UNITED STATES AIR FORCE
AIRCRAFT ACCIDENT
INVESTIGATION BOARD REPORT

MQ-9A, T/N 11-4123
432 WING
CREECH AFB, NEVADA

LOCATION: SOUTHERN CALIFORNIA LOGISTICS AIRPORT

VICTORVILLE, CALIFORNIA

DATE OF ACCIDENT: 18 JANUARY 2023

BOARD PRESIDENT: COLONEL DAVID I. STAMPS

Accident Investigation Board, under Air Force Instruction 51-307

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR COMBAT COMMAND

OFFICE OF THE DEPUTY COMMANDER
205 DODD BOULEVARD, SUITE 203
JOINT BASE LANGLEY-EUSTIS VA 23665

08 MAR 2024

ACTION OF THE CONVENING AUTHORITY

The report of the accident investigation board conducted under the provisions of Air Force Instruction 51-307, *Aerospace and Ground Accident Investigations*, that investigated the 18 January 2023 mishap at the Southern California Logistics Airport, involving an MQ-9A, T/N 11-4123, and operated by a contractor, complies with applicable regulatory and statutory guidance, and is hereby approved.

MICHAEL G. KOSCHESKI
Lieutenant General, USAF
Deputy Commander

EXECUTIVE SUMMARY
UNITED STATES AIR FORCE
AIRCRAFT ACCIDENT INVESTIGATION

MQ-9A, T/N 11-4123
VICTORVILLE, CALIFORNIA
18 JANUARY 2023

On the morning of 18 January 2023 at approximately 1017 local time, a MQ-9A Reaper, the Mishap Aircraft (MA), belonging to the 432nd Wing, Creech Air Force Base, Nevada and on-loan to Integrated Innovation, Incorporated (i3), impacted Runway 17 at Southern California Logistics Airport (SCLA), Victorville, California. The accident destroyed the MA's radome, Multi-Spectral Targeting System (MTS), lower data-link antenna, all three-landing gear, and engine. The MA was being operated by a Launch and Recovery Element (LRE) from the contract firm i3, comprised of the Mishap Pilot (MP) and the Mishap Sensor Operator (MSO). Additionally, a Mishap Safety Observer Instructor Pilot (MSOIP) and Mishap Safety Observer Sensor Operator (MSOSO) were present at the Ground Control Station (GCS). Both mishap safety observers are employed by i3. The mishap resulted in no reported damage to civilian property, no injuries, and no fatalities. The loss of government property is valued at $16,111,000.00.

During pre-flight ground operations, while performing the Angle of Attack (AOA) safety checks with the MA crew chief, the MP failed to recognize the MA AOA was outside of the parameters outlined in the Technical Order (TO). During the initial engine run-up during the first stages of takeoff, MP confirmed all instrument indications were good. The calculated aircraft rotation speed for this flight was 78 knots indicated airspeed (KIAS). No verbal crew acknowledgment of the rotation speed was heard during the takeoff sequence once the MA achieved 78 KIAS. Between 82-83 KIAS, the MSO verbalized "ABORT!" The MP acknowledged the "ABORT" call and executed takeoff abort procedures at 91 KIAS. Both the MP and MSO recognized the MA was airborne at 92 KIAS. The MA climbed to an altitude of 18 feet above ground level (AGL). The MP subsequently directed the MSO to, "Kill the GDT (Ground Data Terminal)." The MSO toggled the GDT kill switch while the aircraft was stalled (67 KIAS, 2 feet AGL over the centerline of the runway). The MA then lost all remote-control connectivity with the GCS as it impacted the runway and drove off the paved runway surface, destroying previously listed components.

The Accident Investigation Board President (AIBP) found, by a preponderance of the evidence, that the cause of the mishap was the MP's decision to "Kill the GDT" causing lost link, while the MA was 2 feet AGL and 67 KIAS. Due to the lost datalink, the MA departed the prepared runway surface subsequently destroying the MA radome, sensor suite, landing gear, and engine. The AIBP found, by a preponderance of the evidence, that three factors substantially contributed to the mishap: (1) The MP failing to recognize the AOA checks being out of Technical Order (TO) limits during ground operations; (2) the MSO's failure to verbalize "ROTATE" at rotation airspeed; and (3) the MSO's failure to recognize the aircraft was beyond rotation airspeed during the "ABORT" command.

SUMMARY OF FACTS AND STATEMENT OF OPINION
MQ-9A, T/N 11-4123
SCLA, VICTORVILLE, CALIFORNIA
18 JANUARY 2023

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ACRONYMS AND ABBREVIATIONS

432 WG	432nd Wing
AIB	Accident Investigation Board
AIBP	Accident Investigation Board President
ACC	Air Combat Command
AFB	Air Force Base
AFI	Air Force Instruction
AFMAN	Air Force Manual
AGL	Above Ground Level
Capt	Captain
Col	Colonel
DAFI	Department of the Air Force Instruction
DoD	Department of Defense
ft	Feet
GCS	Ground Control Station
HFACS	Human Factors Analysis Classification System
HUD	Heads-Up Display
IAW	In Accordance With
IP	Instructor Pilot
KIAS	Knots Indicated Airspeed
LA	Legal Advisor
LRE	Launch and Recovery Element
Lt Col	Lieutenant Colonel
MA	Mishap Aircraft
MC	Mishap Crew
MGCS	Mishap Ground Control Station
MIP	Mishap Instructor Pilot
MISO	Mishap Instructor Sensor Operator
MO	Mishap Observer
MP	Mishap Pilot
MSgt	Master Sergeant
MSO	Mishap Sensor Operator
MSQCC	Mishap Squadron Commander
MTS	Multi-Spectral Targeting System
NV	Nevada
PM	Pilot Member
RCM	Redundant Control Module
Rec	Recorder
SCLA	Southern California Logistics Airport
SIB	Safety Investigation Board
TO	Technical Order
TSgt	Technical Sergeant
USAF	United States Air Force
V	Volume

SUMMARY OF FACTS

1. AUTHORITY AND PURPOSE

a. Authority

On 24 August 2023, the Air Combat Command (ACC) Deputy Commander appointed Colonel David I. Stamps as President of the Accident Investigation Board (AIB) for the mishap that occurred on 18 January 2023 involving an MQ-9A at Southern California Logistics Airport (SCLA), Victorville, California (Tab Y-1). Other board members included a Captain (Capt) Legal Advisor, a Capt MQ-9 Pilot Member, a Master Sergeant (MSgt) Maintenance Member, and a Technical Sergeant (TSgt) Recorder (Tab Y-1). The AIB conducted its investigation in accordance with Air Force Instruction (AFI) 51-307, *Aerospace and Ground Accident Investigations*, from 5 September 2023 to 5 October 2023.

b. Purpose

Under AFI 51-307, *Aerospace and Ground Accident Investigations*, this AIB 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 (Tab Y-1).

