UNITED STATES AIR FORCE

AIRCRAFT ACCIDENT INVESTIGATION

BOARD REPORT

MQ-9A, T/N AF 12-4209

AFLCMC, Detachment 3

GRAY BUTTE AIRFIELD, CALIFORNIA

LOCATION: GRAY BUTTE AIRFIELD, CALIFORNIA

DATE OF ACCIDENT: 7 SEPTEMBER 2023

BOARD PRESIDENT: BRIGADIER GENERAL LANCE R. FRENCH

Conducted IAW Air Force Instruction 51-307

Volume One of Five

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE MATERIEL COMMAND
WRIGHT-PATTERSON AIR FORCE BASE OHIO

4 March 2024

ACTION OF THE CONVENING AUTHORITY

The report of the accident investigation board, conducted under the provisions of AFI 51-307, that investigated the 7 September 2023 mishap at Gray Butte Airfield, CA, involving the fatality of a civilian contract test engineer employed by Sumaria Systems, LLC, complies with the applicable regulatory and statutory guidance and on that basis is approved.

DUKE Z. RICHARDSON
General, USAF
Commander

EXECUTIVE SUMMARY
UNITED STATES AIR FORCE
AIRCRAFT ACCIDENT INVESTIGATION

MQ-9A, T/N 12-4209
GRAY BUTTE AIRFIELD, CALIFORNIA (CA)
07 SEPTEMBER 2023

At 7:57:57 p.m. (Local Time) on 07 September 2023, a test engineer contractor employee came into contact with the propeller of an MQ-9A, aircraft Tail Number 12-4209, while the engine was running during ground testing on Gray Butte Airfield, California (CA). The Mishap Aircraft (MA) was operated by contractors, a pilot and sensor operator, in a Ground Control Station (GCS), Serial Number 08-5049. The MA and Mishap GCS were assigned to the Air Force Life Cycle Management Center (AFLCMC) Detachment 3 at Gray Butte Airfield, CA.

The Mishap Ground Test (MGT) was being conducted by a Mishap Test Director (MTD) assigned to AFLCMC Detachment 3 in support of AFLCMC's Intelligence, Surveillance and Reconnaissance/Special Operation Forces Directorate's Medium Altitude Unmanned Aircraft Systems Division. The Mishap Test Engineer (MTE1) was a civilian contractor employed by Sumaria Systems LLC as was the MTD.

The purpose of the MGT was to determine whether there was electromagnetic interference/ electromagnetic compatibility (EMI/EMC) with the release of a new software version loaded to the MQ-9A. The MGT consisted of two main test objectives. The first test objective was completed prior to breaking for lunch. The mishap occurred during the second test objective.

After the mid-shift meal, the MGT team reassembled and restarted the MA's engine. At 7:51 p.m., MTD directed MTE1 to take telemetry readings from weapons on the MA regarding EMI/EMC. MTE1 proceeded to weapons station 6 on the MA, at the rear of the right wing, without checking in with the Crew Chief. After apparently taking measurements with a handheld meter, MTE1 walked toward the rear of the MA, in an attempt to go behind the MA to get to weapons stations on the left wing. Without looking up to determine her position relative to the propeller, MTE1 walked directly into the MA's propeller sustaining fatal injuries.

The AIB Board President (BP) found, by a preponderance of the evidence, two causes of the mishap: (1) MTE1 was incorrectly instructed, or trained on, how to take the telemetry readings from the loaded weapons on the MQ-9A aircraft while engines were running, and (2) MTE1 lost situational awareness taking telemetry readings. The BP also found by a preponderance of the evidence two factors that substantially contributed to the mishap: (1) on 7 Sep 23 there was a clear lack of communication among the test team and ground support personnel and (2) due to previous delays and cancellations the tests conducted on 7 Sep 23 were rushed.

SUMMARY OF FACTS AND STATEMENT OF OPINION
MQ-9A, T/N 12-4209
GRAY BUTTE AIRFIELD, CALIFORNIA (CA)
7 SEPTEMBER 2023

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ACRONYMS AND ABBREVIATIONS

A&AS	Advisory and Assistance Service
AC-DC	Alternating Current – Direct Current
ADO	Assistant Director of Operations
AF	Air Force
AFB	Air Force Base
AFE	Air Flight Equipment
AFI	Air Force Instruction
AFLCMC	Air Force Life Cycle Management Center
AFMC	Air Force Material Command
AFSOC	Air Force Special Operations Command
AIB	Accident Investigation Board
ASI	Aeronautical Systems, Incorporated
AVMC	Antelope Valley Medical Center
AWACS	Airborne Warning and Control
BADDC	Barrett Asynchronous Digital Datalink Computer
Brig Gen	Brigadier General
BLS	Basic Life Saving
BVM	Bag Valve Mask
CA	California
Capt	Captain
CC	Commander
Col	Colonel
CO	Contracting Officer
COR	Contracting Officer's Representative
CPR	Cardiopulmonary Resuscitation
dB	Decibel
dBm	Decibel-Milliwatts
DC3	DoD Cyber Crime Center
Det	Detachment
DO	Director of Operations
DoD	Department of Defense
ECT	Evening Civil Twilight
EMC	Electromagnetic Capability
EMI	Electromagnetic Interference
EMT	Emergency Medical Technician
EPASS	Engineering Professional Administrative Support Services
ER	Emergency Room
ERT	Emergency Response Team
F	Fahrenheit
FAA	Federal Aviation Administration
FAR	Federal Acquisition Regulation
FL	Flight Lead
FLTE	Flight Test Engineer
FMS	Foreign Military Sales
FPS	Fire Protection System
ft	Feet
GA	General Atomics
GA-ASI	General Atomics-Aeronautical Systems Incorporated
GBA	Gray Butte Airfield
GBU	Guided Bomb Unit
GCS	Ground Control Station
GHz	GigaHertz
GMP	General Minimizing Procedure
HFACS	Human Factors Analysis and Classification System
IAW	In Accordance With
IT	Information Technology
ISR	Intelligence, Surveillance and Reconnaissance
K	Thousand
KTS	Knots
Ku	Ku band of electromagnetic spectrum
L	Local Time
LCMC	Life Cycle Management Center
LLC	Limited Liability Corporation
LOH	Lead Off Hitter
LRU	Line Replacement Unit
LSDB	Laser Small Diameter Bomb
Lt Col	Lieutenant Colonel
MA	Mishap Aircraft
Maj	Major
MAJCOM	Major Command
MAUAS	Medium Altitude Unmanned Aircraft Systems
MERT	Mishap Emergency Response Team
MGT	Mishap Ground Test
MHz	MegaHertz
MM	Mishap Maintainer
MOA	Military Operating Area
MP	Mishap Pilot
MQ	Multi-Role Remotely Piloted Aircraft
MSO	Mishap Sensor Operator
MTD	Mishap Test Director

MTE	Mishap Test Engineer
MWM	Mishap Weapons Maintainer
OI	Operating Instruction
OL	Operating Location
PA	Public Affairs
PR	Pre Flight
PWS	Performance Work Summary
RAMTS	Ruggedized Aircraft Maintenance Stations
RF	Radio Frequency
rn	Right Now
RPM	Revolutions per Minute
SATCOM	Satellite Communication
SDB	Small Diameter Bomb
SDI	System Dynamics Incorporated
S/N	Serial Number
SOF	Special Operation Forces
SRB	Safety Review Board
STandQ	Standards, Test, and Qualifications
TD	Test Director
THA	Threat Hazard Analysis
TM	Telemetry
T/N	Tail Number
TO	Technical Order
TPSR	Test Plan Safety Review
TSgt	Technical Sergeant
TSPR	Test Safety Plan Review
TOD	Tech Order Data
UAS	Unmanned Aerial Systems
USAF	United States Air Force
USB	Universal Serial Bus
VORTEX	Video Oriented Transmission and Exchange
YQ	Experimental Remotely Piloted Aircraft
Z	Zulu

SUMMARY OF FACTS

1. AUTHORITY AND PURPOSE

a. Authority

On 25 September 2023, General Duke Z. Richardson, the Commander, Air Force Materiel Command (AFMC), appointed Brigadier General Lance R. French to conduct an investigation of an accident involving an MQ-9A aircraft, which occurred on 07 September 2023, at Gray Butte Airfield (GBA), California (Tab Y-3). The investigation was conducted pursuant to the provisions of Air Force Instruction (AFI) 51-307, *Aerospace and Ground Accident Investigations*, and took place at Edwards Air Force Base (AFB), California, and GBA, from 13 October 2023 through 30 January 2024. Board members included a Legal Advisor (Lieutenant Colonel), a Medical Member (Lieutenant Colonel), and a Recorder (Technical Sergeant) (Tabs Y-3 and Y-5).

b. Purpose

In accordance with AFI 51-307, *Aerospace and Ground Accident Investigations*, this Accident Investigation Board conducted a legal investigation to inquire into all the facts and circumstances surrounding this Air Force aerospace accident, prepare a publicly-releasable report, and obtain and preserve all available evidence for use in litigation, claims, disciplinary action, and adverse administrative action.

2. ACCIDENT SUMMARY

On 07 September 2023, at 7:57:57p.m. Local Time (L) a contractor flight test engineer, Mishap Test Engineer 1 (MTE1), came into contact with the propeller of a remotely piloted MQ-9A aircraft while the engine was running during a ground test on GBA (Tab V-12.12). The unmanned aerial system, consisting of both an MQ-9A remotely piloted Mishap Aircraft (MA) (Aircraft Tail Number (T/N) 12-4209) and a Mishap Ground Control Station (GCS) (Serial Number (S/N) 08-5049) were assigned to Detachment 3 (Det 3), Air Force Life Cycle Management Center (AFLCMC) at GBA (Tabs V-30.1 to V-30.2, V-38.11, and CC-15). MTE1 was an employee of Sumaria Systems LLC, a contractor hired to provide Advisory and Assistance Service (AandAS) to the Intelligence, Surveillance and Reconnaissance/Special Operation Forces (ISR/SOF) Directorate's Medium Altitude Unmanned Aircraft Systems (MAUAS) Division of AFLCMC at Wright-Patterson AFB, Ohio (Tabs V-26.2 and CC-18). The GCS had one Mishap Pilot (MP), one Mishap Sensor Operator (MSO), one Mishap Test Director (MTD), and five Mishap Test Engineers (Tabs V-1.5 V-8.10, V-10.3, V-11.5, and V-21.8), all of which were contractors. Damage to the MA is unknown as it has been impounded since the mishap. MTE1 sustained fatal injuries (Tabs Q-11 and X-3).

3. BACKGROUND

a. Air Force Materiel Command (AFMC)

AFMC, headquartered at Wright-Patterson AFB, Ohio, is one of the major commands of the United States Air Force (USAF). (Tab CC-4) AFMC's primary mission is to manage installation and mission support, discovery and development, test and evaluation, and life cycle management services and sustainment for every major Air Force weapon system. The command conducts research, development, test and evaluation, and provides acquisition services and logistics support necessary to keep Air Force weapon systems ready for war. AFMC has approximately 89,000 military and civilian employees. (Tab CC-4 to CC-13)

b. Air Force Life Cycle Management Center (AFLCMC)

AFLCMC, headquartered at Wright-Patterson AFB, Ohio, is one of six centers reporting to AFMC (Tab CC-15). AFLCMC's primary mission is to provide holistic management of weapon systems across their life cycle and simplify/consolidate staff functions and processes to curtail redundancy and enhance efficiency. AFLCMC's operating structure provides an integrated framework for decision making and process optimization across the weapon system life cycle. AFLCMC has approximately 30,000 military, civilian, and contractor employees (Tabs CC-15 to CC-16).

c. Air Force Life Cycle Management Center, Detachment 3 (AFLCMC, Det 3)

AFLCMC, Det 3, primarily located in Poway, CA, provides real time cradle to grave warfighter support through excellence in development, test, acquisition, and sustainment. Det 3 consists of three branches: flight operations, test operations, and technical operations. Flight operations executes MQ-9A and YQ-11A Developmental Test for USAF, Foreign Military Sales (FMS), and other government agencies as well as production acceptance flights for USAF and FMS (Tab CC-21). Test operations develops test plans for numerous programs including software, hardware, weapons, etc. and provides engineering support to test execution in conjunction with flight ops. Technical operations include the MQ-9 maintenance help desk and deals with sustainment logistics issues. Det 3 has an operating location (OL) at GBA, CA, consisting of approximately 169 personnel to include military, civilian, and contractor employees. (Tab Q-20)

d. Intelligence, Surveillance, and Reconnaissance / Special Operations Forces (ISR/SOF) Directorate; Medium Altitude Unmanned Aircraft Systems (MAUAS) Division

MAUAS, headquartered at Wright-Patterson AFB, Ohio, plans, develops, acquires, tests, and sustains the fleet of medium altitude Remotely Piloted Aircraft for USAF, Air Combat Command, Air Force Special Operations Command, United States Marine Corps, National Guard, and FMS partner nations. MAUAS is responsible for the development, test, production, and sustainment of the MQ-9 unmanned aerial system (UAS), and associated support programs (Tab CC-19).

e. MQ-9A Reaper

The MQ-9A is an armed, multi-mission, medium-altitude, long-endurance remotely piloted aircraft that is employed primarily against dynamic execution targets and secondarily as an intelligence collection asset (Tab CC-22). It is a single engine, propeller driven aircraft with the pusher type propeller at the rear of the fuselage. Given its significant loiter time, wide-range sensors, multi-mode communications suite, and precision weapons, it provides a unique capability to perform strike, coordination, and reconnaissance against high-value, fleeting, and time-sensitive targets. Reapers can also perform the following missions and tasks: intelligence, surveillance, convoy/raid over watch, and target development. The MQ-9A's capabilities made it uniquely qualified to conduct irregular warfare operations in support of combatant commander objectives (Tabs CC-22 to CC-23).

