UNITED STATES AIR FORCE
AIRCRAFT ACCIDENT INVESTIGATION
BOARD REPORT

F-16CM, T/N 89-2142

138TH FIGHTER WING, DETACHMENT 1
138TH FIGHTER WING
OKLAHOMA AIR NATIONAL GUARD

LOCATION: BEAUREGARD PARISH, LOUISIANA

DATE OF ACCIDENT: 23 MARCH 2022

BOARD PRESIDENT: COLONEL KEVIN M. LORD

Conducted in accordance with 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

AUG 29 2022

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 23 March 2022 mishap in Beauregard Parish, Louisiana, involving an F-16, T/N 89-2142, operated by the 138th Fighter Wing, complies with applicable regulatory and statutory guidance, and on that basis it is approved.

RUSSELL L. MACK
Lieutenant General, USAF
Deputy Commander

EXECUTIVE SUMMARY
UNITED STATES AIR FORCE
AIRCRAFT ACCIDENT INVESTIGATION

F-16CM, T/N 89-2142
BEAUREGARD PARISH, LOUISIANA
23 MARCH 2022

On 23 March 2022, at approximately 10:58 a.m. Central Standard Time, a block 42 F-16CM, tail number (T/N) 89-2142, assigned to the 138th Fighter Wing (FW), 125th Fighter Squadron, Air National Guard, Tulsa Air National Guard Base, Oklahoma, with duties at 138 FW, Detachment 1, Ellington Field Joint Reserve Base, Houston, Texas, crashed after performing an intercept against a general aviation (GA) aircraft. There were no fatalities; the mishap pilot (MP), assigned to 138 FW, ejected safely before impact, sustaining minor injuries. The mishap aircraft (MA) was destroyed upon impact, with total loss valued at $26,950,985.00. The aircraft impacted the ground in a desolate area on private land, causing superficial landscape damage.

The mishap flight's (MF) mission was to practice an Aerospace Control Alert (ACA) launch of two F-16s, out of Ellington Field, as part of a North American Aerospace Defense Command (NORAD) mission. The MP was number two of a two-ship formation flight. Following an ACA launch, the MF conducted continuation training within their designated training airspace, the Warrior Military Operating Area (MOA), located near Beauregard Parish, Louisiana. The MF planned to practice intercepts and air-to-air refueling. The first intercept exercise was uneventful, with the Mishap Flight Lead (MFL) acting as a training aid for the MP to practice ACA intercept procedures. After this exercise, the MP discovered a general aviation (GA) aircraft below the MOA, flying at 1,700 feet mean sea level (MSL). The MFL directed the formation to intercept the GA aircraft, with a training objective of accomplishing a low/slow Visual Identification (VID) intercept. During this unplanned and uncoordinated intercept, the MP failed to maintain positive aircraft control in a low airspeed state. The MP incorrectly assessed that the aircraft had departed controlled flight below uncontrolled ejection minimums, resulting in the MP ejecting.

The Accident Investigation Board (AIB) President found, by a preponderance of the evidence, the cause of the mishap was MP's ejection from the MA, following his incorrect assessment that the MA had departed controlled flight. The MP inadvertently placed the Digital Backup (DBU) switch to BACKUP, resulting in an incorrect assessment that the aircraft had departed controlled flight and a misperceived inability to recover the MA before initiating ejection. Also, by a preponderance of the evidence, the Board President found two substantially contributing factors to the mishap, 1) lack of flight leadership and 2) lack of flight discipline, in MFL and MP's violation of various training rules, including intercepting a non-participating GA aircraft, and incorrectly handling the F-16 in a low speed and low altitude environment.