2. ACCIDENT SUMMARY

On the morning of 18 January 2023 at approximately 10:17 Pacific Standard Time (PST), a MQ-9A Reaper tail number (T/N) 11-4123, the Mishap Aircraft (MA), belonging to the 432nd Wing (432 WG), Creech Air Force Base, Nevada and on-loan to Integration Innovation, Incorporated (i3), impacted Runway 17 at Southern California Logistics Airport (SCLA), Victorville, California (Tabs H-2, H-4, D-335, Z-1, DD-1, DD-2, and EE-4). The MA radome (front of the aircraft nose section housing multiple sensors), Multi-Spectral, Targeting System (MTS), all three-landing gear, and engine were destroyed when the MA lost datalink communication with the mishap crew (MC) Ground Control Station (GCS) and veered off the runway and crashed on the dirt infield of SCLA (Tabs H-26, H-27, J-4, and EE-4).

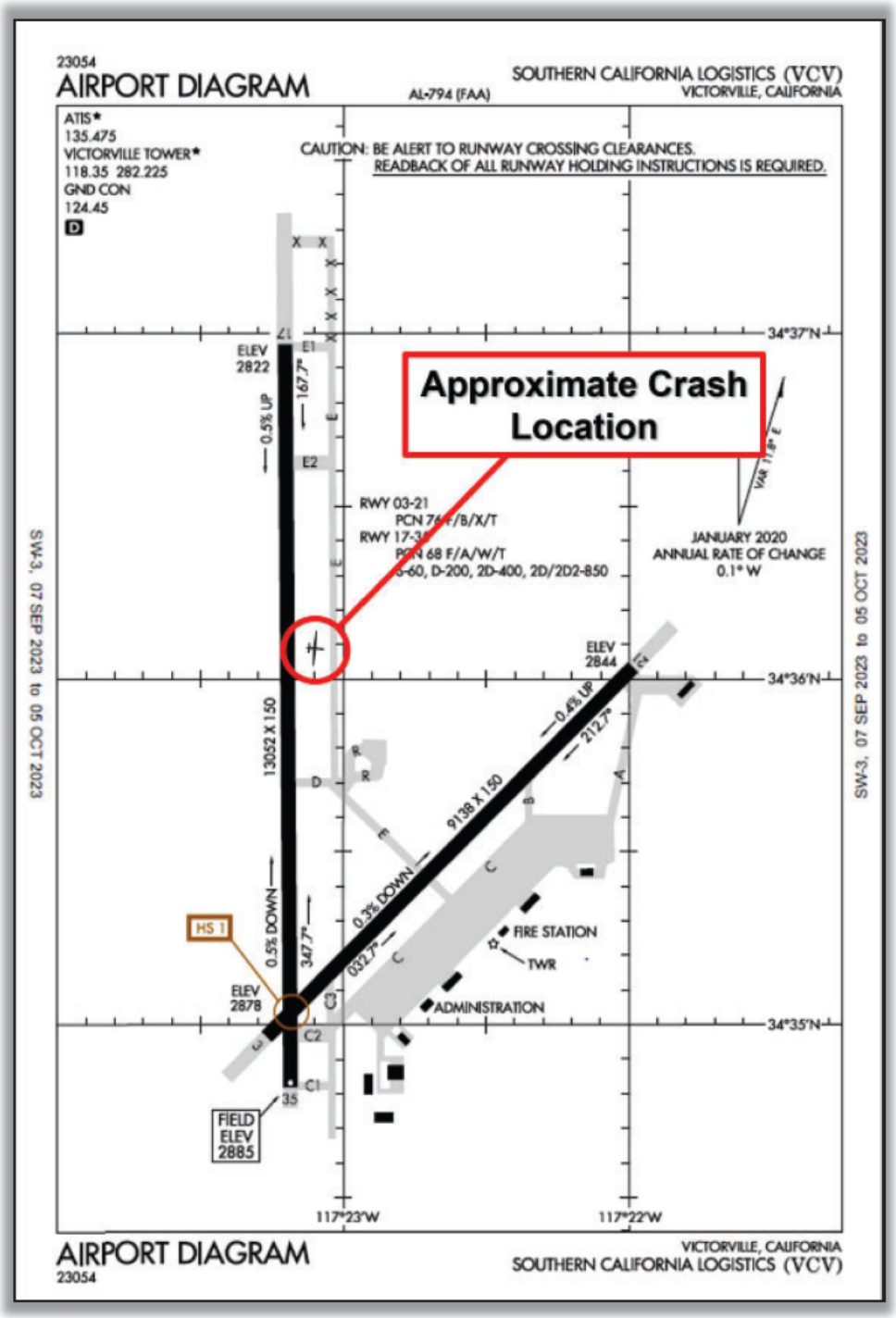
The MA was being operated by a Launch and Recovery Element (LRE) from the contract firm i3, and the LRE was comprised of the Mishap Pilot (MP) and the Mishap Sensor Operator (MSO) (Tabs V-1.6, H-25 to H-26, BB-16, and DD-2). Additionally, the Mishap Safety Observer Instructor Pilot (MSOIP) and Mishap Safety Observer Sensor Operator (MSOSO) were present within the GCS (Tabs V-1.6, V-2.8, V-3.6, and V-4.5). Both mishap safety observers are employed by i3 (Tabs R-2, V-3.4, V-4.4). At the time of the mishap, both the crew and MA were located at SCLA, Victorville, California (Tabs V-1.6, V-2.6, and DD-2). The crew are members of the California Air National Guard but operating in civilian status at the time of the mishap (Tabs V-1.4, V-2.4, V-3.4, V-4.4). The mishap resulted in no reported damage to civilian property, no injuries, and no fatalities (Tab P-1). The loss of government property was valued at $16,111,000.00 and the total environmental clean-up costs were $11,000.00 (Tab P-1).