Figure #1: MQ-9A Reaper (Tab CC-24)

f. General Atomics-Aeronautical Systems, Inc. (GA-ASI)

GA-ASI, a corporation headquartered in Poway, California, is a military contractor and subsidiary of General Atomics that designs and manufactures unmanned aerial vehicles and radar systems for the United States military, foreign militaries, and commercial applications worldwide (Tabs CC-26 and CC-28).

g. Sumaria Systems, LLC (Sumaria)

Sumaria, headquartered in Peabody, Massachusetts, is an information technology (IT), engineering, and professional services company with operations across the United States (Tabs CC-29 to CC-30). Sumaria provides contract support in a variety of technical, engineering, professional and enterprise networking solutions to the United States Department of Defense (DoD) and other government agencies. (Tabs CC-29 to CC-30).

Sumaria was contracted by the Engineering, Professional, and Administrative Support Services (EPASS) Program Management Office at Wright-Patterson AFB, OH, to provide Advisory and Assistance Services (A&AS) to AFLCMC's MAUAS Division (Tab AA-51). In accordance with (IAW) the contract's Performance Work Statement (PWS) the contract provides "a broad range of professional acquisition, engineering, scientific, research, financial, and administrative capabilities to execute effective and responsive integrated program management of aircraft research, development, production, and lifecycle acquisition and sustainment activities" (Tab AA-51).

Under this contract the general performance requirements for Flight Test Engineering Support can be found in PWS paragraph 3.7.2 (Tab AA-91). The performance requirements include paragraph 3.7.2.2, the "Contractor shall assist the Government in performing all facets of flight testing, from initial planning and operations through execution, data collection, reduction and analysis, report writing and recommendations to ensure on-time completion" (Tab AA-91). The Scope section of the PWS also specifies that Sumaria contractors will comply with all "applicable statutes, regulations, policies, and other requirements," in the performance of the services covered in the contract (Tab AA-51). Further, the PWS in the Safety and Health requirements section, 8.1, states that the contractor, Sumaria, shall comply with all applicable Occupational Safety and Health Administration and Air Force Occupational Safety and Health standards, Technical Orders (TO), and referenced publications (Tabs AA-169 to AA-170).

h. Agilent V3500A RF Power Meter

The Agilent V3500A RF Power Meter is a compact, handheld instrument (dimensions 3 inches by 2 inches by 7 inches) that makes accurate radio frequency (RF) power measurements in both field and manufacturing applications (Tabs BB- 1627 and BB-1631). With a wide frequency range of 10 MHz to 6 GHz, the V3500A is suitable for a wide variety of RF measurement applications (Tab BB-1627). Its built-in power sensor eliminates the need for users to carry both an instrument and a separate sensor module (Tab BB-1627). It is capable of drawing operating power from batteries, an AC-DC converter module, or a computer via a USB interface (Tab BB-1627). (Image below has the backlight feature on).

Figure #2: Agilent V3500A RF Power Meter (Tab BB-1627)

4. SEQUENCE OF EVENTS

a. Mission

The Mishap Ground Test (MGT) was the latest in a series of tests of the Air Force Special Operations Command (AFSOC) software release known as “Lead-Off Hitter” (LOH) for the MQ-9A aircraft approved by the AFLCMC Det 3/CC. (Tabs K-25 and K-49) The primary objective of the LOH program is to conduct regression testing on various payloads, subsystems, and weapons to ensure that previous functionality was not unintentionally altered, while also confirming functionality of those systems remains (Tab K-53).

The electromagnetic interference/electromagnetic compatibility (EMI/EMC) testing, also known as Source/Victim testing, is to demonstrate that any newly integrated assembly, line replacement unit (LRU), or payload is compatible with (i.e., no interference is caused by) all other existing equipment and systems on the aircraft in order to satisfy Federal Aviation Administration (FAA) Safety of Flight requirements (Tabs O-3313, V-6.5, and V-18.3).

The overall methodology for the Source/Victim testing is a ground test procedure where the integrated assembly being tested is activated along with several aircraft subsystems of interest to determine electromagnetic compatibility (Tab O-3313). The MGT consisted of two main test objectives: (1) Source/Victim compatibility between the Block 5 Aircraft systems and Flight Safety Critical Systems; and (2) Source/Victim compatibility between the Block 5 Aircraft systems and Mission Essential Equipment. (Tabs O-3313, O-3320, and O-3322).

b. Planning

On 6 September 2023, the night prior to the MGT, at approximately 5:00p.m. the test team gathered in Hangar 54 on Gray Butte Airfield in an attempt to complete the Source/Victim testing on aircraft 12-4209 with the following weapons loadout (Tabs K-26, V-2.5 to V-2.6, V-6.4, V-18.3, V-32.15, and V-8.8):

Station 2: Ordnance
Station 3: Ordnance
Station 5: Pressure plate
Station 6: Ordnance

In addition to General Atomics weapons technicians, the following personnel were present in Hangar 54: MTD, MTE1, MTE2, MWM1, MWM2, MM1, MM4, MM6, MM8, MM10 (Tabs V-6.4, V-8.8, V-17.4, V-18.7, V-23.4, and V-32.15). Hangar 54 on Gray Butte Airfield is a normal aircraft hangar with full overhead lighting (Tab V-9.23).

As the weapons technicians were loading the required munitions, MTD discovered the spectrum analyzer that was planned to be used for getting telemetry off the weapons was out for calibration (Tabs V-5.4, V-8.15, V-17.8, V-18.10, V-23.4, and V-32.13 to V-32.15). MTD was only interested in getting telemetry off weapons stations 2 and 6 (Tab V-32.21 to V-32.22).

In previous tests a spectrum analyzer was used to read telemetry off aircraft systems and payloads to ensure proper communication between the payloads on the aircraft and ground control station (GCS) (Tabs V-5.3, V-5.5, V-8.15, V-8.21, and V-17.8). The previously used spectrum analyzer is the approximate size and shape of a briefcase (Tabs V-8.34, V-17.8, V-23.3, and V-35.10) Also, during previous tests, the spectrum analyzer was placed on a table either in front of the aircraft or off to the side of the aircraft outside the aircraft's wingspan (Tabs V-8.21 and V-35.10). The technician conducting the test would then be seated behind the table (Tabs V-8.21 and V-35.10).

Because the spectrum analyzer was not available, MTD, MM6, and MM8 looked in the tool crib for a substitute (Tabs V-5.4, V-17.7 to V-17.8, and V-32.14). They located an Agilent V3500A Radio Frequency (RF) Power Meter (Tabs V-5.4, V-8.5, V-17.7, and V-32.14). The device was

new to MTD, as he had never used one before, but felt it would serve the purpose needed (Tabs V-8.21 and V-32.14 to V-32.15). The Agilent device is a handheld, palm size, instrument that can take RF power measurements (Tab BB-1627). It has a design feature that shuts the backlight off after 60 seconds if no buttons are pressed (Tab BB-1627).

As the night progressed, different setbacks delayed the testing, such as weapons loading, quality assurance paperwork sign-off, and a lingering issue with the nose wheel steering servo (Tabs V-7.6, V-8.5, and V-18.6). As a result, the aircraft was not fueled or pulled from the hangar and the rest of the test was canceled (Tabs V-7.8, V-8.35, V-14.7, and V-32.17). The aircrew was notified of the test cancellation and that testing would resume the next day, 7 September 2023, with the pre-test mission briefing at 3:00p.m. in Building 54A (Tabs V-7.8, V-8.35, V-14.7, and V-32.17).

When MTE2 suggested cancelling the follow-on test planned for 7 September as well, MTD replied, "We're going to run until we fall" (Tab V-8.34).

MTD still wanted to get the baseline telemetry readings from the weapons on the night of 6 September (Tabs V-8.7 and V-32.16). The aircraft was still powered up and had a Ruggedized Aircraft Maintenance Test Station (RAMTS) which facilitated the continuation of the telemetry assessment (Tabs V-17.5, V-18.10, V-19.5, V-23.20, and V-32.23).

With the Agilent device in hand, MTD walked to the rear of the right wing of the MA, behind weapons station 6 and took a measurement (Tabs V-17.9 to V-17.10, V-19.5 to V-19.6, and V-32.22). MTE1 was observing and was told by MTD she would be taking the measurements the next night, 7 September (Tab V-32.17). MTD then proceeded around the back of the aircraft, behind the propeller and took measurements behind the left wing at the rear of weapons station 2 (Tabs V-8.8, V-17.9, V-18.11, and V-32.22). MTD took multiple measurements from the weapons on stations 2 and 6, taking the same direction of travel to and from the various weapon stations, walking around the rear of the aircraft to the trailing edges of both wings and the rear of both weapons stations all while being observed by MTE1 (Tabs V-8.8, V-17.9 to V-17.10, V-18.11, V-19.5, V-32.17, and V-32.22). MM7 overheard that "they said it [Agilent device] had to be maybe 6 to 12 inches behind the weapon to collect the data" (V-2.6).

MTE2 described the events of 6 September 2023 as a "dry run" for how the testing would proceed the following day, 7 September (Tab V-8.5). When MWM1 asked MTE1 what she was doing there, MTE1 responded, "Soon enough, that will be me [referring to watching MTD take readings]" (Tab V-18.11) and "I'm just here to mimic MTD because that is what I'll be doing" (Tab V-18.5).

MTD testified that night in the hangar (6 September), he told MTE1 to take readings at the wingtips, or in front of the weapons stations (Tabs V-32.25 and V-32.36 to V-32.37). However, this was never demonstrated to MTE1 on 6 September (Tabs V-8.8, V-17.9, V-17.10, V-18.11, V-19.5, V-32.17, and V-32.22). MTD also testified he told MTE1 to check in with the crew chief prior to approaching the aircraft, though no one else present in the hangar participated in or recalls this specific conversation (Tab V-32.37).

c. Preflight/Pre-Test Mission Brief

On 7 September 2023 at 3:00p.m., the test team gathered in the "fishbowl" conference room, Building 54A, for the pre-test mission briefing (Tabs V-9.7 and V-21.4). The briefer was MTD with vast majority of the MGT participants present such as MTE1, MTE4, MTE6, MTE5, MTE2, MP, MSO, MM1, MM3, MM4, MM10 (Tabs V-1.4, V-2.8, V-7.5, V-8.3, V-9.7, V-11.3, V-12.3, V-14.9, V-16.2, V-17.12, and V-21.4).

In accordance with AFLCMC Det 3 Operating Instruction (OI) 99-103, *Test and Evaluation Process*, paragraph 4.3, Mission Brief, there are 24 items that should be included in a pre-test mission brief (Tabs O-12 to O-13).

