfighter (Tab CC-13).

d. 414th Expeditionary Reconnaissance Squadron (414 ERS)

The 414 ERS is responsible for launch and recovery operations of the MQ-1B Predator in the deployed environment. (Tab V-5.4)

e. MQ-1B Predator

The MQ-1B Predator is an armed, multi-mission, medium-altitude, long endurance RPA that is employed primarily as an intelligence-collection asset and secondarily against dynamic execution targets (Tab CC-14). Given its significant loiter time, wide-range sensors, multi-mode communications suite, and precision weapons, it provides a uniquely capability to perform strike, coordination and reconnaisance against high-value, fleeting, and time-sensitive targets (Tab CC-14). Predators can also perform the following missions and tasks: intelligence, surveillance and reconnaissance, close air support, combat search and rescuse, precision strike, buddy-lase, convoy/raid overwatch, route clearance, target development, and terminal air guidance (Tab CC-14). The MQ-1B's capabilities make it uniquely qualified to conduct irregular warfare operations in support of combatant commander objectives (Tab CC-14).

The Predator carries the Multi-spectral Targeting System (MTS), which integrates an infrared sensor, color/monochrome daylight TV camera, image-intensified TV camera, laser designator and laser illuminator (Tab CC-14). The full-motion video from each of the imaging sensors can be viewed as separate video streams or fused (Tab CC-14). The aircraft can employ two laser-guided Hellfire missiles that possess high accuracy, low-collateral damage anti-armor/anti-personnel engagement capabilities (Tab CC-14).

The aircraft is employed from a ground control station (GCS) via a line-of-sight datalink or a satellite datalink for beyond line-of-sight operations (Tab CC-14). The basic crew for the Predator is a rated pilot to control the aircraft and command the mission and an enlisted aircrew member to operate senors and weapons inside the GCS (Tab CC-14).

4. SEQUENCE OF EVENTS

a. Mission

On 2 February 2016, the MRPA conducted a combat support mission in a deployed location (Tabs V-3.2, V-5.4, and AA-3).

b. Planning

On 2 February 2016, at around 2200Z, the MLRE consisting of the mishap pilot (MP) and the mishap sensor operator (MSO) attended a pre-shift brief within the 414 ERS (Tab V-3.2 to V-3.4, and V-4.2 to V-4.3). The briefing was uneventful, with no risk factors noted (Tab V-3.3 to V-3.4, and V-4.16). The weather briefing indicated no significant weather in the AOR (Tab V-3.3 and V-4.16). The MP and MSO indicated an overall moderate risk level on the Wing Risk Management Sheet with the highest risk factor being that each individual had less than 6 months of Launch and Recovery Element (LRE) experience (Tab AA-4).

c. Preflight

The MLRE conducted preflight checks with no maintenance discrepancies (Tab V-3.3 to V-3.4). There were no factor Notices to Airmen (NOTAMs) relevant to the mishap (Tab V-3.3 to V-3.4, and V-4.2 to V-4.4). The MLRE reviewed GCS maintenance forms with no discrepancies noted (Tab V-3.4). The MRPA had been flying for a short period of time when the MLRE took control for landing (Tab V-3.3 and V-4.3).

d. Summary of Accident

The MP and the MSO proceeded to the GCS at a normal time for the shift (Tab V-3.2 to V-3.3, and V-4.3). The MLRE was tasked with landing the MRPA that was returning early with a possible engine anomaly (Tab V-3.3 and V-4.3). After the GCS was ready to take control of the aircraft, the MP commented to the MSO that nothing was wrong with the aircraft or datalink and the MLRE was ready to take control (Tab EE-33). Mission Control Element (MCE) to MLRE handover of the MRPA occurred at approximately 231350Z (Tab EE-5 and EE-33). Following handover, the GCS and MRPA appeared to be operating normally (Tabs V-4.6, EE 5, and EE-33). The MRPA properly responded to all GCS commands for pitch, roll, yaw, and throttle (Tab EE-5). Manifold Absolute Pressure (MAP) surging occurred for the duration of the flight; however, MAP and turbocharger oil temperature did not exceed any published operating limitations (Tab J-2). The surging MAP resulted in engine underperformance (Tabs V-4.7 and EE-5).