During preflight ground operations at 09:39:55 PST, while performing the MA Angle of Attack

(AOA) sensor safety checks with the MA crew chief, the MP failed to recognize the MA AOA was outside of the parameters outlined in the Technical Order (TO) (Tab H-26). U.S. Air Force TOs provide aircrew with operating instructions for all phases of flight, provide engineer approved checklists, and provide specific aircraft technical limitations pertaining to each of the aircraft's mechanical, electrical, hydraulic, flight control, and fuel systems (Tabs BB-2, BB-4). After completing pre-takeoff checklists, the MP called for a manual takeoff and then the MP stated, "lets do it." (Tab N-4). At 10:02:35 PST, during the initial engine run-up on takeoff, MP confirmed all aircraft system were "normal" (Tab N-4, H-26). The MA safely passed the acceleration check (Tabs BB-13, N-4, V-1.7). The acceleration check is, "the speed at which the aircraft should be traveling in a given time after initiating take-off run" (Tab BB-12). "This number ensures you have a normally performing airplane for takeoff" (Tab BB-12). The calculated aircraft rotation speed for this flight was 78 KIAS (Tab H-4, H-26).

Technical Order 1Q-9(M)A-1 specifically states, "Transition to ABORT state is not allowed once the aircraft exceeds rotation speed or the commit point, whichever comes first" (Tab BB-5). A verbal "ROTATE" call made by MQ-9 sensor operators is standard operating procedure and is used as the "abort no later than air speed," as depicted in the i3 SkyRange KVCV Standards dated 2 June 2022 (i3 SkyRange Standards) (Tabs BB-21, V-1.9, V-2.10, V-4.7). The MSO did not verbalize "ROTATE" at 78 KIAS, time 10:17:27 (Tabs N-4, V-4.7). Between 82-83 KIAS, at 10:17:28 PST, an "ABORT" call was made by the MSO (Tabs H-26, V-4.7). The MP acknowledged the "ABORT" call and executed takeoff abort procedures at 91 KIAS, time 10:17:32 when the MA was 1-foot above ground level (AGL) (Tabs H-26, Tab EE-4, V-2.10 to V-2.11). Both the MP and MSO recognized the MA went airborne at 92 KIAS (Tab N-5, EE-4). The MA climbed to an altitude of 18 feet AGL (Tab H-3). The MP subsequently directed the MSO to, "Kill the GDT (Ground Data Terminal)" (Tabs N-5, V-1.10). The MSO switched off the GDT power switch at 10:17:39 PST while the aircraft was stalled (67 KIAS, 2 feet AGL over the centerline of the runway) (Tabs N-5, V-2.11, Tab EE-4). The MA subsequently went lost link (losing all remote-control communication), impacted the runway, and veered off the paved runway surface into the dirt infield area (Figure 1) (Tabs N-5, Z-1, and FF-7).

Figure 1. SCLA Diagram – Approximate Crash Location (Tab Z-1)



Upon the MA departing the prepared runway surface the MA's radome, sensor suite, landing gear, and engine were destroyed (Tabs H-5, H-26, and EE-4).

The AIB team recreated the mishap flight profile in the simulator on 6 September 2023 and executed seven simulated takeoffs (Tab EE-1). The same AIB crew performed all seven simulator profiles (Tab EE-1). The MQ-9 AIB Pilot studied the MA HUD video to accurately recreate the

simulator profile. (Tab EE-1) The simulator profile included an 8200-pound aircraft, winds, and weather conditions to match what would have been on Runway 17 (Tab EE-1). During all seven profiles, the AIB team aborted takeoff at 83 KIAS (Tab EE-1). During all seven simulation profiles the aircraft went airborne around 91 KIAS, climbed above 18 feet AGL and proceeded to stall (Tab EE-1). The AIB team did not severe the GDT and was able to maintain aircraft control on the runway, bringing the aircraft to a full stop (Tab EE-1).

3. BACKGROUND

a. Air Combat Command (ACC)

ACC, headquartered at Joint Base Langley-Eustis, Virginia, is one of ten major commands (MAJCOMs) in the United States Air Force (Tab CC-1). For more than seven decades, ACC has served as the primary provider of air combat forces to America's warfighting commanders (Tab CC-1). ACC organizes, trains, and equips Airmen who fight in and from multiple domains to control the air, space, and cyberspace (Tab CC-1). As the lead command for fighter, command and control, intelligence, surveillance and reconnaissance, personnel recovery, persistent attack and reconnaissance, electronic warfare, and cyber operations, ACC is responsible for providing combat air, space, and cyber power and combat support that assures mission success to America's warfighting commands (Tab CC-1).

b. 432nd Wing (432 WG)

The 432 WG is located at Creech AFB, Nevada (Tab CC-9). The 432 WG was returned to active service in May 2007 as the U.S. Air Force's first unmanned (and later remotely piloted) aircraft systems wing (Tab CC-9). The wing's mission is to conduct unmanned precision attack and intelligence, surveillance, and reconnaissance combat missions in support of overseas contingency operations (Tab CC-9).