Only a limited number of items, well less than the 24 listed in the OI, were included in the briefing given on 7 September (Tabs V-1.5, V-2.9, V-7.5, V-8.3 to V-8.4, V-9.7, V-11.3, V-12.3, V-14.9, V-16.2, V-17.12, and V-21.6). Some of the items not included concerned assigned roles in the test and the communications plan such as OI paragraph 4.3.2, *Test crew identification, assignment and duties* (Tab O-12). There was not a roll call taken, nor was every member of the team identified and what their role would be (Tabs V-7.5, V-8.4, and V-9.9). Specifically, for MTE1, MTD did not identify what role she had or any mention of MTE1 needing to approach the aircraft during the test (Tabs V-7.5, V-8.4, V-9.9, and V-12.13).

When questioned, none of the ground crew knew what MTE1's role in the testing was on 7 September 2023. (Tabs V-2.18, V-9.9, V-12.3, V-13.8, V-15.3, V-20.3, and V-28.2) In fact, prior to the incident most of the ground crew did not even know MTE1's name, they only knew that MTE1 was a test engineer of some sort (Tabs V-2.19, V-9.4, V-15.8). As to paragraph 4.3.10, *Communications Plan*, (Tab O-12), it was not identified how MTE1 would communicate with MM1, MTD or the GCS. (Tabs V-7.5, V-8.4, V-9.9, and V-12.13)

And regarding paragraph 4.3.15 *Test Plan Safety Review (TPSR)*, (Tab O-12), the only safety related item heard by those in attendance at the briefing was a statement about the radiation hazard when Ku (Satellite Communication (SATCOM)) was turned on. There was no discussion on propeller hazards nor propeller keep out zones (Tabs V-1.5, V-2.9, V-7.5, V-8.3, V-9.7, V-11.3, V-12.3, V-14.9, V-16.3, V-17.12, and V-21.6).

Of note, in the TPSR the only hazards noted for ground testing were 1) Injury to ground personnel while transmitting; 2) Damage to captive store batteries; and 3) Inadvertent release of inert stores (Tabs K-71 and K-72). There was no mention of a propeller hazard. Det 3 normally does not list hazards that are viewed as standard to airplane operations (Tabs V-30.7 and V-37.6).

Test Plan ASI-23386, paragraph H.1.8, Safety Requirements, states standard precautions shall be followed during testing (Tab O-3317). In addition to briefing and enforcing any RF hazard zones, "aircraft keep out zones shall be briefed and enforced by the aircraft Crew Chief in accordance with TO 1Q-9(M)A-1" (Tab O-3317). The aircraft keep out zones were not briefed by the crew chief or MTD (Tabs V-1.5, V-2.9, V-7.5, V-8.3, V-9.7, V-11.3, V-12.3, V-14.9, V-16.2, V-17.12, and V-21.6).

Additionally, there was an equipment change from a spectrum analyzer (Tab K-1075) to the Agilent device, and the MQ-9 Configuration Log was changed the morning of 7 September 2023 to reflect the change (Tabs K-1073 and V-21.5). The Agilent device required the user to be within the wingspan of the aircraft to check telemetry signal as opposed to using the spectrum analyzer outside of the wingspan of the aircraft (Tabs V-8.8, V-17.10, and V-32.22). During the pre-test mission briefing and the day prior in Hangar 54, witnesses heard that the device had to be *behind* the weapons to get an accurate reading (Tabs V-7.4 and V-9.13 to V-9.14). Despite the change in the MQ-9A configuration log, the TPSR was not reevaluated as to the ground safety risk (Tab V-37.25).

MTD did not brief any kind of "knock it off" phrase that was understood by everyone to mean terminate the test/shut down the aircraft engine as required by the relevant OI paragraphs, 4.3.20 *Emergency procedures* and 4.3.21 *Actions and key terms to terminate test profile*: (Tabs O-12, O-13, V-1.13, V-7.17, and V-14.10).

d. Summary of Accident

After the briefing MSO, MTD, and MTE2-MTE6 went to the GCS (Tabs V-10.9, V-11.5, V-21.7). MP conducted an aircraft walkaround and confirmed the MA located at aircraft spot 15 was chocked and tied down (Tab V-7.11). MM1 also confirmed the MA was chocked and tied down prior to the beginning of the test (Tab V-12.21).

At 3:25p.m., while MP was conducting an aircraft safety walkaround inspection to ensure the aircraft to include its engine was physically ready to be started, MTD called MP and questioned why he was not in the GCS yet (Tab V-7.12). MTD asked, "Everybody else is here, why aren't you here?" (Tab V-7.12). MP testified to the AIB that, "this was just 25 minutes after we just started the brief, so I wasn't dilly-dallying or anything (Tab V-7.12).

At around 3:30p.m. MTE1 approached the GCS and had a conversation with MTD about the Agilent device and MTE1's role in the testing (Tab V-21.9). MTD told MTE1, just how it was done yesterday, "…you're going to do the same thing" (Tab V-21.9). MTD was eager to begin the test as the test conductor. (Tab V-32.50)

MTE1 then proceeded out to the MA at aircraft spot 15 (Tabs V-7.11 to V-7.12, V-12.9 to V-12.11, V-16.7, and V-17.16). During previous LOH tests MTE1 had been positioned in the GCS (Tab V-21.6). Other witnesses testified they had never known a test engineer to be out at the aircraft during a ground test with engines running (Tabs V-11.15 and V-12.21). During the night of the mishap, MTE2 wondered why, as a test engineer, MTE1 was out at the aircraft for the entire test, vice in the GCS with the rest of the test engineers (Tab V-8.32).

MTD testified that he had MTE1 out at the MA "to look for any uncommanded movement on the turrets or on the control surfaces" (Tab V-32.21). MTE1 had no direct communication with the aircrew or MM1 to hear what control movements the aircrew was inputting (Tabs V-12.15 and V-23.13). The only communication MTE1 had with the GCS was through MTD via text on MTE1's personal cell phone (Figure 3, Tab Z-16).

From 4:00 to 4:50p.m. the aircrew and GCS personnel were running through different checklists to include the aircraft's pre-start checklist (Tabs V-1.7, V-7.15, and N-3). At 4:50p.m. the MA's engine was started (Tab N-3).

From 4:50 to 5:49p.m., the aircrew completed the 'post engine start checklist' to ensure the aircraft was operating smoothly and proceeded with flight safety critical systems and control surface checks (Tabs N-3 to N-4). At 5:13p.m. while talking about conducting surface control checks, MTD states, "We want to get this over with quick" (Tab N-3). During this time on the recorded GCS audio, communication could be heard between MSO and MM1 asking about surface control movements (flaps) (Tab N-4) with flap corresponding movement being seen in the video. MTE1 could not be heard on GCS audio. In addition, there were no texts on MTE1's phone from MTD asking about uncommanded control surface movement. The only text on MTE1's phone from MTD during the entire test sequence was at 7:51p.m., 6 minutes before the mishap (Figure 3, Tab Z-16).

When the AIB asked MTD how many times he had a flight test engineer sit out at the aircraft looking for aircraft control surface movements during previous ground tests, he responded, "Never" (Tab V-32.26).

By 5:45p.m. Test Objective One had been accomplished, but the oil temps continued to rise. (Tab N-7). At 5:49p.m. MP states, "We are at 110 [oil temp] so we are shutting down" (Tab N-7). MTD then paused the test to allow the aircraft to cool and took the second shift lunch break until 7:00p.m. (Tab N-7).

During the lunch break, MM7 asked MTE1 how the test was going (Tab V-2.9). MTE1 replied, 'I don't know, they sent me out to check control surfaces and make sure everything is moving right, but I don't have a radio or comms to relay this info' (Tabs R-62 and V-2.9).

At 7:00p.m. the MGT team reassembled and after completing the pre-start checklist the MA was restarted at 7:36p.m. (Tabs V-13.14 and V-21.11). By 7:47p.m. the MA's engine was at its normal operation range with 100% RPM and 16% torque (Tabs N-9 and L-7 (video file "2094320039080254")).

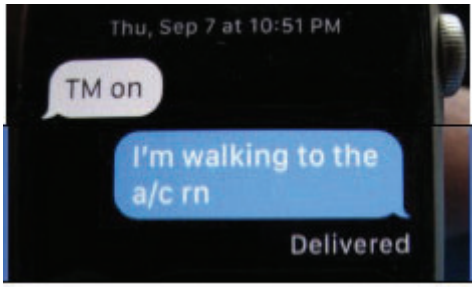
On the GCS audio recordings during the pre-start checklist, MTD and MP could be heard moving rapidly through the checklist (Tabs N-8 to N-9). In addition, conversation in the GCS included comments like, "C'mon guys, the quicker you respond the faster we get out of here" (Tab N-10). This was in reference to the aircrew waiting for a response from the ground crew at the MA (Tab N-10). Other comments included the need to move swiftly. (Tabs N-20 to N-22):

"Yeah, we definitely want to expedite this stuff."
"Not the time to putz around."
"Let's get this show on the road. This is not the time to delay."

At one point, while personnel in the GCS were waiting for the ground crew to load the weapons keys, a comment was made that the ground crew was walking, not running (Tab N-9).
MTD then said, "I'll chase after them with a lash" (Tab N-9).

At 7:51p.m. MTD sent a text to MTE1 that "TM on" (Figure 3, Tab Z-16). This indicated to MTE1 that it was time to take telemetry readings on the weapons (MTD). At 7:53p.m. MTE1 responded via text to MTD that "I'm walking to a/c rn" indicating she 'is walking to the aircraft right now' to take the telemetry readings (Figure 3, Tab Z-16).

Figure #3: Text Message (Tab Z-16, DC3 Apple Watch Recovery)



MTE2 left the GCS to check on MTE1 (Tabs V-8.12 to V-8.13 and V-32.28). MTE2 asked MTE1 if she was good and had everything she needed (Tab V-8.14). MTE1 replied, "Yep" and picked up the power meter and walked toward the right side of the aircraft (Tabs R-166, V-8.14 to V-8.16, V-9.12, and V-12.11 to V-12.12). The MA, and aircraft spot 15, were illuminated by four overhead stadium-like lights (two each on two different light poles) behind the aircraft (Tabs V-12.12, V-14.20, and V-15.17). The lights are operated manually, vice a timer or automatically (Tab V-37.9). The MA was marked off with cones at the wingtips and nose to alert to the radiation hazard when the Ku link (Ku is a particular part of the RF bandwidth) was active (Tabs V-2.12 and V-9.14). In addition, the MA's strobe lights were also on to indicate the Ku hazard (Tabs V-12.11 And V-13.10).

Multiple witnesses saw MTE1 walk directly towards the MA without stopping to check in with MM1, the crew chief (Tabs V-2.12 to V-2.13, V-9.18, V-12.16). MTE1 then passed the right wingtip radiation hazard cone and walked to the trailing edge of the right wing, behind the weapons (Tabs V-2.13, V-8.16, V-9.13, and V-12.11). MTE2 testified that MTE1 walked to the rear of weapons station 6 and took readings "just like how they did the day before" (Tab V-8.16). MM7 testified that, "what MTE1 was doing, was basically what they did on 6 September" (Tab V-2.15).

After apparently taking measurements with the power meter, MTE1 turned to the left and walked down the right side of the fuselage toward the rear of the MA (Tabs V-8.17, V-12.11 to V-12.12, and V-9.15). MTE1 was looking down at the testing device the whole time, and appeared to be pressing buttons, possibly to keep the backlight on (Tabs V-12.11 and V-9.14). MM10 testified, "She was focused in on that meter," or words to that effect (Tabs R-170, R-178, and V-9.14).

MM1 began walking toward MTE1 shouting and waving his arms in an attempt to get MTE1's attention (Tabs V-2.14, V-12.11, V-13.9, and V-16.15). Others began shouting and waving to get MTE1's attention as well (Tabs 2.15, V-16.15, and V-19.14).

Without looking up to determine her position relative to the aircraft, MTE1 proceeded to walk directly into the propeller of the MA sustaining fatal injuries (Tabs V-2.15, V-12.12, and V-13.9).