For several minutes, the MLRE conducted throttle changes, climbs, and turns to test the MRPA performance and handling (Tab EE-5 and EE-33). The MRPA was able to gain both airspeed and altitude despite the underperforming turbocharger (Tab EE-33). While level at 10,000 feet mean sea level (MSL), and full power, the MRPA accelerated from 73 knots indicated airspeed (KIAS) to 91 KIAS in 23 seconds (Tab EE-33). Then, the MP initiated a climb above 10,000 feet MSL and was able to achieve over 767 feet per minute climb rate while losing 4 KIAS (Tab EE-33). The MP stated that the turbocharger was not operating correctly and coordinated a descent for a straight-in approach (Tabs V-3.6, N-4, and EE-5).

At 231730Z the MP directed the MSO to preemptively run the *Turbocharger/MAP Sensor Failure* checklist (Tabs V-4.10, EE-5, and EE-33). The MSO began running the checklist and read it verbally to the MP (Tabs V-4.10 and EE-33). The MP confirmed that the MAP sensors were functioning normally, but that the engine performance was not returning to normal (Tabs V-4.10, EE-33, and EE-5). At 231823Z, the MP stated a plan to descend the MRPA to 6000 feet MSL and test engine performance again (Tab EE-33). The MSO then paused the checklist procedures and the MP did not adjust any engine or turbocharger settings, waiting for the level-off engine performance assessment (Tab EE-33). At 231940Z, the MSO stated the MRPA weight was at 2,490 pounds (Tab EE-6 and EE-33). Next, descending through 8,800 feet MSL, the MLRE conducted the *Descent Checklist* and commanded the landing gear down at 232005Z (Tab EE-6 and EE-33). The MP commanded Landing Configuration (Tab EE-33). Commanding Landing Configuration mode disables the MRPA's autopilot function for stall protection (Tabs V-3.6 and BB-11).

The MLRE relied on two datalinks for operation of the aircraft during Line of Sight (LOS) operations: C-Band uplink and C-Band downlink. (Tab V-3.5 and V-4.11). The C-Band uplink refers to the inputs from the pilot and sensor operator to the aircraft. (Tabs V-3.5 and BB-11). C-Band downlink refers to the telemetry from the aircraft, which allows the MLRE to monitor or view what the MRPA is doing via the main displays on the multifunction workstation (MFW) within the GCS (Tabs V-3.5 and B-11). If the MRPA loses uplink, either unintentionally or intentionally by disabling the uplink or the Ground Data Terminal (GDT), the MRPA is designed to automatically fly to its planned emergency mission (Tabs V-3.14, V-4.13, V-5.6 to V-5.8).

At 232013Z, the video and Heads Up Display (HUD) image began to degrade and the time displayed in the lower left corner of the HUD began to freeze intermittently (Tabs EE-6 and EE-33). Approximately eight seconds later, an unidentified individual asked the MP if it was okay to turn on the GDT (Tab EE-6). This is a common practice during deployed operations to have two GDTs operating in close proximity (Tab V-4.4, V-4.19, and V-5.9). Shortly thereafter, at 232033Z, the MP stated that the MLRE lost link with the MRPA (Tabs V-3.8, EE-6, and EE-33). Next, the MP stated that he did not have telemetry with the aircraft and directed the individuals testing the other LRE GDT to turn off their link (Tabs N-2 and V-3.9).