c. Integration Innovation, Incorporated (i3)

i3 is a United States based IT company that provides testing, training, and technology development services to the United States Government (Tab CC-11). i3 operates the SkyRange program (Tab CC-7). The program is focused on developing and integrating advanced sensors and capabilities and providing flight operations and maintenance for a fleet of manned/unmanned and optionally manned air-vehicle systems to support hypersonic capability development (Tab CC-6). The SkyRange test architecture includes both MQ-9 Reapers and RQ-4 Global Hawks allowing for the capture of real-time telemetry, real-time multi-spectral full motion video, maritime range surveillance and clearing, and the collection of weather data to support real-time launch decision-making for high-speed system testing (HSST) (Tab CC-6).

d. MQ-9A Reaper

The MQ-9A Reaper is employed primarily as an intelligence-collection asset and secondarily against dynamic execution targets (Tab CC-4). 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 (Tab CC-4). Reapers can also perform the following missions and tasks: intelligence, surveillance and reconnaissance, close air support, combat search and rescue, precision strike, buddy-lase, convoy and raid overwatch, route clearance, target development, and terminal air guidance (Tab CC-4). The MQ-9A's capabilities make it uniquely qualified to conduct irregular warfare operations in support of combatant commander objectives (Tab CC-4).

4. SEQUENCE OF EVENTS

a. Mission

The morning of 18 January 2023, a launch and recovery element (LRE) from i3 was tasked with launching an Air Combat Command, 432 WG loaned, MQ-9A Reaper, T/N 11-4123, as a part of the inaugural flight for this contractor at the SCLA, Victorville, California (Tab D-335, DD-2). The mission objectives of this flight were (1) establish baseline for MQ-9 operations in the SCLA traffic pattern; (2) validate Flight Ground Operating Procedures (FGOP); (3) assess link integrity throughout the traffic pattern; and (4) exercise aircraft and support equipment and assess deficiencies (Tab DD-2). No evidence indicates the overall mission profile was a factor in this mishap (Tab DD-2). The mishap crew (MC) was operating under the authorization of a Government Flight Representative (GFR) approved flight and ground operations procedures and an approved Department of Defense (DD) Form 3062 (Request for Flight Approval) (Tab DD-2).

b. Planning

i3 planned to conduct a flight under an Army Other Transaction Agreement (OTA) using an Air Combat Command, 432 WG owned MQ-9 Reaper aircraft (Tab D-335, DD-2). The events planned for this mission were standard MQ-9 ground operations to include a physical aircraft inspection and preflight start, taxi, and takeoff checklist procedures (Tab V-1.4 to V-1.5). Immediately after takeoff, the MC planned to establish the aircraft into the overhead air traffic control pattern at SCLA, execute one touch-and-go landing-to-takeoff, and re-enter the overhead air traffic control pattern to return for a full stop landing at SCLA (Tabs V-1.5, V-4.5). The team met on 17 January to plan for their flight the following day (Tab V-1.4). The preparation included checking the weather, having the crew brief, and looking over the aircraft forms (Tab V-2.5). The team planned for a simple flight, designed to test the basic functions of the MA (Tab V-1.4). The entire team also met the morning of 18 January for a final brief before the flight (Tab V-4.5). Members of both briefings included the crew and safety observers (Tab V-4.5). No evidence indicates that mission planning was a factor in this mishap.

c. Preflight

The MP conducted a physical preflight inspection of the MQ-9 in accordance with (IAW) the MQ-9–1 checklist (Tab V-1.5). The MC accomplished all applicable checklist steps and procedures correctly to prepare the mishap ground control station (MGCS) and MA for flight (Tabs V-1.5 to V-1.7). No evidence indicates the preflight procedures were a factor in this mishap.

d. Summary of Accident

Prior to takeoff, at 09:39:55 Pacific Standard Time (PST), the MC completed all required ground safety and systems checks (Tabs H-4). One of the ground safety and system checks includes the MQ-9 crew chief and pilot verifying the Ground Control Station (GCS) pilot cockpit angle of attack (AOA) gauge displays accurate information (Tab BB-7). The crew chief physically moves the MQ-9 AOA probe with their hand while the pilot verifies the AOA gauge in the cockpit displays accurate information (Tab BB-7). On the day of this mishap, during the AOA probe and sensor safety checks with the MA crew chief, the MP states, "Positive, Negative, Neutral" but doesn't verify on the gauge that the displayed readings are outside the parameters written within the MQ-9 TO (Tabs H-4, V-1.8, V-3.6). The AOA cockpit indicator hovered between 6.5 and 7.0 degrees (Tab H-4, H-26). According to TO 1Q-9(M)A-1, the neutral position will normally be -1 AoA (+/-2) (Tab BB-7). As stated in the MP's sworn testimony, this error was not noticed nor verbalized by the MP or any mishap safety observers (Tab V-1.8). The MC continued to the next checklist item (Tab H-4).

If the AOA gauge had displayed within TO limits, the subsequent AILERON *TIP STALL OVERRIDE* caution, audible warning tone, and the *WARN message* displayed in the cockpit head's up display (HUD) would not have been a factor prior to takeoff (Tab H-9).

During the MA taxi towards the runway at 09:58:25 PST, the MC verified their takeoff and landing data (TOLD) calculations in accordance with checklist procedures (Tabs H-4, V-1.6, V-1.7, and BB-6). The MSO identified the rotation and liftoff speeds as 77 KIAS and 90 KIAS, respectively (Tab H-4). At 10:04:52 PST, prior to takeoff, the MP stated the rotation speed was 78 KIAS and liftoff speed was 98 KIAS (Tabs H-4). The numbers were not corrected by the MSO or any mishap safety observers (Tab H-4). After completing all before-takeoff checklists, the MSO stated, "Manual take-off" (Tab FF-6). The MP then stated, "lets do it." (Tab FF-6). At 10:17:13 PST, once the MA was in position on Runway 17, the MP pushes up the throttle, begins the takeoff, and confirmed all indications looked good (Tabs H-4, N-4, and V-1.7). Before the takeoff was initiated, the AOA indicator on the HUD read 9.5 degrees (Tabs H-4, H-26, BB-7).