Focused time stamp of sequence of events (Tabs N-23 to N-24 and Z-16) (All times in Pacific Daylight Savings Time (aka local)):

7:51p.m. – MTD sends text to MTE1, "TM is on."
7:52p.m. (approx) – MTE2 leaves GCS to check on MTE1.
7:53p.m. – MTE1 replies to MTD, "I'm walking to the a/c rn."
7:56p.m. – MTE2 sends text to MTD "Putting on hearing protection…grabbing meter…" meaning MTE1 was putting on hearing protection and grabbing the Agilent device (Tab Z-18).
7:57:50p.m. – MM1 radios to the GCS, "Are you guys in Ku?' This is after MTE1 walks past the "radiation area" cone near the right wingtip. Also, the strobe lights are on, indicating Ku is on.
7:57:54p.m. – MSO replies to MM1, "Yes we are."
7:57:57p.m. – Engine RPM drops from 100% to 99% and engine torque jumps from 16% to 31%. This is believed to be the moment of impact.
7:57:59p.m. – MM1 radios, "Kill, kill, kill, kill!" followed immediately by "Kill, kill, kill!"
7:58:02p.m. – MP can be heard on GCS audio, "Kill…geez…"
7:58:04p.m. – MM1 radios again, "Kill, kill, kill!"
7:58:07p.m. – MSO radios to MM1, "Copy, we're going down."
7:58:07p.m. – Someone can be seen on the aircraft's front camera running from right to left. This is assumed to be MM1 running to the aircraft kill switch (Tab L-7 (video file "2094320039080254")).
7:58:14p.m. – MSO radios to MM1, "Kill the engine, or…?"
7:58:14p.m. – The engine RPMs can be seen rolling back on the GCS video.
7:58:17p.m. – MP can be heard on GCS audio, "Oh, [expletive]!" apparently noticing the RPMs rolling back.

There was confusion in the GCS on what the repeated command of "Kill" was referring to as to whether it was the Ku link or the engine (Tabs V-7.20, V-11.14, V-14.13, V-21.12, and V-23.16). Because it was proceeded by the question about the Ku being on, the aircrew assumed that is what MM1 meant, so they killed the Ku link, but not the engine (Tabs V-7.20 and V-14.13). At 7:58:14p.m. the engine RPMs begin to roll back as MM1 had reached the MA's kill switch on the left side of the aircraft (Tab V-12.12).

Although MM1 testified he radioed, "Kill, kill, kill, kill" to the GCS prior to MTE1 getting struck by the propeller (Tab V-12.12), multiple witnesses testified that this "Kill" call was made after MTE1 was struck (Tabs V-2.16, V-13.9, and V-17.20). In addition, the change in RPM and torque can be visually seen on the GCS video fluctuating seconds before the "Kill" transmission.

e. Impact

Not applicable.

f. Egress and Aircrew Flight Equipment

Not applicable.

g. Search and Rescue

At 7:57:57p.m. MTE1 was struck in the head and left arm by the MA propeller at operating speed on GBA at aircraft spot 15 (Tabs N-23 to N-24 and V-12.12). MTE1 was immediately assessed by mishap ground crew and found to be unresponsive, but to have a pulse (Tab V-18.15). Ground crew implemented life saving measures of bleeding control by applying pressure to her head and fashioning a tourniquet from a belt for her left arm (Tabs V-4.6 and V-18.16).

At 7:59p.m. MP, as well as several mishap personnel including MM8 while located at the accident scene, called 911. (Tabs V-5.7 and V-7.28)

At approximately 8:00p.m., General Atomics Emergency Response Team (ERT) personnel, stationed out of Building 1, were notified of an emergency by the company cellphone as well as personnel from the scene physically driving to their location (Tabs R- 71, R-488, V-3.4, V-4.4, and V-22.4). MERT arrived on the accident scene in an Oshkosh Striker Aircraft Rescue and Firefighting truck at approximately 8:05p.m (Tabs R-88, R-488, V-3.7, V-4.3, and V-22.5). They took command of the incident response and rendered first aid to MTE1 (Tabs V-3.6 and V-22.5).

MERT2 reported that the MTE1 was unresponsive but had a pulse on her right wrist that was weak, and MTE1 had very strained breathing (Tabs V-4.5 and V-22.6). MERT2 was instructed to start Cardiopulmonary Resuscitation (CPR) from the 911 dispatcher on MM8's phone (Tabs V-4.5, V-18.16, and V-22.6). The GA ERT provided treatment which included bleeding control via pressure and a tourniquet from MM5, compressions, airway management with suction, and oxygen therapy via a non-rebreather mask (Tab V-3.7, V-4.6, V-19.15, and V-22.6). They also applied an automated external defibrillator, but no shock was ever advised or delivered (Tab V-4.5).

Paramedic Squad (S92) was notified by 911 dispatch at 8:06p.m (Tab X-7). S92 cleared another response they were on in Lake Los Angeles, CA and departed for the scene at 8:10p.m. and arrived on the scene at 8:24p.m (Tab X-7).

A patrol vehicle (P114) and firetruck (E114) from Fire Station 114, Lake Los Angeles, CA, were dispatched to the scene at 8:17p.m. after clearing another call they were on and arrived on scene at 8:29p.m. and assisted with patient care and scene management. (Tab X-7)

S92 evaluated MTE1 to be unresponsive at 8:32p.m., but still with a pulse and a normal heart rhythm with ongoing, though strained, breathing, so CPR was stopped (Tab X-7). S92 provided treatment that included airway management, breathing support, fluid resuscitation, and bleeding control (Tab X-3). It was noted at 8:39p.m. that MTE1's pupils were fixed and dilated (Tab X-3). MTE1 was loaded onto a backboard in preparation for evacuation via helicopter (Tab X-3).

Paramedic air squad (COPT22) was dispatched via helicopter from Northern Air Operations center in Lancaster, CA and was enroute at 8:25p.m. and arrived on scene at 8:37p.m (Tab X-3). They

arrived at MTE1's location at 8:40p.m. and found the patient unresponsive on a backboard with Glascow Coma Scale of 3, fixed dilated pupils, pulse still palpable with breathing being assisted by S92 paramedics (Tab X-3).

COPT22 loaded MTE1 into their helicopter and departed the scene at 8:48p.m. at which time GA and Det 3 security cordoned off the mishap area. (Tabs S-29, S-31, V-5.7, and X-3 to X-4) Shortly after takeoff, MTE1 lost palpable pulses and CPR was initiated, the cardiac rhythm was found to be a non-shockable rhythm and CPR continued enroute to Antelope Valley Medical Center (AVMC) Level II Trauma Center (Tabs X-4 and CC-32).

COPT22 arrived at AVMC at 8:58p.m. (Tab X-4). MTE1's care was transferred to an awaiting ER trauma team. Trauma care was rendered for MTE1's injuries (Tab X-4). MTE1 remained unresponsive throughout the entire process (Tab X-4). Resuscitative efforts were unsuccessful and MTE1 was pronounced deceased at 9:06p.m. on 7 September 2023 (Tab X-4). There were no observed delays in care due to weather, time of day, or topography.

h. Recovery of Remains

MTE1's remains were transferred from AVMC in Palmdale, CA, to the Los Angeles County Medical Examiner's Office in Los Angeles, CA, where an autopsy was performed (Tab X-4). Personal effects were processed through AFLCMC Det 3.

5. MAINTENANCE

No evidence indicated the maintenance of the Mishap GCS nor MA (forms documentation; inspection; maintenance procedures; maintenance personnel and supervision; or unscheduled maintenance) were a factor in the mishap (Tab D-3). A 7-day inspection of the GCS was accomplished on 6 September 23 with no abnormal findings or necessitated maintenance (Tab D-3).

a. Forms Documentation

A review of the maintenance records for the MA leading up to the mishap day revealed no relevant discrepancies or issues (Tab D-3). All relevant pre-operation inspections and release procedures were followed, with various non-flyable conditions having been waived by AFLCMC Det 3 leadership, as the 7 September 23 test was a ground test only (Tabs V-7.6, V-10.5, and V-18.6).

b. Inspections

All relevant MA maintenance inspections were current and complied with by AFLCMC Det 3 authorities (Tab D-3).

c. Maintenance Procedures

Maintenance personnel conducted all relevant maintenance procedures in accordance with applicable TOs and guidance (Tab D-3).

d. Maintenance Personnel and Supervision

Test Plan ASI-23386, paragraph H.1.8, Safety Requirements, states standard precautions shall be followed during testing (Tab O-3317). In addition to briefing and enforcing any RF hazard zones, aircraft keep out zones shall be briefed and enforced by the aircraft Crew Chief (Tab O-3317). However, at the pre-test mission briefing on 7 September 2023, the aircraft keep out zones were not briefed to the entire test team by either the crew chief nor MTD (Tabs V-1.5, V-2.9, V-7.5, V-8.3, V-9.8, V-12.3, V-14.9, V-16.2, V-17.12, and V-21.6).

In accordance with Det 3 OI 99-103, The test director (TD) is responsible for the technical quality, security, safety, and support aspects of the mission, as identified in the test plan (Tab O-11). The TD "coordinates ground activities with the aircrew [in] real-time, paces the progression through the test cards as agreed to in the mission briefing, and is the primary communicator to the aircrew" (Tab O-11). MTD did not communicate to the aircrew that MTE1 was approaching the aircraft, as stated in her text to MTD at 7:53p.m. (Figure 3, Tab Z-16). Both the MP and MSO1 were unaware anyone was approaching the aircraft. (Tabs V-7.5 and V-14.9)

During the mishap sequence, MTE1 walked past the crew chief and the cone indicating a RF radiation hazard without anyone, to include the crew chief, stopping her (Tabs V-2.12 to V-2.13, V-8.16, V-9.18, V-12.16, and V-12.11).

e. Fuel, Hydraulic, and Oil Inspection Analysis

The AIB found no evidence these items played a role in this mishap.

f. Unscheduled Maintenance

The AIB found no evidence unscheduled maintenance played a role in this mishap.

g. Communications

Communication between the aircrew and the MTD was functioning properly. Communication between the aircrew and MM1 was also functioning properly with no report of interrupted communication during the day of the mishap (Tab V-12.10).

6. AIRFRAME, MISSILE, OR SPACE VEHICLE SYSTEMS

There is no evidence indicating that any MA or GCS systems were operating abnormally at any time during the mishap sequence.

7. WEATHER

a. Forecasted Weather

The forecasted weather for the duration of the ground test was favorable (Tab W-3). Surface winds were forecasted to be light and variable at 6 knots (KTS) before 4:00p.m (Tab W-3). And then from 4:00p.m. to 7:00p.m., surface winds were forecasted to be a little stronger, as light to moderate, from the South Southwest (200 degrees) at 10 KTS with gusts up to 15 KTS (Tab W-3). After 7:00p.m., surface winds were forecasted to diminish to light and variable at 6 KTS (Tab W-3). Visibility was greater than 7 miles (Tab W-3). The temperature was forecasted to be fairly warm at 92 degrees Fahrenheit at the start of the test (4:00p.m.) and dropping to 79 degrees Fahrenheit at the time of the mishap (7:57p.m.) (Tab W-3). There were no forecasted weather hazards during the mishap ground test (Tab W-3).

b. Observed Weather

No significant weather was reported or observed at the time of the mishap (Tab W-4). The weather was consistent with the forecast. The skies were clear and the wind did not exceed 8 KTS (Tab W-3). Sunset was at 7:11p.m., with the last sunlight disappearing following sunset (aka evening civil twilight (ECT)) at 7:37p.m. (Tab W-3).

c. Space Environment

The AIB found no evidence the space environment played a role in this mishap.

d. Operations

The MGT was conducted within prescribed weather requirements and in accordance with published restrictions.

On 7 November 2023, the AIB coordinated with AFLCMC Det 3 to conduct a replication of the mishap sequence with an MQ-9A with engine running at the same power settings on aircraft spot 15, in the same twilight lighting conditions, and ramp stadium lighting that were present on 7 September 2023 (Tab Z-20).

Figure #4 (Tab Z-6)

In that simulation, the spinning propeller was not visible when looking to the rear of the aircraft from the trailing edge of the right wing behind weapon station 6 (Tab Z-20).

Figure #5 (Tab Z-4)

Under those lighting conditions, portions of the MA and MTE1's own body would have created shadows that made it difficult to see if concentrating on the handheld testing device, contributing to the loss of situational awareness (Tab Z-20).

Figure #6 (Tab Z-9)

Using the hearing protection used by MTE1, both the AIB Board President and another AIB member separately walked the trailing edge of the right wing while others were shouting from the approximate location where the crew chief was standing during the mishap (Tab Z-21). While passing the wingtip each AIB member could hear muffled shouting (Tab Z-21). Yet, well before the two AIB members reached the location at the rear of weapon station 6 on the right wing, neither AIB member could hear anything other than the noise from the aircraft itself (Tab Z-21).