When the MP stated that he had lost link, the MSO tested and confirmed that he had control of the payload (Tabs N-2 and EE-33). The MP again stated that he did not have telemetry (Tab N-2). Degradation or loss of video and telemetry is indicative of a degradation or loss of C-Band downlink (Tabs V-4.12 and BB-11). The MSO observed intermittent telemetry and described it as "going in-and-out," but telemetry values were red and yellow (Tab N-2). The MRPA never downlinked an indication that it had initiated lost link logic or displayed behavior consistent with an emergency mission profile (Tabs J-3 and EE-6). At 232110Z, the MSO then stated that the MRPA was in an angle of attack (AOA) stall (Tabs N-2, V-4.15, and EE-34). The correct response in this situation is to increase airspeed by accelerating or lowering the nose of the aircraft (Tabs V-3.11, V-5.11, and BB-11).

At approximately 232112Z, the MSO's intermittent HUD indications displayed 66 KIAS, 8,300 feet MSL, 11.3 AOA, 1,241 feet per minute descent rate, 2,982 revolutions per minute (RPM), and 9.2 MAP (Tab EE-34). At approximately 232144Z, the MP asked if the other LRE GDT was off and stated that he was still not receiving telemetry (Tab N-2). At 232152Z, the MRPA's roll angle decreased from a slightly positive roll angle to -27 degrees with no corresponding command (Tab J-3). In addition, at this same time, yaw rate decreased from a slightly positive rate to -10 degrees after a command of -20 degrees was made by the MP (Tab J-3). The HUD video showed the MRPA began to yaw and roll left and then entered a spin to the left (Tab EE-7). The MP did not make any spin recovery control inputs (Tab V-3.12). Five seconds later, the MP directed the MSO to turn off the GDT in hopes that the aircraft would recover itself and execute the emergency mission (Tabs N-2, V-3.12, and V-3.14). In an additional four seconds, the MSO verbally confirmed that the GDT was off (Tab N-2). At 232204Z, the MP said let the MRPA recover itself (Tab N-2). The MP then checked the status of the aircraft with the approach controller (Tabs N-2 and V-3.12). The approach controller described seeing an emergency identification friend or foe (IFF) code, a decreasing altitude with a last reported altitude of 600 feet, and eventual loss of radar contact (Tabs N-2 to N-3, V-3.12, and V-4.14).

e. Impact

At approximately 232252Z, the MRPA impacted the ground in close proximity to where it began its departure from controlled flight (Tabs N-3, S-3 to S-10, and EE-8). The impact destroyed the MRPA but the parts remained close together and almost intact or attached (Tabs S-3 to S-10). There was no indication of skidding or sliding through the field (Tab S-3, S-5, S-8, and S-9).

f. Egress and Aircrew Flight Equipment (AFE)

Not Applicable.

g. Search and Rescue (SAR)

The MRPA was recovered from a cultivated field without incident. (Tabs S-1, and EE-8).

h. Recovery of Remains

Not Applicable.

5. MAINTENANCE

a. Forms Documentation

A review of the MRPA's maintenance documentation recorded in the Air Force Technical Order (AFTO) 781 series, revealed no relevant discrepancies (Tab D). AFTO Form 781H, dated 2 February 2016, revealed total MRPA airframe time of 25,266.9 hours (Tab D-22).

b. Inspections

All maintenance inspections were current and complied with (Tab D).

c. Maintenance Procedures

Preflight inspections, servicing operations, and launch procedures were accomplished without incident (Tabs D-2 to D-334, and V-3.4).

d. Maintenance Personnel and Supervision

There is no evidence to suggest military and civilian maintenance personnel's training, qualifications, and supervision contributed to the mishap (Tab D). Military and civilian maintenance personnel correctly documented all preflight servicing and maintenance (Tab D).

e. Fuel, Hydraulic, and Oil Inspection Analyses

Maintenance documentation shows proper servicing and correct levels of fluids in the aircraft at the time of takeoff (Tab D). No post-accident fluid sample analyses were available for review.

f. Unscheduled Maintenance

Maintenance documentation revealed no unscheduled maintenance (Tab D).