The MA safely passed the 50 KIAS acceleration check (Tab V-1.7, V-4.7). The MSO failed to verbally communicate "ROTATE" at 78 KIAS (Tab V-4.7). TO 1Q-9(M)A-1 advises, "It is critical to identify an abort point" (Tabs BB-8, BB-9). The "ROTATE" call is standard operating procedure and is used as the "abort no later than speed," as depicted in the i3 SkyRange Standards (Tabs V-1.9, V-2.10, BB-21). During this board's interviews with the MSO, it was verified a "ROTATE" call by sensor operators is a MQ-9 community-wide standard procedure (V-2.10). Additionally, the 1Q-9(M)A-1 and 1Q-9(M)A-1-1 states, "An abort above the refusal speed or with engine failure may result in departing the prepared surface" (Tabs BB-8, BB-9).

The i3 SkyRange KVCV Standards states, "To abort the takeoff prior to rotation, call "ABORT, ABORT, ABORT" and then say the reason for the abort" (Tab BB-21). "**After rotate, do not call**

abort, but concisely describe any abnormalities" (Tab BB-21). Additionally, these standards direct, "Call "ROTATE" at briefed airspeed and "LIFTOFF" with two positive rates of climb" (Tab BB-21).

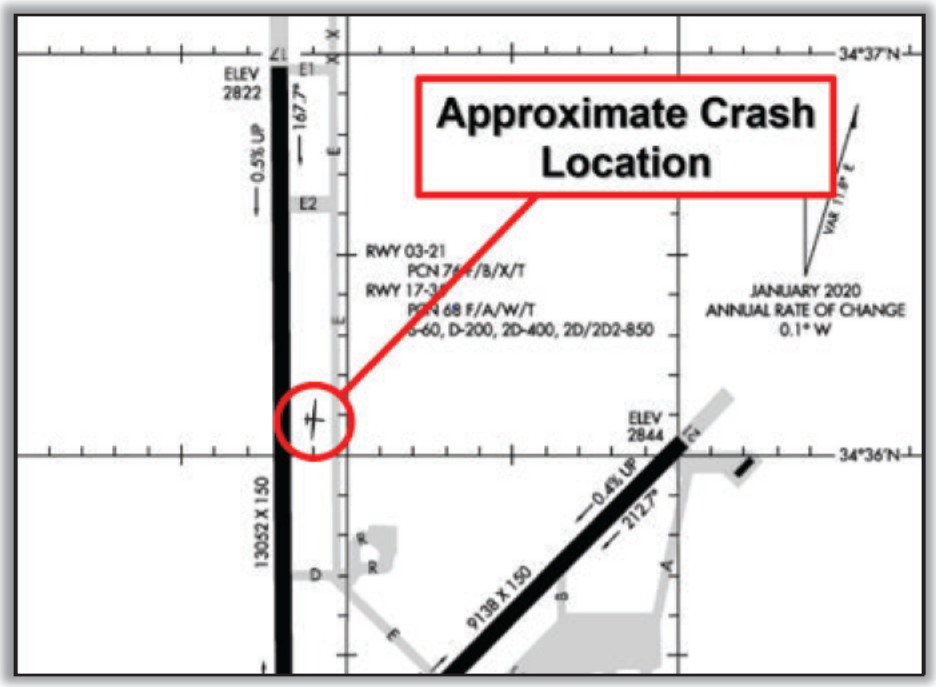
At 10:17:24 PST, when the MA was at 61 KIAS, the words *AILERON TIP STALL OVERRIDE* began flashing on the HUD because the AOA gauge indicated an AOA of 6.3 degrees (Tab H-26). Immediately following the *AILERON TIP STALL OVERRIDE* caution, at 8.0 AOA, the word *WARN* appeared in the HUD and an audible warning tone sounded in the GCS (Tab H-26). At 10:17:28 PST, when the MA is at 83 KIAS, the MSO called, "ABORT, ABORT, ABORT" because of the *AILERON TIP STALL OVERRIDE* caution (Tab H-26, V-2.10). At 91 KIAS and an AOA indication of 7.8 degrees, the MP acknowledged and applied standardized takeoff abort procedures in accordance with the emergency procedures checklist, while verbalizing, "Throttle full reverse, brakes applied" (Tabs H-26, N-5, and BB-9).

Technical Order 1Q-9(M)A-1 specifically states, "Transition to ABORT state is not allowed once the aircraft exceeds rotation speed or the commit point, whichever comes first" (Tab BB-5). At this point, the MA accelerated to 93 KIAS and was airborne (Tab FF-6, Tab EE-4). At 10:17:35 PST, once the MP recognized the MA was airborne, the MP directed the MSO to, "Kill the GDT (Ground Data Terminal)" (Tabs H-26, V-1.10). The maximum altitude and airspeed the MA achieved was 18 feet AGL and 72 KIAS (Tabs H-26). During the time it took the MSO to stand up and activate the GDT "KILL" switch, the MA descended and slowed to 67 KIAS (Tab EE-4). The MSO activated the GDT "KILL" switch at 10:17:39 PST severing all remote-control ability with the MA and causing all displays in the mishap ground control station (MGCS) to go black (Tabs H-26, V-2.11). The MA was at 2 feet AGL and 67 KIAS when the remote-control communication was fully severed (Tabs H-26, EE-4).

e. Impact

The MA impacted SCLA Runway 17, on the prepared runway surface, 4-5 feet left of centerline with the nose of the MA canted 1 degree to the right (Tabs EE-4, FF-6). All three of the landing gear impacted the runway nearly simultaneously (Tab EE-4). As the MA careened into the dirt surface surrounding the runway, all three landing gears collapsed causing catastrophic damage to the aircraft's radome, lower data link antenna, MTS, and the engine (Tab EE-4). The MA came to a complete stop approximately 6000 feet down Runway 17, approximately 140 feet from the runway on the infield to the left, facing eastward (Tab Z-1).

Southern California Logistics Airfield Diagram – Approximate Crash Location (Tab Z-1)



f. Egress and Aircrew Flight Equipment (AFE)

Not applicable.

g. Search and Rescue (SAR)

Not applicable.

h. Recovery of Remains

Not applicable.