8. CREW QUALIFICATIONS

a. Mishap Pilot (MP)

The MP was current and qualified to accomplish the mission in the MQ-9A at the time of the mishap (Tab T-5 to T-6). MP is a contractor working for System Dynamics Incorporated (SDI) (Tab V-7.1). The MP had 761.7 hours of MQ-9A flight time and 694.6 hours of MQ-9A simulator time around the time of the mishap (Tab T-21). Recent flight hours were as follows (Tab T-7):

Figure #7: MP's Recent Flight Hours (Tab T-7)

	Flight Hours	Sorties
Last 30 Days	0.2	0
Last 60 Days	10.9	6
Last 90 Days	17.3	9

b. Mishap Sensor Operator (MSO)

The MSO was current and qualified to accomplish the mission in the MQ-9A at the time of the mishap (Tab T-13). MSO is a contractor working for System Dynamics Incorporated (SDI) (Tab V-14.1). The MSO had 1,038.1 hours of MQ-9A flight time and 1,322.3 hours of MQ-1 flight time around the time of the mishap (Tab T-21). Recent flight hours were as follows (Tab T-14):

Figure #8: MSO's Recent Flight Hours (Tab T-14)

	Flight Hours	Sorties
Last 30 Days	0.8	0
Last 60 Days	11.5	2
Last 90 Days	18.9	6

c. Mishap Crew Chief (MM1)

The MM1 (Crew Chief) was current and qualified to accomplish the mission in the MQ-9A at the time of the mishap. MM1 is a contractor working for GA (Tab V-12.1). MM1 had seven (7) years maintenance experience on the MQ-9A around the time of the mishap and completed the General Atomics *MQ-9A Reaper System (AandP) FSR Maintenance Training Course* on 30 June 2023 (Tabs G-1347 and V-12.2).

d. Mishap Test Director (MTD)

The MTD was current and qualified to accomplish the test mission for the MQ-9A at the time of the mishap (Tabs G-12, V-21.7, and V-36.4). MTD is a contractor working for Sumaria Systems Incorporated (Tab V-32.1). MTD has worked on MQ-9 aircraft since 2009 (Tab V-32.2). In 2010, MTD was then certified as a test director by General Atomics (Tab V-32.3). And then he became a test director instructor, teaching those seeking test director certification as early as 2011 (Tabs G-12, G-23, and V-32.3 to V-32.4). MTD also authored twelve distinct MQ-9 system training programs consisting of over 400 pages of content (Tabs G-12 and V-38.8). MTD admittedly has participated in hundreds of tests at Gray Butte and was the most experienced test engineer on the MGT (Tabs V-1.10, V-21.7, and V-32.5).

e. Mishap Test Engineer (MTE1)

(1) Academic Qualifications

The MTE1 earned a Bachelor of Science degree in Electrical Engineering in 2016 and a Master of Science degree in Engineering Management in 2020 (Tab T-19).

(2) Job Experience

From March 2016 to September 2017, MTE1 was an engineer intern with the Air Force Operational Test and Evaluation Center working on the Airborne Warning and Control Systems program at Edwards AFB, CA (Tab T-19). From September 2017 to March 2023 MTE1 was an instrumentation engineer with defense contractor JT4 working on the F-35 Joint Strike Fighter program at Edwards AFB, CA (Tabs T-19 and V-25.1 to V-25.2).

(3) MQ-9 Experience

MTE1 began working for Sumaria as an employee and a contractor on the MQ-9 program at GBA in April 2023 (Tabs V-26.2 to V-26.3). After review of the evidence and witness interviews, the AIB could find no evidence MTE1 had worked around the MQ-9 aircraft or other propeller driven aircraft prior to April 2023. It was noted that MTE1 kept referring to the MQ-9A as a “jet” vice a “plane” like other personnel on GBA (Tabs R-187 and V-32.44).

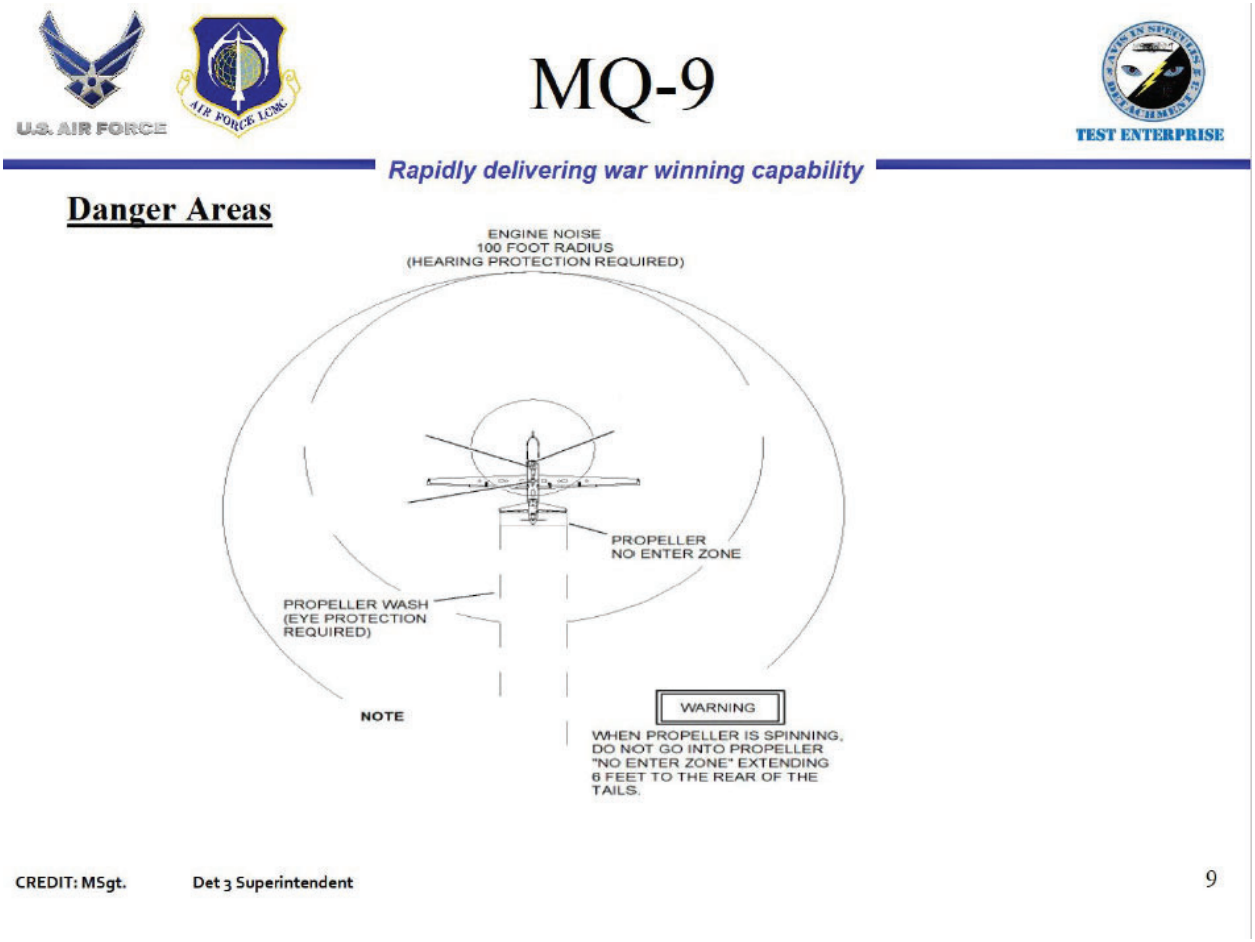
(4) MQ-9 Safety Training

There is no evidence, beyond MTD’s testimony, that MTE1 was instructed on the TO mandated procedures to approach a running MQ-9 such as checking in with the crew chief before approaching, and only approach from the front of the aircraft. (Tab V-32.21) This occurred during her initial training with Sumaria at Det 3 via review of various documents, hands-on training, and through some in-class training (Tabs G-11 to G-15). The proper procedure for approaching an aircraft was the Aircraft Launch TO, Figure #9 (Tab O-26). And compliance with that TO and OI 99-103 is required by paragraph 4.2.1 of the PWS (Tabs AA-51 and AA-145).

After review of the evidence, the AIB discovered three different "danger area" diagrams for the MQ-9A in use on GBA (Tabs O-26, O-3260, and U-23).

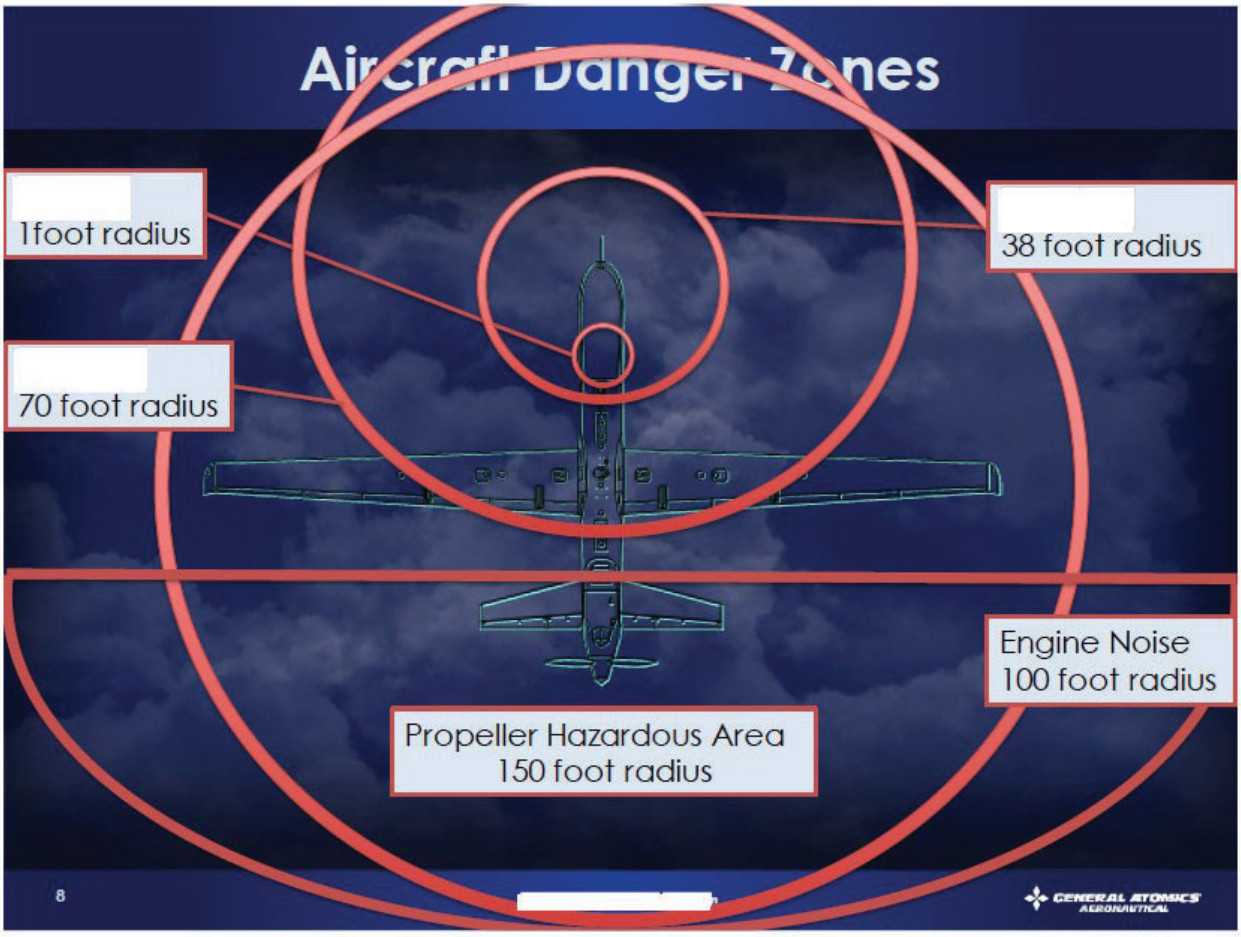
The training provided to new employees by AFLCMC Det 3 showed various radiation zones for various antennae (Tab O-26). The Detachment 3 provided diagram also identifies a "propeller no enter zone" that extended from the rear tip of each tail, back six feet to the tip of the propeller cone (Tab O-26). Further back from the propeller cone was identified as a "propeller wash zone" and only required the addition of eye protection (Tab O-26).