SUMMARY OF FACTS AND STATEMENT OF OPINION
F-16CM, T/N 89-2142
BEAUREGARD PARISH, LOUISIANA
23 MARCH 2022

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ACRONYMS AND ABBREVIATIONS

138 FW	138th Fighter Wing
147 AW	147th Attack Wing
A/A TACAN	Air-to-Air Tactical Air Navigation System
ACA	Aerospace Control Alert
ACC	Air Combat Command
ACES	Advanced Concept Ejections Seat
AFB	Air Force Base
AFE	Aircrew Flight Equipment
AFI	Air Force Instruction
AFMAN	Air Force Manual
AFPET	Air Force Petroleum Office
AFSEC	Air Force Safety Center
AFTO	Air Force Technical Order
AFTTP	Air Force Tactic, Techniques, Procedures
AGL	Above Ground Level
AIB	Accident Investigation Board
AMIS	Automated Maintenance Information Systems
AIM	Air Intercept Missile
AGCAS	Automatic Ground Collision Avoidance System
ANG	Air National Gaurd
ANGB	Air National Guard Base
ARMS	Aviation Resource Management System
ATAGS	Advanced Tactical Anti-G System
BPO	Basic Postflight
CAP	Civil Air Patrol
CAT	Category
Capt	Captain
CDU	Center Display Unit
CL	Checklist
CSFDR	Crash Survivable Flight Data Recorder
CSMU	Crash Survivable Memory Unit
DBU	Digital Backup
DFLCC	Digital Flight Control Computer
DFLCS	Digital Flight Control System
DTC	Data Transfer Cartridge
DoD	Department of Defense
DVR	Digital Video Recorder
EADS	Eastern Air Defense Sector
ELT	Emergency Locator Transmitter
FDR	Flight Data Recorder
FL	Flight Lead
FLCS	Flight Control System
FP	Flight Profile
FPM	Flight Path Marker
FS	Fighter Squadron
FW	Fighter Wing
ft	Feet
GA	General Aviation
HFAC	Human Factors Analysis and Classification System
HUD	Head-Up Display
IAW	In Accordance With
IFF	Identification Friend or Foe
IMDS	Integrated Maintenance Data System
INS	Inertial Navigation System
IP	Instructor Pilot
JAP	Junior Alert Pilot
JOAP	Joint Oil Analysis Program
K	Thousand
KCAS	Knots Calibrated Air Speed
kts	Knots
L	Local Time
M	Mach
MA	Mishap Aircraft
MAJCOM	Major Command
MF	Mishap Flight
MFL	Maintenance Fault List
MFL	Mishap Flight Lead
MGRS	Military Grid Reference System
MOA	Military Operating Area
MRI	Magnetic Resonance Imagery
MP	Mishap Pilot
MSL	Mean Sea Level
NM	Nautical Miles
NORAD	North American Aerospace Defense Command
NOTAMs	Notices to Airmen
ONE	Operation Noble Eagle
ORM	Operational Risk Management
P&W	Pratt and Whitney

PARS	Pilot Activated Recovery System
POI	Point of Interest
PFD	Primary Flight Display
PH	Phase
PHA	Physical Health Assessment
PR	Pre-Flight
PSI	Pounds Per Square Inch
QA	Quality Assurance
RAP	Ready Aircrew Program
RegAF	Regular Air Force
RTB	Return-To-Base
RNAV	Area Navigation
SAP	Senior Alert Pilot
SAR	Search and Rescue
SDR	Seat Data Recorder
SAU	Signal Actuation Unit
SME	Subject Matter Expert
SPO	System Program Office
SOF	Supervisor of Flying
SS	System Status
T/N	Tail Number
TCTO	Time Compliance Technical Order
TDY	Temporary Duty
TIAP	Tulsa International Airport
TO	Technical Order
TOD	Technical Order Data
TOI	Track Of Interest
VID	Visual Identification
VVI	Vertical Velocity Indication
WAI	Walk Around Inspection
WOC	Warrior Operations Center
WOW	Weight on Wheels
Z	Zulu

SUMMARY OF FACTS

1. AUTHORITY AND PURPOSE

a. Authority

On 16 May 2022, the Deputy Commander, Air Combat Command (ACC), appointed Colonel Kevin M. Lord to conduct an aircraft investigation of the 23 March 2022 crash of an F-16CM, tail number (T/N) 89-2142, assigned to the 138th Fighter Wing (FW), Oklahoma (OK), Air National Guard (ANG) (Tab Y-2 to Y-3). The investigation was conducted by an accident investigation board (AIB) pursuant to Air Force Instruction (AFI) 51-307, *Aerospace and Ground Accident Investigations* (Tab Y-2 to Y-3). The investigation was conducted at Ellington Field, Texas (TX), from 3 June 2022 to 27 June 2022, with visits to the mishap site in Beauregard Parrish, Louisiana (LA) and the mishap unit in Tulsa, OK (Tab Y-2 to Y-3). A legal advisor (Captain), recorder (Technical Sergeant), maintenance member (Master Sergeant, ANG) and pilot member (Lieutenant Colonel, ANG) were detailed as board members (Tab Y-2 to Y-5). A Medical Subject Matter Expert (SME) (Colonel) was also appointed to advise the AIB (Tab Y-5).

b. Purpose

In accordance with (IAW) AFI 51-307, this AIB conducted a legal investigation to inquire into all 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-2 to Y).