5. MAINTENANCE

a. Forms Documentation

A review of the maintenance records for the MA leading up to the mishap revealed no relevant discrepancies (Tabs D-3 to D-306). The MA was in storage for an extended period of time (last flown 25 October 2019) prior to the mishap (Tabs D-9, D-11, and H-4).

b. Inspections

All MA maintenance inspections were current and complied with all relevant authorities (Tabs

D-3 to D-306). No evidence indicates the MA maintenance inspections were a factor in this mishap.

c. Maintenance Procedures

i3 maintenance personnel conducted all maintenance procedures in accordance with applicable Technical Orders (TOs) and guidance (Tabs D-3 to D-306). No evidence indicates that the maintenance procedures executed were a factor in this mishap.

d. Maintenance Personnel and Supervision

No evidence indicates that the training, qualifications, and supervision of the maintenance personnel were a factor in this mishap (Tabs T-1 to T-48).

e. Fuel, Hydraulic, Oil, and Oxygen Inspection Analyses

No evidence indicates that the fuel, hydraulic, oil, and oxygen were factors in this mishap (Tabs D-3 to D-306).

f. Unscheduled Maintenance

A review of the maintenance records for the MA leading up to the mishap revealed no relevant discrepancies (Tabs D-3 to D-306).

6. AIRFRAME, MISSILE, OR SPACE VEHICLE SYSTEMS

a. Structures and Systems

On 02 February 2023, the aircraft was inspected and photographed at the mishap site within the SCLA by US Air Force Safety investigators and General Atomics-Aeronautical Systems, Incorporated (GA-ASI) engineers (Tab H-5). The inspection indicated that the landing gear had collapsed, and the aft part of the aircraft had burned near the engine and diagonal tails (Tab H-5). The propeller and part of the gearbox had separated from the aircraft (Tab H-5). The MA MTS had also separated from the aircraft (Tab H-5). The alpha/beta probe, W132 cable, and Redundancy Control Module (RCM) were removed from the aircraft for further inspection and testing at GA-ASI (Tab H-5). There was no obvious damage to the removed hardware (Tab H-5).

b. Evaluation and Analysis

The MA flew over 4,255 hours and over 522 flights before the mishap on 18 January 2023 (Tab D-19). Prior to the mishap, the aircraft last flew on 25 October 2019 (Tab H-4) and the AOA sensor was last calibrated in September 2022 (Tab H-4).

Mishap maintenance hardware inspections and testing revealed the alpha/beta probe, W132 cable, and RCM which computes the AOA display, were returned to GA-ASI following the mishap inspection at SCLA on 02 February 2023 (Tab H-5). Visual inspection at GA-ASI did not reveal any obvious damage (Tab H-5). Upon closer inspection of the alpha/beta probe, the shaft leaving the potentiometer that holds the alpha vane was found to be marginally bent (Tab H-5). The

following testing was performed on the alpha/beta probe at the Engineering Field Support (EFS) Hot Mock-Up (HMU) area (no further testing was performed on the W132 cable or RCM) (Tab H-5).

During AOA sensor operational checks an inclinometer was installed onto the alpha vane, the vane was positioned at different angles, and the inclinometer readings were compared to the indicated AOA readings presented on the HUD (Tab H-5).

Hardware inspections and testing revealed the mishap alpha/beta probe produced AOA values above the acceptable range during operational checks at GA-ASI (Tab H-9). The erroneously high AOA indications caused the high AOA warnings and aileron tip stall activation (Tab H-4).

The marginal bend in the pot shaft is not likely to have contributed to the offset AOA indications, and it is not clear whether the bend was present prior to the mishap (Tab H-9). No evidence was found of wear in the pot resistive element (Tab H-6). The cleats holding the pot in place were secure (Tab H-6).

The MA indicated high during the AOA post engine start, preflight checks between the crew chief and MP (Tab H-4). The MP called out "negative, positive, neutral" as the crew chief moved the AOA (Tab H-4). The MA AOA display indicated between 6.5 and 7.0 degrees on the HUD during the neutral check and was not acknowledged verbally by any aircrew member (Tab H-4). The preflight checklist in TO 1Q-9(M)A-1 states, "Neutral position will normally be -1 AOA (+/- 2)" (Tab BB-7).

Evidence indicates the MA alpha/beta probes were installed correctly but displayed erroneous readings (Tabs D-116, D-193, H-4, H-27, H-28).

7. WEATHER

a. Forecast Weather

The forecasted weather provided to the MA by weather personnel (Tabs F-1 to F-2)

- Winds: 230 at 8 knots, no gust
- Visibility: Clear
- Significant Weather: None

b. Observed Weather

Weather observed at the initiation of the mishap sequence (Tabs F-1 to F-2)

- Winds: 150 at 4 knots, no gust
- Visibility: Clear
- Significant Weather: None
- Outside Air Temperature: 4 degrees Celsius

c. Space Environment

Not applicable.

d. Operations

No evidence indicates the MA operated outside of prescribed operational weather limits (Tabs F-1 to F-2).

8. CREW QUALIFICATIONS

a. Mishap Pilot (MP)

MP was current and qualified to instruct and conduct launch and recovery duties in the MQ-9A at the time of the mishap (Tabs G-27 to G-48). MP had 1217.1 hours of MQ-9A flight time and 330 hours of MQ-9A simulator time around the time of the mishap (Tab G-3). The total instructor, flight time, and simulator flying hours/sorties for the previous 30, 60, and 90 days are set forth below (Tab G-4):

	Flight Hours	Flight Sorties
Last 30 Days	4.6	6
Last 60 Days	25.8	16
Last 90 Days	41	22

b. Mishap Sensor Operator (MSO)

MSO was current and qualified to instruct and conduct launch and recovery duties in the MQ-9A at the time of the mishap (Tabs G-9 to G-26). MSO had 896.4 hours of MQ-9A flight time and 540.2 hours of MQ-9A simulator time around the time of the mishap (Tab G-1). The total instructor, flight time, and simulator flying hours/sorties for the previous 30, 60, and 90 days are set forth below (Tab G-2):