6. AIRFRAME, MISSILE, OR SPACE VEHICLE SYSTEMS

a. Structures and Systems

The Mishap Primary Control Module (MPCM) was returned to General Atomics Aeronautical Systems (GA-ASI) for testing following the mishap (Tab EE-9). All other hardware was determined to not have an impact on the mishap and therefore was not tested (Tab EE-9). In addition, GA-ASI's review of the aircraft maintenance records indicated no issues relating to the turbocharger or datalink systems (Tab EE-9).

b. Evaluation and Analysis

According to the GA-ASI report, the MPCM did not have any visual signs of damage, but it was tested and functioned correctly with the exception of Receiver 1 (Tab EE-9). It determined that Receiver 1 was damaged during the crash (Tab EE-9). Receiver 1 was replaced and the MPCM subsequently passed all functional tests, to include thermal cycling (Tab EE-9). Additionally, the MPCM's directional and omni transmitters were tested and operated normally (Tab EE-10). The radio frequency (RF) tray correctly switched between transmitters (Tab EE-10). Following the hot mockup (HMU) test, the MPCM was disassembled and the sync board, datalink board, and interface board were individually tested (Tab EE-9 to EE-10). All three boards passed Production Test Procedure (PTP) testing (Tab EE-10).

Post-mishap evaluation and analysis indicated that the MPCM was functioning normally at the time of the mishap (Tab EE-12 to EE-13).

7. WEATHER

a. Forecast Weather

The MLRE briefed the weather and there was nothing indicated that would influence the mission (Tabs V-3.3, V-4.16, and AA-4). For the remainder of the mission, there is no evidence that suggests weather played a significant role in this mishap (Tab V-3.3 and V-4.16).

b. Observed Weather

After gaining the MRPA, the MLRE noted no significant weather in the AOR that would influence the mission (Tab V-3.3 and V-4.16).

c. Operations

No evidence suggests that the MLRE operated the MRPA outside of prescribed operational weather limits (Tab V-3.3 and V-4.16).

8. CREW QUALIFICATIONS

a. Mishap Pilot

The MP was current and had been qualified in the MQ-1B since 9 January 2014 (Tab G-14). At the time of the mishap, the MP had a total flight time of 1,123.9 hours in the MQ-1B (Tab G-3). The MP's flight time during the 90 days before the mishap was as follows (Tab G-3):

	Hours	Sorties
30	19.3	15
60	42	34
90	45.9	37

b. Mishap Sensor Operator

The MSO was current and had been qualified in the MQ-1B since 7 August 2014 (Tab G-25). At the time of the mishap, the MSO had a total flight time of 657.4 hours in the MQ-1B (Tab G-6). The MSO's flight time during the 90 days before the mishap was as follows (Tab G-6):

	Hours	Sorties
30	19.3	15
60	49.8	38
90	68.9	56

9. MEDICAL

a. Qualifications

At the time of the mishap, MLRE crewmembers were fully medically qualified for flight duty. (Tab DD-3 and DD-4).

b. Health

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

c. Pathology

A medical group in the USCENTCOM AOR collected blood and urine samples from the MLRE crewmembers following the mishap (Tab DD-5 to DD-6). All toxicology reports resulted in negative findings (Tab DD-5 to DD-6).

d. Lifestyle

There is no evidence to suggest lifestyle factors contributed to the mishap.

e. Crew Rest and Crew Duty Time

Aircrew members are required to have proper crew rest prior to performing in-flight duties, defined as a minimum of 12-hours non-duty time before the designated flight duty period begins (Tab BB-4). The MLRE met crew rest requirements (Tab V-3.4 and V-4.2). There is no evidence to suggest crew rest and crew duty time were factors in the mishap.