Figure #9: Det 3 Danger Area PowerPoint Slide



In a briefing on safety and flightline basics provided by General Atomics, similar radiation zones are identified as in the Det 3 training, but the "propeller hazardous area" extends from the base of each tail out 150 feet in each direction and encompasses a half circle around the back of the aircraft (Tab O-3260).

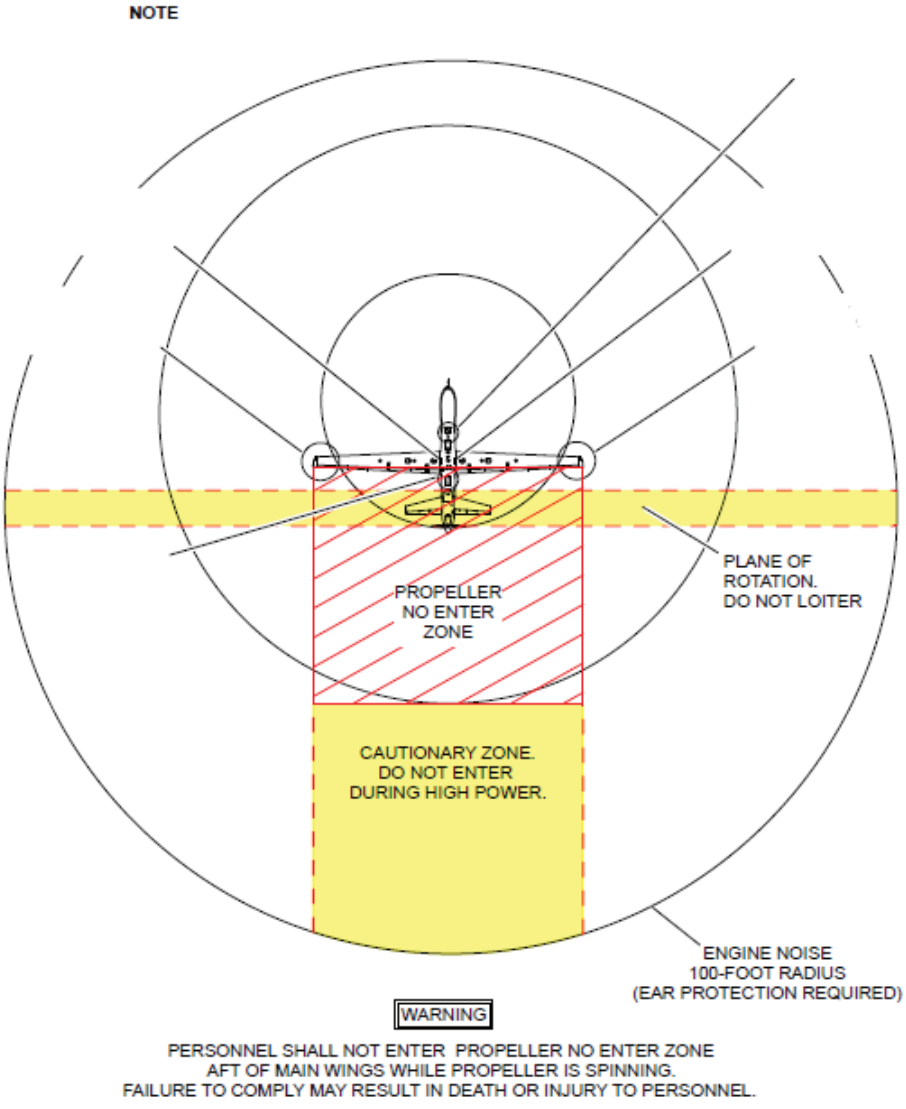
Figure #10: General Atomics, Aircraft Danger Zones PowerPoint Slide



Finally, in a general maintenance procedure technical order the "propeller no enter zone" extends from the wingtips straight back 50 feet (Tab U-23). In addition, beyond that no enter zone for another 50 feet is an area identified as "Cautionary zone. Do not enter during high power." (Tab U-23). In this same document in a red and white striped "WARNING" box is "Personnel shall not enter Propeller No Enter Zone aft of main wings while propeller is spinning. Failure to comply may result in death or injury to personnel" (Tab U-23).

Figure #11: General Atomics, Technical Order, Aircraft Danger Areas

Fig 1. Aircraft Danger Areas



During the investigation, the AIB was only able to confirm MTE1 was instructed on the diagram provided by the Detachment 3 training, the least restrictive of the three diagrams (Tab G-12). This represented the smallest propeller danger area of the three documents, an area of approximately 22 feet by 6 feet (Tab O-52).

(5) Test Director Training

At the time of the mishap, MTE1 was in test director upgrade training (Tabs V-30.11, V-31.7, V-32.8, V-35.6, and V-36.4). The test director upgrade training consists of participation in 15 discreet testing events (Tab G-11). The events include 5 test observations with a qualified test director, 5 test 'ride-alongs' with a qualified test director, and 5 solo test events with a qualified test director and/or instructor test director (Tab G-11). As of the mishap, MTE1 had completed the first 8 of the events listed on the training form (Tab G-11). MTD was MTE1's primary trainer. (Tabs V-32.7 and V-36.3 to V-36.4).

The next event would have been MTE1's Ride-Along #4 with a qualified test director (Tab G-11). However, MTE1 was not in the GCS so could not get credit for a ride-along, but instead MTD placed her at the aircraft, without direct communications with the GCS and the rest of the test team, to observe aircraft surface control movements (Tabs V-7.24, and V-32.21 to V-32.22).

9. MEDICAL

a. Qualifications

There were no medical qualifications or requirements for MTE1 to perform her job duties as a flight test engineer (Tab V-38.9).

b. Health

The AIB Medical Member was not provided any medical records, other than the autopsy report and toxicology reports, to review for MTE1 or any other mishap personnel. The AIB Medical Member reviewed all relevant testimony relating to MTE1's well-being for the time period prior to the mishap (Tabs X-4 and X-5). There was no evidence that any medical condition, substance, or medication was relevant to the mishap. Additionally, toxicology tests from MP, MSO, MM1, MM2, MM3, MM4, MM5, MM7, and MM10 revealed no evidence of alcohol or drug use (Tabs O-3342 to O-3350). No toxicology testing was found related to MTD (Tabs O-3136 to O-3137).

c. Pathology

The AIB Medical Member reviewed relevant testimony and records including the autopsy report from the LA County Medical Examiner (Tabs X-3 to X-5). The cause of death for MTE1 was determined to be trauma to the head and left arm sustained in the accident from the aircraft propeller (Tabs X-4 and X-5). Post-mortem fluid analysis of MTE1 conducted by the LA County

Medical Examiner's Office revealed no evidence of ethanol or screened drugs of abuse or medications (Tabs X-4 and X-5).

d. Lifestyle

The AIB found no evidence that any relevant individual's lifestyle played a role in this mishap.

e. Crew Rest and Crew Duty Time

Non-privileged written 72 hr and 7 days histories for MTE6, MM7, MM11, MERT2, MM8, MP, MTE3, MM1, MM2, MSO, MERT3, MM3, MM4, MM5, MM9, MTE5, MERT1, MM6 were reviewed by the AIB Medical Member and found to be uneventful and non-relevant. (Tab X-3). IAW with PWS 4.2.3 contract personnel duty hours are an eight-to-nine hour shift reflected in a normal industry standard eight hour a day 40 hour a week schedule. Short-term situations may make performance in excess of eight/nine hours per day occur, but will be coordinated through the Contracting Officer's Representative (COR) to Engineering Professional Administrative Support Services (EPASS) Contracting Officer (CO), regardless, this effort will not exceed 80 hours in a two-week period without COR notification (Tab AA-146). There was no evidence that MTE1 was required to work more than an eight/nine hour day nor were any requests made to the COR to exceed contract duty hours (Tab V-36.2). No data was available on MTE1 cumulative sleep for the 72 hrs prior to the accident. Prior to the accident, there is no evidence that MTE1 traveled outside of the local time zone and she had been working second shift for at least the duration of the week of the mishap.

10. OPERATIONS AND SUPERVISION

a. Operations

The test on 7 September 2023 was at least the fifth attempt to complete the ground portion of the LOH test plan (Tabs V-7.3 and V-11.3). Previous tests were cancelled for unrelated technical issues. (Tabs V-7.21 and V-11.10).

The attempt on 6 September was cancelled because "configuring the aircraft proved to be time-consuming" (Tab V-32.16). In addition, because the aircraft had a nose gear steering servo issue, higher level approvals had to be received to clear the aircraft for test (Tabs V-7.6, V-8.5, V-18.6, and V-29.6). This resulted in additional delay that ultimately led MTD to cancel the test for 6 Sep (Tabs V-7.8 and V-32.17).

The device used to test for telemetry was changed the day of the mishap (Tabs K-1073, K-1075, and V-37.25). In the original MQ-9 Configuration Log a spectrum analyzer was listed (Tab K-1075). As noted previously the required distance between the person conducting the telemetry tests and the object under test is significantly different between the spectrum analyzer and the power meter ultimately used during the mishap (Tabs V-5.5, V-8.21, and V-32.22). However, a re-review of the Test Project Safety Review (TPSR) was not accomplished to determine whether

there was a need to identify additional risks and/or change the risk rating of the ground test (Tabs V-30.7 and V-37.25).

AFLCMC Det 3 OI 99-103, *Test and Evaluation Process*, paragraph 3.9.1 states, "An out-of-scope amendment is required for any major changes to safety or a major test plan change" (Tab O-6). The original TPSR did not address any hazards associated with anyone approaching the aircraft to collect telemetry while the engine was running (Tab O-3112).

The Det 3 OI goes on to state in paragraph 3.9.1.1.1, *Major Safety Plan Change*,

> A major safety plan change is any change that fundamentally alters the risk assessment. This may be caused by test hazards not previously identified or adequately controlled, removing mitigations such as [General Mitigating Procedures] GMP or [Threat Hazard Areas] THA, adding safety planning for test plan changes that have actual or potential safety implications, or changes due to an unexpected test event. Major safety plan changes are documented via a TPSR amendment. (Tab O-6).

After review of the evidence and witness interviews, the AIB could find no evidence the updated MQ-9 Configuration Log, with the new test device listed, was brought to the Safety Review Board in order to make an informed decision on any potential changes to the safety plan (Tabs V-30.8 and V-30.17). The test proceeded on 7 September 2023 without a review of the TPSR nor any update to the risk assessment for the ground test (Tab V-30.17).

b. Supervision

On the day of the mishap, there were no Government personnel (military or DoD civilians) present during the test (Tab V-30.8). Through witness interviews, it was determined it is not unusual to have contractor employees run the tests without any Government personnel present (Tabs V-30.8, V-37.15, and V-38.7).

MTE1 came onboard to Sumaria and reported to AFLCMC Det 3 in April 2023. (Tab V-26.3) MTE1's direct supervisor from Sumaria was SPM (Tabs V-26.3 and V-36.3). SPM is located in Fairborn, Ohio (Tab V-26.1). SPM talked to MTE1 during the hiring process in the March 2023 time frame (Tabs V-26.2 to V-26.3). SPM only met MTE1 in person once, approximately 2 months before the mishap when SPM came to GBA for a site visit (Tab V-26.2). The only other interaction SPM had with MTE1 was an email from him to MTE1 requesting a monthly status report. (Tab V-26.4)

MTE1's timecard was approved by MTE7 (Tab V-36.2). Although MTE7 is a remote worker out of Taylor, Arizona he was also MTE1's site lead at GBA. (Tabs V-26.5 and V-36.2 to V-36.3)

Work assignments for MTE1 were assigned by MTD (Tabs V-26.3, V-32.42, and V-36.3 to V-36.4). As the Sumaria senior flight test engineer at GBA, MTD was MTE1's trainer and "mentor" (Tabs V-26.3, V-32.42, and V-36.4). According to MTE7's testimony, MTD told MTE7 that MTE1's training was going slowly and not meeting MTD's expectations. (Tabs V-32.7 to V-32.8

and V-36.11) However, in interactions with MTE1, MTE7 felt she "was doing all the right things to position herself to get [test director] qualified within a reasonable time frame." (Tab V-36.4)

11. HUMAN FACTORS ANALYSIS

a. Introduction

The Department of Defense Human Factors Analysis and Classification System 8.0 (DoD HFACS 8.0) lists potential human factors that can play a role in aircraft mishaps and identifies potential areas of assessment during an accident investigation (Tab BB-1676 to BB-1708). The AIB reviewed all the evidence during its investigation, to include but not limited to GCS voice recorder, witness interviews, Det 3 OIs, and 14 human factors were identified as relevant to the mishap.

b. Relevant Human Factors Identified by the AIB

(1) AE102 Procedure or Checklist Not Followed Correctly: is when the mishap individual did not follow correct procedure which resulted in the near-miss or mishap.