	Flight Hours	Flight Sorties
Last 30 Days	.9	1
Last 60 Days	14.9	7
Last 90 Days	19.1	11

9. MEDICAL

a. Qualifications

All crew members were medically qualified for their specific duties at the time of the mishap (Tab EE-2).

b. Health

No evidence indicates that crew members' health contributed to the mishap (Tab EE-2).

c. Pathology

Toxicology test samples were collected from members after the mishap (Tab EE-2). The reports indicate that toxicology was not a factor in the mishap (Tab EE-2).

d. Lifestyle

No evidence indicates that lifestyle was a factor in the mishap (Tab EE-2).

e. Crew Rest and Crew Duty Time

At the time of the mishap, AFMAN 11-202, Volume (V) 3, *Flight Operations*, 10 January 2022, required aircrew members have proper crew rest prior to performing any duties involving aircraft operations (Tab DD-4). This rule applies to civilian operators of military aircraft (Tab DD-3). Paragraph 3.1 of the applicable version of AFMAN 11-202 V3 defined crew rest periods as a minimum 12-hour non-duty period before the flight duty period begins (Tab DD-4). Crew rest is defined as "free time and includes time for meals, transportation, and an opportunity for at least 8 hours of uninterrupted sleep" (Tab DD-4). The mishap crew verified they received adequate crew rest before the mishap on the required Operational Risk Management form (Tab T-59).

10. OPERATIONS AND SUPERVISION

a. Operations

When the mishap aircrew's aircraft experienced stall conditions and impacted the runway, the crew was less than one minute into their planned no more than 30-minute sortie (Tabs H-3, V-1.5, and V-4.5). No evidence indicates that the mishap crew's operations tempo contributed to the mishap (Tab V-1.11).

b. Supervision

No evidence indicates that operations supervision contributed to the mishap.

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-24). Three human factors were identified as relevant to this mishap.

b. Relevant Factors Identified by AIB

(1) Procedure or Checklist Not Followed Correctly (AE102) is when the mishap individual did not follow correct procedure which resulted in the near-miss or mishap (Tab BB-29). Examples include "failed to execute proper sequence, learned maneuver or proper emergency procedures; failed to follow a published checklist, Technical Manual (TM), or Standard Operating Procedure

(SOP) to perform an inspection or maintenance of aircraft/vehicle/vessel/equipment, etc." (Tab BB-29).

(2) Breakdown of Visual Scan (AE105) is a factor when the mishap individual fails to effectively execute visual scan patterns (Tab BB-29).

(3) Inadequate Real-Time Risk Assessment/Action (AE201) 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 (Tab BB-30).

12. GOVERNING DIRECTIVES AND PUBLICATIONS

a. Publicly Available Directives and Publications Relevant to the Mishap

(1) Human Factors Analysis and Classification System, Version 8.0, available at https://www.safety.af.mil/Divisions/Human-Performance-Division/HFACS/.

(2) AFI 51-307, *Aerospace and Ground Accident Investigations*, 18 March 2019, available at https://www.e-publishing.af.mil.

(3) AFI 51-307, Air Combat Command Supplement, *Aerospace and Ground Accident Investigations*, 3 December 2019, available at https://www.e-publishing.af.mil.

(4) Department of the Air Force Instruction (DAFI) 91-204, *Safety Investigations and Reports*, 10 March 2021, available at https://www.e-publishing.af.mil.

(5) AFMAN 11-2MQ-9 V1, *MQ-9-Aircrew Training*, 12 January 2023, available at https://www.e-publishing.af.mil.

(6) AFMAN 11-2MQ-9 V3, *MQ-9-Operations Procedure*s, 12 January 2023, available at https://www.e-publishing.af.mil.

(7) AFMAN 11-202 V3, *Flight Operations*, 10 January 2022, available at https://www.e- publishing.af.mil.

(8) AFMAN 11-2FT V3, *Flight Test Operations Procedures*, 29 December 2020, available at https://www.e-publishing.af.mil.

b. Other Directives and Publications Relevant to the Mishap

(1) i3 SkyRange KVCV *Standards*, 2 June 2022

(2) TO lQ-9(M)A-1, *Flight Manual*, 31 October 2022

(3) TO 1Q-9(M)A-1-1, *Flight Manual*, 11 July 2022

c. Known or Suspected Deviations from Directives or Publications

(1) TO 1Q-9(M)A-1, *Flight Manual*, 31 October 2022, paragraph 26, 1.18.11.5

(2) TO 1Q-9(M)A-1-1*, Flight Manual*, 11 July 2022, paragraph A3.6

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29 February 2024

DAVID I. STAMPS, Colonel, USAF
President, Accident Investigation Board

STATEMENT OF OPINION

MQ-9A, T/N 11-4123
SOUTHERN CALIFORNIA LOGISTICS AIRPORT
VICTORVILLE, CALIFORNIA
18 JANUARY 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

On the morning of 18 January 2023 at approximately 10:17 Pacific Standard Time (PST), a MQ-9A Reaper, the Mishap Aircraft (MA), belonging to the 432nd Wing, Creech Air Force Base, Nevada and on-loan to the contract firm Integration Innovation, Incorporated (i3), impacted Runway 17 at Southern California Logistics Airport (SCLA), Victorville, California. The MA radome (front of the aircraft nose section housing multiple sensors), lower data-link antenna, Multi-Spectral, Targeting System (MTS), all three-landing gear, and engine were destroyed when the MA veered off the runway and crashed on the dirt infield of SCLA. The MA was being operated by a Launch and Recovery Element (LRE) from i3 comprised of the Mishap Pilot (MP) and the Mishap Sensor Operator (MSO). Additionally, a Mishap Safety Observer Instructor Pilot (MSOIP) and Mishap Safety Observer Sensor Operator (MSOSO) were present within the Ground Control Station (GCS). Both mishap safety observers are employed by i3. The mishap resulted in no reported damage to civilian property, no injuries, and no fatalities. The loss of government property is valued at $16,111,000.00.