10. OPERATIONS AND SUPERVISION

a. Operations

There is no evidence to suggest operations tempo contributed to the mishap (Tabs V-3.14, V-4.16, and AA-4).

b. Supervision

On the day of the mishap, the MLRE received their daily briefing as they came on shift around 2200Z (Tab V-3.2 to V-3.3, and V-4.2). Shortly after, the MLRE conducted their crew mission briefing (Tab V-3.3). The MLRE was current on their go/no-go requirements and their operational risk management (ORM) was signed off and approved prior to proceeding to the GCS (Tabs V-3.3, V-4.3, and AA-4).

11. HUMAN FACTORS ANALYSIS

a. Human Factor 3 – PC508 – Spatial Disorientation (Type 1) Unrecognized

The intermittent downlink resulted in frozen, erroneous, and/or unreliable HUD video (Tabs V-3.8 to V-3.9, EE-5 to EE-6, and EE-33). MP based control inputs on information that did not accurately reflect reality, resulting in spatial disorientation (Tabs BB-9 to BB-10, EE-7, and EE-33).

12. GOVERNING DIRECTIVES AND PUBLICATIONS

a. Publically Available Directives and Publications Relevant to the Mishap

(1) AFI 51-503, *Aerospace Accident Investigations,* 14 April 2015
(2) AFI 51-503, *Aerospace Accident Investigations*, Air Combat Command *Supplement*, 28 January 2016
(3) AFI 11-2MQ-1&9, Volume 1, *MQ-1&9, Aircrew Training*, 23 April 2015
(4) AFI 11-2MQ-1&9, Volume 3, *MQ-1 AND MQ-9*, *Operations Procedures*, 28 August 2015
(5) AFI 11-202, Volume 3, *General Flight Rules,* 7 November 2014
(6) AFI 91-204, *Safety Investigations and Reports*, 12 February 2014, Corrective Actions Applied 10 April 2014, Attachment 6, *DoD Human Factors Analysis and Classification System*.

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

b. Other Directives and Publications Relevant to the Mishap

(1) AFTO 1Q-1(M)B-1, Aircrew Flight Manual – USAF Series MQ-1B System, 20 March 2015
(2) AFTO 1Q-1(M)(B)-1-1, Flight Manual Appendix A Performance Data – USAF Series MQ-1B System, 10 December 2012
(3) AFTO 1Q-1(M)B-1CL-1, Flight Crew Checklist – USAF Series MQ-1B System, 20 March 2015

c. Known or Suspected Deviations from Directives or Publications

(1) Paragraph 3.4 of AFI 11-2MQ-1&9, *Operations Procedures,* 28 August 2015

//Signed//

16 January 2018

RICHARD C. ORZECHOWSKI, Lt Col, USAF
President, Accident Investigation Board

STATEMENT OF OPINION

MQ-1B PREDATOR, T/N 04-3129
USCENTCOM
2 FEBRUARY 2016

Under 10 U.S.C. § 2254(d) the opinion of the accident investigator as to the cause of, or the factors contributing to, the accident set forth in the accident investigation report, if any, may not be considered as evidence in any civil or criminal proceeding arising from the accident, nor may such information be considered an admission of liability of the United States or by any person referred to in those conclusions or statements.

1. OPINION SUMMARY

On 2 February 2016, at approximately 2322 Zulu time (Z), the mishap remotely piloted aircraft (MRPA), an MQ-1B Predator, tail number (T/N) 04-3129, forward deployed from the 432d Wing, Creech Air Force Base (AFB), Nevada, crashed after conducting a combat support mission. At the time of the mishap, the mishap launch and recovery element (MLRE) from the 414th Expeditionary Reconnaissance Squadron (414 ERS) operated the MRPA from a deployed location in the USCENTCOM AOR. The MRPA experienced datalink problems, departed controlled flight, and crashed approximately 10 nautical miles south of the intended base of landing. The estimated cost of aircraft and munitions is $4.1 million. No one reported any injuries or deaths, only minor damages to a cultivated field.