(2) AE201 Inadequate Real-Time Risk Assessment/Action: is when the mishap individual, through inexperience, faulty logic, poor judgment, or insufficient information, selected or proceeded with the wrong course of action based on an ineffective real-time assessment of immediate hazards during execution of a task/mission/activity, which resulted in the near-miss or mishap. This faulty reasoning or erroneous expectation is the result of any one or a combination of: physical or mental conditions of the individual, environmental conditions, crew/team influence, supervisory influence and/or ineffective training.

(3) PC102 Fixation (Channelized Attention): is when the individual focused all conscious attention on a limited number of environmental cues to the exclusion of others, which resulted in a hazardous condition or unsafe act. This may be described as a tight focus of attention that led to the exclusion of comprehensive situational information.

(4) PE101 Environmental Conditions Affected Vision: is when conditions such as lighting/illumination, physical obstructions, rain, snow, spray, fog, haze, darkness, smoke, dust, sand, other particulates, etc., impeded clear viewing/vision, negatively affected performance, and resulted in hazardous conditions or unsafe acts.

(5) PP101 Ineffective Team Resource Management: is when crew/team members failed to actively maintain an accurate and shared understanding of the evolving task, or manage their distribution of tasks, which resulted in a hazardous condition or unsafe act. This includes communication breakdowns critical information not shared, rank/position intimidation, lack of assertiveness or other teamwork functions.

(6) PP109 Task/Mission Planning and/or Briefing Inadequate: is when an individual, crew or team failed to complete all preparatory tasks associated with planning the mission

and/or effective briefing the tasks, which resulted in a hazardous condition or unsafe act. Planning tasks include information collection and analysis, coordinating activities within the crew or team and with appropriate external agencies, risk assessment followed by the pre-mission/task safety briefing.

(7) PT101 Untrained Operator/Worker: is when the mishap individual did not receive adequate/sufficient training or received no training for a specific task, which resulted in a hazardous condition or unsafe act.

(8) SC102 Pace of OPTEMPO/Workload: is when the pace of primary duties, additional duties, training, deployments, or other workload-inducing conditions of a unit created hazardous conditions or unsafe acts.

(9) SI003 Failed to Provide Effective Training: is when supervisors/leaders failed to provide effective training to ensure competency and proficiency of their personnel for a specific task which resulted in hazardous conditions or unsafe acts.

(10). SI004 Failed to Provide Clear Written Procedure/Guidance/Policy: is when unit level guidance or policy was ineffective, unclear, impractical, or non-existent and resulted in hazardous conditions or unsafe acts.

(11). SI008 Tasked Individual(s) with Lack of Experience, Currency or Proficiency: is when a supervisor/leader inadvertently tasked an individual or team whose fluency or expertise did not match skills required for safe execution of the task, system or mission; or whose familiarity with a task or process was either not current or limited by infrequent or rare performance, and resulted in hazardous conditions or unsafe acts. This may be due to flaws in institutional or local training or a leader's lack of knowledge of his/her personnel.

(12). SP006 Ineffective Deliberate Risk Assessment: is when supervision/leadership did not effectively apply DoD risk management procedures during pre-mission/activity/event planning or a job hazard analysis, which resulted in hazardous conditions and/or unsafe acts. This includes assessment of all hazards including crew/team composition.

(13). SP011 Unit Failure to Provide Sufficient Equipment or Supplies: is when unit/ship or installation level leaders failed to ensure personnel executing the mission received all necessary equipment and/or supplies to effectively implement risk control measures which, resulted in hazardous conditions and/or unsafe acts.

(14). OC005 Organizational Structure is Unclear or Inadequate: is when the chain of command of subordinate commander(s) or structure of an organization was confusing, non-standard or inadequate, resulting in hazardous conditions or unsafe acts throughout subordinate units or the field/fleet.

12. GOVERNING DIRECTIVES AND PUBLICATIONS

a. Publicly Available Directives and Publications Relevant to the Mishap

(1) AFI 51-307, *Aerospace and Ground Accident Investigations*, 18 March 2019

NOTICE: The publication listed above is available digitally on the Air Force Departmental Publishing Office website at: https://www.e-publishing.af.mil.

b. Other Directives and Publications Relevant to the Mishap

(1) AFLCMC Detachment 3 Operating Instruction (OI) 99-103, *Test and Evaluation Process*, 31 May 2022.

(2) PTO 1Q-9(M)A-1, *Flight Manual – USAF Series 2400 Software and Above, MQ-9A Aircraft*, 1 June 2023.

c. Known or Suspected Deviations from Directives or Publications

AFLCMC Detachment 3 OI 99-103, paragraph 4.1.1.1, concerns Test Director responsibility to verify that the test "procedures have been properly reviewed and approved" to include any amendments to a previously approved TPSR that reveals a potential higher safety risk.

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30 January 2024

LANCE R. FRENCH
Brigadier General, USAF
President, Accident Investigation Board

STATEMENT OF OPINION

MQ-9A, T/N 12-4209, GCS, S/N 08-5049
GRAY BUTTE AIRFIELD, CALIFORNIA (CA)
07 SEPTEMBER 2023

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

At 7:57:57p.m. (all times are in the local time, Pacific Daylight Savings Time) on 07 September 2023, a test engineer contractor employee came into contact with the spinning propeller of an MQ-9A, Tail Number 12-4209, while checking weapons telemetry during ground testing on Gray Butte Airfield (GBA), CA. The Mishap Aircraft (MA) located at aircraft spot 15 of GBA was operated by a pilot and sensor operator from a Ground Control Station (GCS), Serial Number 08-5049, also located on GBA. The aircraft and GCS were assigned to Air Force Life Cycle Management Center (AFLCMC) Detachment (Det) 3 for testing purposes.

The Mishap Ground Test (MGT) was being conducted for Air Force Special Operations Command (AFSOC) by the AFLCMC's Det 3 in support of AFLCMC's Intelligence, Surveillance and Reconnaissance / Special Operation Forces (ISR/SOF) Directorate's Medium Altitude Unmanned Aircraft Systems (MAUAS) Division. The Mishap Test Engineer (MTE1) was a civilian contractor employed by Sumaria Systems LLC, and Sumaria was supporting AFLCMC Det 3 and the MQ-9 program.

The purpose of the MGT was to determine whether there was electromagnetic interference / electromagnetic compatibility (EMI/EMC), also known as "Source/Victim" testing, with the release of a new software version on the MQ-9A. The MGT team consisted of the MTE1, Mishap Test Director (MTD), Mishap Pilot (MP), Mishap Sensor Operator (MSO), Mishap Crew Chief (MM1), and Mishap Test Engineers 2-6 (MTE 2-6). MTE1 and MM1 were out at the MA on aircraft spot 15. MTE2 floated between the MA and GCS. MP, MSO, MTD and MTEs 3-6 were in the GCS for the entire event until MTE1 was struck by the propeller. There were other various ground support personnel on site observing the test, but they were not directly supporting the telemetry portion of the EMI/EMC test.

The MGT consisted of two main test objectives: (1) Source/Victim compatibility between the Block 5 Aircraft Systems and Flight Safety Critical Systems; and (2) Source/Victim compatibility between the Block 5 Aircraft Systems and Mission Essential Equipment. After Test Objective One was completed, and with MA oil temperatures rising, the MA was shut down and the MGT team broke for lunch at 5:50p.m.

At approximately 7:00p.m. the MGT team reassembled and after completing the pre-start checklist the MA was restarted at 7:36:30p.m. to complete Test Objective 2. At 7:51p.m. MTD sent a text to MTE1 that "TM is on." This indicated to MTE1 that it was time to check telemetry measurements on the weapons to ensure the weapons were properly communicating with the MA and GCS. At 7:53p.m. MTE1 responded via text to MTD that "I'm walking to a/c rn" indicating MTE1 'is walking to the aircraft right now' to take the measurements. Multiple witnesses saw MTE1 walk directly to weapons station 6 on the MA, at the trailing edge of the right wing, without stopping to check in with the crew chief. After apparently taking telemetry measurements with the Agilent V3500A RF (Radio Frequency) Power Meter, MTE1 turned to the left and walked down the right side of the fuselage toward the spinning propeller and the rear of the MA while looking down at the testing device. Without looking up to determine her position relative to the aircraft, MTE1 proceeded to walk directly into the propeller of the MA sustaining fatal injuries.

I find, by a preponderance of the evidence, there are two causes of the mishap: (1) MTE1 was incorrectly instructed, or trained on, how to take the telemetry measurements from the loaded weapons on the MQ-9A aircraft while the engine was running with the propeller in motion;. (2) MTE1 lost situational awareness while walking around the MA taking telemetry measurements, which resulted in contact with the propeller. I also find, by a preponderance of the evidence, two factors that substantially contributed to the mishap: (1) on 7 Sep 23 there was a clear lack of communication among the test team and ground support personnel and (2) due to previous delays and cancellations the tests conducted on 7 Sep 23 were rushed.

2. CAUSES

a. Improper Training

On GBA, there is conflicting guidance concerning the danger areas and propeller no enter zones for the MQ-9A. During this investigation, the AIB located three different diagrams and each varied drastically on the danger areas. The Air Force contract with Sumaria contains a Performance Work Statement (PWS). Within that PWS, there is a requirement for Sumaria contractors to follow Air Force guidance on technical and safety matters concerning the MQ-9A.

The training provided to new employees by AFLCMC Det 3 showed various radiation zones for various antennae, in addition to a propeller no enter zone that extended from the rear tip of each tail, back six feet to the tip of the propeller cone. Further back from the propeller cone was identified as a propeller wash zone and only required the addition of eye protection.

In a briefing on safety and flightline basics provided by General Atomics, similar radiation zones are identified, but the propeller hazard zone extends from each tail out 150 feet in each direction and encompasses a half circle around the back of the aircraft, much more encompassing than the Det 3 training.

Finally, in a general maintenance procedure technical order the propeller no enter zone extended from the wingtips straight back 50 feet. In addition, beyond that for another 50 feet is an area identified as "Cautionary zone. Do not enter during high power."

The AIB was only able to confirm MTE1 was instructed on the diagram provided by the Det 3 training, the least restrictive of the three diagrams. This represented a propeller danger area of approximately 22 ft by 6 ft.

The night prior to the incident, 6 September 2023, the test team gathered at 5:00p.m. in an attempt to complete the test. The weapons team and test engineers, including MTE1 and MTD, met inside Hangar 54 where the MA was located. MTD was informed the requested test device normally used, a spectrum analyzer, was out for calibration and would not be available. Previously, the spectrum analyzer had been used to receive telemetry from the weapons to ensure they were sending and receiving signals from the aircraft and the GCS. During these previous tests, the individual using the spectrum analyzer would be positioned either in front of or to the rear of the aircraft, outside of the wingspan of the aircraft to take the telemetry measurements. The device is typically positioned on a table (because of the size) and the test engineer takes the measurements from a stationary position without any need to approach the aircraft.

MTD was informed by the tool crib attendant that they had a power meter, specifically an Agilent V3500A RF Power Meter. MTD testified that he had never seen or used this device in the past. There is also no indication that MTE1 had ever seen or used the device. After researching the device specifications on the internet, MTD decided this device would suffice for the required testing. However, the device had to be much closer, within 2-3 feet of the object being tested to properly measure telemetry.

At approximately 9:00p.m., for other reasons, it was decided to cancel the remainder of the test for 6 September 2023. The primary reason for the cancelation was that the MA was not fueled and could not operate the engine and propeller in the hangar in any case. However, MTD still wanted to get baseline telemetry measurements for the weapons using the new power meter device. According to MTD's testimony, in addition to several other witnesses, MTD took the device and walked to the rear of weapons station 6, behind the MA's right wing. MTD apparently took measurements, then walked behind the MA, around the unmoving propeller, to weapons station 2, behind the MA's left wing. MTD then walked back behind the MA to take the measurements for a second time. It is unclear whether MTE1 used the device on 6 September 2023 in Hangar 54 which left her without the proper training to utilize the device on 7 September 2023.