During pre-flight ground operations, while performing the Angle of Attack (AOA) safety checks with the MA crew chief, the MP failed to recognize the MA AOA was out of Technical Order (TO) limits. If this error was recognized during ground operations, the MP and MA crew chief could have taken immediate action to correct the error. During the initial engine run-up during the first stages of takeoff, the MP confirmed all instrument indications were good. The calculated aircraft rotation speed for this flight was 78 Knots Indicated Airspeed (KIAS). No verbal crew acknowledgment of the rotation speed was heard during the takeoff sequence once the MA achieved 78 KIAS.

Between 82-83 KIAS, the MSO verbalized “ABORT!” The MP acknowledged the “ABORT” call and executed takeoff abort procedures at 91 KIAS. Both the MP and MSO recognized the MA was airborne at 92 KIAS. The MA climbed to an altitude of 18 feet above ground level (AGL). The MP subsequently directed the MSO to “Kill the GDT (Ground Data Terminal).” The MSO toggled the GDT kill switch while the aircraft was stalled (67 KIAS, 2 feet AGL over the centerline of the runway). The MA subsequently lost all remote-control connectivity with the GCS as it impacted the runway and drove off the paved runway surface. Upon the MA driving off the paved runway surface, the MA’s radome, lower data-link antenna, MTS, all three-landing gear, and engine were

destroyed.

2. CAUSE

As the Accident Investigation Board President, I found, by a preponderance of the evidence, that the cause of the mishap was the MP's decision to "Kill the Ground Data Terminal" causing all remote-control connectivity to the MA to be lost, while the MA was 2 feet above ground level (AGL) and 67 KIAS. The MA impacted the ground leaving the MP with no capability to maintain aircraft control. The lack of MP control, coupled with the MA executing a hard landing because it stalled out of the sky, caused the MA to veer left off the paved runway surface into a dirt infield. As the MA drove into the dirt infield, all three of its landing gear collapsed destroying the MA's radome (front of the aircraft nose section housing multiple sensors), lower data-link antenna, Multi-Spectral, Targeting System (MTS), all three-landing gear, and engine. The AIB's simulation of the mishap confirmed although the MA stalled and impacted the runway hard, not cutting the GDT allowed us to maintain aircraft control to a full-stop on the runway.

3. SUBSTANTIALLY CONTRIBUTING FACTORS

Further, I find, by a preponderance of the evidence, that the following three factors substantially contributed to the mishap: (1) The MP failing to recognize the AOA checks being out of TO limits during ground operations. (2) The MSO's failure to verbalize rotation airspeed. (3) The MSO's failure to recognize the aircraft was beyond rotation airspeed during the "ABORT" command.

First, during standard operation ground safety and systems checks between the MP and the MA crew chief, the AOA verification was out of limits and went unnoticed by the MP (as admitted in the MP sworn testimony). The cockpit AOA gauge indication during the MP's "neutral" call hovered between 6.5-7 degrees. Again, this was unnoticed by the MP. TO 1Q-9(M)A-1 state *AV PREFLIGHT* procedures for AOA checks are: "Pilot verifies the crew chief sets the AOA sensor to a negative value, a positive value, and neutral value, in any order. The AOA sensor position should not exceed +/-90 degrees. Neutral position will normally be -1 AOA (+/-2)." During the entirety of ground operations through the initial stages of takeoff, the MA's AOA indications exceeded 5 degrees. Consequently, during takeoff, visual and audible warnings for high indicated AOA led the MSO to call for the ABORT and the MP to abort the takeoff.

Second, the MSO failed to verbalize, "ROTATE", once the MA achieved its pre-briefed airspeed of 78 KIAS. The *i3 SkyRange KVCV Standards*, dated 2 June 2022, Section B titled *LAUNCH*, subsection 6 titled *TAKEOFF*, sub bullet B titled *SENSOR OPERATOR RESPONSIBILITIES* states, "To abort the takeoff prior to rotation, call "ABORT, ABORT, ABORT" and then say the reason for the abort. **After rotate, do not call abort**, but concisely describe any abnormalities." Additionally, these standards direct, "Call "ROTATE" at briefed airspeed and "LIFTOFF" with two positive rates of climb." During this board's interviews with both the MSO and MSO Safety Observer, both verified a "ROTATE" call by sensor operators is MQ-9 community-wide standard procedure.

Finally, the MSO's failure to recognize the aircraft was beyond rotation airspeed during the "ABORT" command was a substantially contributing factor. As stated in the previous paragraph, the *i3 SkyRange KVCV Standards* explicitly states, "After rotate, do not call abort, but concisely describe any abnormalities." Additionally, TO 1Q-9(M)A-1, page 1-158, paragraph 1.18.11.5 states, "Transition to ABORT state is not allowed once the aircraft exceeds rotation speed or the commit point, whichever comes first." The late "ABORT" command contributed to the MA being induced into a stall condition.

4. CONCLUSION

Aircraft data logs, witness testimony, technical reports, and operational and maintenance practices prove, by a preponderance of evidence, the cause of the mishap was the MP incorrectly executed takeoff abort procedures above rotation airspeed. The MP failed to recognize the MA was airborne and proceeded to pull the throttles to full reverse, causing the MA to rapidly decelerate and rapidly descend back towards the runway. These actions resulted in an unpowered climb, stall, and descent to hard return to the runway. Once the MP recognized the MA was airborne, the MP directed, "Kill the Ground Data Terminal" causing lost remote-control connectivity with the MA. Further, I find, by a preponderance of the evidence that the following three factors substantially contributed to the mishap: (1) The MP failing to recognize the AOA checks being out of TO specified limits during ground operations, (2) the MSO's failure to verbalize "ROTATE" at rotation airspeed, and (3) the MSO's failure to recognize the aircraft was beyond rotation airspeed at the time of the "ABORT" command.

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29 February 2024

DAVID I. STAMPS, Colonel, USAF
President, Accident Investigation Board

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