I find by a preponderance of the evidence the cause of the mishap was the failure to execute the checklist procedure for a loss of usable C-band downlink above 2000 feet above ground level (AGL), which resulted in ill-informed control inputs and a subsequent unrecoverable departure from controlled flight. I also found by a preponderance of the evidence that the MRPA's underperforming turbocharger was a factor that substantially contributed to the mishap by causing a major distraction to the MLRE.

I developed my opinion by analyzing factual data from historical records, flight data logs, manufacturer reports, maintenance records, witness testimony, Air Force directives and guidance, and Air Force Technical Orders (AFTO).

2. CAUSE

I find by a preponderance of the evidence the cause of the mishap was the failure to execute the checklist procedure for a loss of usable C-band downlink above 2000 feet AGL, which resulted in ill-informed control inputs and a subsequent unrecoverable departure from controlled flight.

The mishap pilot (MP) was flying an aircraft with an underperforming turbocharger. The aircraft was able to maintain level flight at 10,000 feet mean sea level (MSL), but was unable to climb effectively above that. The decision was made to descend, enter Landing Configuration, and reassess engine performance at a lower altitude. Commanding Landing Configuration mode disables the MRPA's autopilot function for stall protection. The MP slowed down and lowered the landing gear in preparation for the approach to land. While descending, the C-band downlink started to degrade. The information displayed to the MP and mishap sensor operator (MSO) became intermittent and erroneous, particularly for the MP.

The MP recognized and verbalized a lost link situation. I believe the MP was distracted by the underperforming turbocharger and the aircraft's proximity to a populated area, and incorrectly chose not to execute the *Loss of C-Band Downlink Above 2,000 Feet AGL* checklist. This decision resulted in the MRPA continuing under control of the uplink and not executing the emergency mission. The MRPA never reported losing the uplink and continued responding to MP control inputs. The information displayed to the MP continued to degrade and was unacceptable to maintain situational awareness of the MRPA's attitude and control parameters. The misinformation displayed in the ground control station contributed to the MP's spatial disorientation. The MSO verbalized an angle of attack stall, to which the MP did not correctly respond. With the power setting at idle and intermittent stall indications, the MP commanded a large left rudder and left roll input. The MRPA responded, resulting in an unrecoverable departure from controlled flight. The MP did not attempt to recover from the stall or spin, and the MLRE turned off the uplink in hopes that the aircraft would recover itself and execute the emergency mission. The MRPA came to rest in a cultivated field and the impact destroyed the aircraft.

3. SUBSTANTIALLY CONTRIBUTING FACTORS

I find by a preponderance of the evidence that an underperforming turbocharger was a substantially contributing factor in the mishap by causing a major distraction to the MLRE. The underperforming turbocharger was a major distraction for the MLRE and led the MP down a path of poor decision-making. The MP incorrectly chose not to follow checklist procedures over his concern that the aircraft could not maintain flight for a short distance to clear a populated area en route to the aircraft's emergency orbit. Although underperforming, the aircraft had enough thrust to maintain level flight at 10,000 MSL. The turbocharger itself had no impact on the loss of C-Band downlink or the ultimate departure from controlled flight.

4. CONCLUSION

I find by a preponderance of the evidence the cause of the mishap was the failure to execute the checklist procedure for a loss of usable C-band downlink above 2000 feet AGL which resulted in ill-informed control inputs, and a subsequent unrecoverable departure from controlled flight. Additionally, an underperforming turbocharger was a substantially contributing factor in the mishap, by causing a major distraction to the MLRE. The evidence indicates that the MLRE did not respond appropriately and not in accordance with established emergency procedures. Had the MLRE followed emergency procedures, I believe the MRPA would have executed the emergency mission and time would have allowed for C-Band datalink restoration and safe recovery of the aircraft.

//Signed//

16 January 2018

RICHARD C. ORZECHOWSKI, Lt Col, USAF
President, Accident Investigation Board

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