Based on testimony and documentary records review, there is no credible evidence MTD instructed MTE1 on the proper procedures to approach a running aircraft, e.g., checking in with the crew chief before approaching, and only approach from the front of the aircraft.

When asked about the events of 6 September 2023, MTE2 said it was a "dry run" for the test planned the following day, 7 September 2023. Moreover, while in Hangar 54 on 6 September 2023, MWM1 asked MTE1 what she was doing there. MTE1 responded, "I'm just here to mimic [MTD]." None of the witnesses who were present in Hangar 54 on 6 September 2023 testified that they heard MTD tell MTE1 to not follow the path he took around the MA, but instead walk around the front of the aircraft. Based on witness testimony, on the night of 7 September 2023 it appears MTE1 was attempting to take the same path that she observed MTD taking around the MA the night prior.

I find by a preponderance of the evidence that MTE1 lacked proper training on the hazard areas of the MQ-9, how to approach a running aircraft and how to safely take measurements with the newly discovered, unfamiliar power meter.

b. Loss of Situational Awareness

Prior to accepting the position at Sumaria, MTE1 was supporting the F-35 program at Edwards Air Force Base, CA from September 2017 – March 2023. Prior to that, from March 2016 – September 2017, MTE1 was an engineer intern with the Air Force Operational Test and Evaluation Center at Edwards Air Force Base, CA supporting the Airborne Warning and Control System program. There is no indication in MTE1's background of any prior work experience around propeller driven aircraft. Of note, witnesses testified that MTE1 kept referring to the MQ-9A as a "jet" vice a "plane" like other personnel on GBA.

MTE1 was not provided communication equipment which denied her the ability to have direct communication with the crew chief or MGT personnel in the GCS. As MTE1 approached the trailing edge of the right wing of the MA, the sound got progressively louder and she may have been able to physically feel the vibrations of the engine and propeller; however, she continued to look down, fixated on the testing device. The RF power meter that MTE1 was using has a design feature that times out the backlight after 60 seconds and requires the user to periodically hit a button on the device to get the backlight to turn back on. It is more likely than not that MTE1's focus was in operating the unfamiliar device, to include keeping it continuously illuminated.

At the time of the mishap, the aircraft was running at 100% RPM and 16% torque. Though the ground test was occurring at night, the area for aircraft spot 15 was lit by four overhead stadium-like lights (two each on two different light poles) behind the aircraft. Facing the rear of the aircraft next to the fuselage behind the right wing, the spinning propeller is not visible in those lighting conditions. In addition, because of the position of the lights, shadows would have been created by both the aircraft structure and MTE1's own body.

I find by a preponderance of the evidence that MTE1's lack of familiarity with the airframe, low lighting conditions, and fixation on the unfamiliar testing device resulted in MTE1 losing situational awareness while walking around the MA with the engine running.

3. SUBSTANTIALLY CONTRIBUTING FACTORS

a. Lack of Communication Among Entire Test Team

When questioned, none of the ground crew knew what MTE1's role in the testing was on 7 September 23. In fact, prior to the incident most of the ground crew did not even know MTE1's name, they only knew that she was a test engineer of some sort.

The pre-test mission briefing was conducted by MTD at 3:00p.m. in the "fishbowl," building 54A, on GBA. AFLCMC Det 3 Operating Instruction (OI) 99-103, *Test and Evaluation Process*, paragraph 4.3, Mission Brief, lists 24 items that should be covered in a mission brief. According to witness testimony a majority of those items were omitted in the mission briefing on 7 September 2023.

AFLCMC Det 3 OI 99-103, paragraph 4.3.2 addresses "Test crew identification, assignment, and duties," however, no one in attendance at the mission brief remembers this being covered. In fact, there was no mention of MTE1's role in the test, or that a test engineer (or anyone else) would be approaching the MA while the engine was running. A few of the witnesses remember hearing about the use of a new testing device, the Agilent, and that measurements needed to be taken *behind* the weapons. However, there was no mention of who would take the measurements, or at what point during the overall ground test sequence it would occur.

In addition, there was no mention of "emergency procedures" (para 4.3.20) or "actions and key words to terminate [a] test profile" (para 4.3.21). This was key as the mishap developed. During the mission briefing the crew chief did not brief the aircraft keep out zones as mandated in the safety requirements of the Test Plan.

During previous testing attempts, MTE1 was located in the Ground Control Station (GCS) with other test engineers, not out at the aircraft. When questioned whether it was odd MTE1 was out at the aircraft that afternoon and evening, test engineers that were in the GCS during the mishap all responded that yes, it was out of the norm for a test engineer to be out at the aircraft, vice in the GCS. As MTE1 was still a relatively new employee and still in training, being in the GCS where one could hear as each test point was reached/achieved was the place to learn about the test procedures. However, with the exception of the lunch break (5:50p.m. – 7:00p.m.) MTE1 was sitting/standing out at the MA (outside the coned off area) from approximately 3:30p.m. - 7:53p.m.

MTD's reasoning for having MTE1 out at the MA all day was to check for "inadvertent flight control surface movements," while awaiting the time for the telemetry measurement. The task would have been extremely difficult as MTE1 was not provided any direct communication with the GCS to hear what flight control commands the aircrew was inputting. The only communication MTE1 had was via text on a personal cell phone. The only text MTE1 received from the GCS during the entire test was from MTD at 7:51p.m., "TM is on." There were no text messages from MTD asking about flight control surface movements. MM1 confirmed in sworn testimony that it is the responsibility of the crew chief to confirm flight control surface movements with the aircrew, not a test engineer at the aircraft. MTD admitted that he has never had a test engineer out at an aircraft to confirm flight control surface movements.

At 7:53p.m. MTE1 texted MTD that she's walking to the aircraft. As the primary communicator to the aircrew in accordance with the Det 3 OI, MTD should have informed the aircrew that MTE1 was approaching the aircraft. But this communication never occurred.

The ground crew watched as MTE1 proceeded past both the crew chief and the cone identifying the Ku radiation hazard. MTE1 then walked directly to weapon station 6 at the rear of the right wing of the MA. Because they knew MTE1 was an engineer and was holding a testing device, the

ground crew all collectively just assumed she knew what she was doing. After MTE1 apparently took measurements from the weapons on station 6, she turned to the left and proceeded toward the spinning propeller and the rear of the MA while looking down at the test device in her hand. At this point ground crew members began shouting and waving their hands to get MTE1's attention. MM1 began walking toward MTE1, also yelling and waving.

At 7:57:51 p.m., MM1 asked the aircrew "Are you guys still in Ku?" asking if the Ku satellite link was up, and therefore the radiation hazard still existed. The aircrew responded at 7:57:54 p.m. "Yes we are." At 7:57:57 p.m., MTE1 came into contact with the spinning propeller. At 7:57:59 p.m. MM1 yelled over the radio to the aircrew, "Kill, kill, kill, kill!" this was followed a second later with, "Kill, kill, kill!" At 7:58:07 p.m. MSO responded, "Copy, we're going down." However, there was confusion in the GCS on what the "Kill" command meant. Because it was proceeded by the question about the Ku being on, the aircrew assumed that is what MM1 meant, so they turned off the Ku link, but not the engine. At 7:58:14 p.m. the engine RPMs began to roll back as MM1 had reached the MA's kill switch on the left side of the aircraft.

I find that by a preponderance of the evidence, there was a lack of communication among the test team on roles and responsibilities of each team member, specifically MTE1's role. This lack of information caused hesitation on the part of the crew chief and the rest of the ground crew from intervening before the situation became critical. In addition, the mission brief failed to identify the aircraft keep out zones and a clear "knock it off" type phrase that everyone clearly understood to mean immediately terminate the test. Finally, MTD failed to inform the aircrew and crew chief that MTE1 was due to approach the MA.

b. Rushed Testing

The EMI/EMC ground testing on the MA had been ongoing for a few weeks with at least four prior attempts. Previous attempts were cancelled for various reasons because of issues with software and/or hardware and engine/fuel temperature concerns. In addition, different weapon load outs had to be tested.

The test on 6 September 2023 was the final attempt before the mishap. There was an issue with the nose wheel steering servo that required higher level approval to continue with testing. This was eventually approved by Det 3 leadership, but there were other delays in getting the proper weapons loaded and the correct paperwork signed off by quality assurance personnel. At one point, MTE2 suggested to MTD that the tests should be canceled for both 6 and 7 September 2023. MTD responded with, "We are going to run until we fall." MTD then directed the aircrew to the GCS; however, it is notable that the MA was still in the hangar and had not been fueled. Eventually at 9:00 p.m., testing on 6 September 2023 was terminated and it was relayed to the MGT team that testing would resume on 7 September 2023 with the pre-test mission briefing at 3:00 p.m. the next afternoon.

Listening to GCS audio recordings of the test on 7 September 2023, MTD could be heard talking over MP while MP was reading off checklist items. This demonstrated a rushed atmosphere in the GCS. In addition, conversation in the GCS included comments like, "C'mon guys, the quicker

you respond the faster we get out of here." This was in reference to the aircrew waiting for a response from the ground crew at the MA. Other comments included:

"Yeah, we definitely want to expedite this stuff."
"Not the time to putz around."
"C'mon guys, let's get this show on the road. This is not the time to delay."

At one point, while personnel in the GCS were waiting for the ground crew to load the weapons keys, a comment was made that the ground crew was walking, not running. MTD then said, "I'll chase after them with a lash." Although the comment may have been in jest, there was a clear indication from the recorded GCS audio that the ground crew and personnel at the MA were not moving fast enough according to the MTD's expressed direction.

After MTD sent the text to MTE1 that "TM is on," and MTE1 replied she was going to the aircraft, MTD still sent MTE2 to the aircraft to see what was taking MTE1 so long.

The use of a new test device, which required close proximity to the weapons at the back of the wing, should have warranted a review of the previously approved Test Project Safety Review (TPSR). The new device, which was discovered 24 hours prior to the mishap was new and unfamiliar to both MTD and MTE1. The team spent minimal time using the newly discovered power meter on 6 September 2023, with a majority of the witnesses testifying they saw MTD using it not MTE1. The power meter required the user to be much closer to the object under test, within 2-3 feet, vice outside the wingspan of the aircraft with the previously used spectrum analyzer. This major change should have triggered an "Out of Scope Amendment" of the TPSR, as it would mean a "major safety plan change" and "major test plan change." This review of the TSPR would have allowed the entire test team to be aware of the new test device and the operating parameters under which it would be used for the test on 7 September 2023. However, MTD did not initiate a review of the TPSR and the risk assessment remained "Low" for the ground test with no mention of hazard to personnel in regards to approaching a running aircraft.

I find by a preponderance of the evidence that there was a rush in trying to complete the test on the night of 7 September 2023.

4. CONCLUSION

In addition to review of the evidence described in the Summary of Facts, which included aircraft systems display data and audio from the ground control station, and interviews with relevant personnel, I replicated the mishap sequence with an MQ-9A with engine running at the same power settings on aircraft spot 15, in the same twilight lighting conditions, and ramp stadium lighting that were present on 7 September 2023. The spinning propeller was not visible when looking to the rear of the aircraft from the trailing edge of the right wing behind weapon station 6. Under those lighting conditions, portions of the MA and MTE1's own body would have created shadows that made it difficult to see if concentrating on the handheld testing device, contributing to the loss of situational awareness. Using the hearing protection used by MTE1, both myself and another AIB member separately walked the trailing edge of the right wing while others were shouting from the approximate location where the crew chief was standing during the mishap. Before both of us

reached the rear of weapon station 6 on the right wing, we could no longer hear anything other than the noise from the aircraft itself. It is highly probable MTE1 never heard anyone shouting warnings on the night of the mishap.

I find, by a preponderance of the evidence, there are two causes of the mishap: (1) MTE1 was incorrectly instructed, or trained on, how to take the telemetry measurements from the weapons loaded on the MQ-9A aircraft while engines were running, and (2) MTE1 lost situational awareness while walking around the MA taking telemetry measurements. Further, I find by a preponderance of the evidence there are two factors that substantially contributed to the mishap: (1) on the day of the mishap there was a clear lack of communication among the test team and ground support personnel and (2) because of previous delays and cancellations the testing being conducted on 7 September 2023 was rushed.

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30 January 2024

LANCE R. FRENCH
Brigadier General, USAF
President, Accident Investigation Board

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