2. ACCIDENT SUMMARY

On 23 March 2022, at approximately 10:30 a.m. Central Standard Time, Tulsa ANG block 42 F-16CM, T/N 89-2142, was performing a day time Airspace Control Alert (ACA) training mission from Ellington Field (Tabs AA-2, J-71 to J-72, and K-2). The mishap flight (MF) was performing a low altitude and slow speed (low/slow) intercept against a general aviation (GA) aircraft (Tab V-2.27 to V-2.28). A low/slow intercept is training accomplished below 5,000 feet above ground level (AGL) and at speeds slower than 250 knots with the objective to visually inspect an intercepted aircraft (Tab AA-8). The Mishap Pilot (MP) assessed that the aircraft had departed controlled flight below uncontrolled ejection minimums, resulting in the MP ejecting (Tab V-1.13 and V-1.38 to V-1.39). The mishap aircraft (MA) impacted the ground near Beauregard Parrish, LA (Tabs H-29 and S-2). As a single-seat aircraft, only the MP was onboard the MA at the time of the incident (Tab CC-25). The MP successfully ejected from the MA prior to the crash (Tabs R-39 and V-1.39). The MA, valued at $26,950,985.00, was destroyed on impact (Tab P-2 to P-3).

3. BACKGROUND

a. North American Aerospace Defense Command (NORAD)

The NORAD and United States Northern Command (USNORTHCOM) are separate commands (Tab CC-3). NORAD conducts aerospace warning, aerospace control, and maritime warning in the defense of North America (Tab CC-7).

b. Air National Guard (ANG)

The ANG's federal mission is to maintain well-trained, well-equipped units available for prompt mobilization during war and provide assistance during national emergencies, to include natural disasters or civil disturbances (Tab CC-22). During peacetime, the combat-ready units and support units are assigned to most Air Force major commands to carry out missions compatible with training, mobilization readiness, humanitarian and contingency operations, such as Operation Enduring Freedom in Afghanistan (Tab CC-22).

c. Air Combat Command (ACC)

ACC is one of ten major commands in the United States Air Force, headquartered at Joint Base Langley-Eustis, Virginia (Tab CC-18). 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 the combat support that assures mission success to America's warfighting commands (Tab CC-18). The Command operates more than 1,000 aircraft, 27 wings, 1,122 units and has more than 201 operating locations, with 157,549 total force active-duty and civilian personnel (Tabs CC-18 to CC-19).

d. Wing 138th Fighter Wing (138 FW)

The 138th Fighter Wing (FW), located at the Tulsa ANG in Tulsa, OK, is America's premier FW supporting the Nation, the State of OK, and local communities, while defending Freedom with lethal, agile Combat Air Power (Tab CC-23). The 138 FW is comprised of more than 1,200 Personnel, over 20 aircraft, and is the second largest F-16 ANG FW (Tab CC-23).

e. 138th Fighter Wing Detachment 1 (138 FW Det-1)

The 138 FW Det-1's Aerospace Control Alert (ACA) is a 24/7 mission located at Ellington Field, Houston, TX (Tab CC-23). The Tulsa ACA mission began in 2008, with a mission to defend the Gulf Region of the United States, from New Orleans, LA, to Tucson, Arizona, with armed aircraft ready at a moment's notice (Tab CC-23). Pilots train for the ACA mission at the 138 FW, Tulsa Air National Guard Base (Tab CC-23).

f. Aircraft F-16CM

The F-16 Fighting Falcon is a multi-role fighter aircraft (Tab CC-25). The aircraft is highly maneuverable and has proven itself in air-to-air combat and air-to-surface attack (Tab CC-24 to CC-25). In addition to flying in every major United States mission, including ALLIED FORCE, IRAQI FREEDOM, ENDURING FREEDOM, UNIFIED PROTECTOR, INHERENT RESOLVE, and FREEDOM SENTINEL, the F-16 has been the backbone of United States air defense, through OPERATION NOBLE EAGLE (ONE) (Tab CC-25).

4. SEQUENCE OF EVENTS

a. Mission

On 23 March 2022, the MF was scheduled for a routine training mission, comprised of two F-16CM aircraft (Tab K-2 to K-3). The MF was planned, briefed, and flown as an ACA training mission, with air-to-air refueling taking place within the Warrior MOA (Tab V-2.10). The MP, radio call sign Shield 52, was mission wingman, or Junior Alert Pilot (JAP), flying the MA, T/N 89-2142 (Tabs K-2 and V-8.9). Shield 51 was the radio call sign for the MFL, or Senior Alert Pilot (SAP) (Tabs K-2 and V-8.49). The planned mission objectives included standard ground operations, taxi, and departure to the training airspace (Tab V-1.28 and V-2.22). The planned training events were low/slow intercepts, with Shield 51 simulating a defecting foreign military aircraft, and an air-to-air refueling training (Tab V-2.10 and V-2.26).

The scheduled mission for 23 March 2022 was authorized on an Aviation Resource Management System fighter authorization form (Tab K-2).

Figure 1: MF Operating Area (Tab K-10)

b. Planning

The MP began a 7-day alert tour on Monday, 21 March 2022 (Tab V-1.7). He accomplished an alert changeover brief with the previous alert crew, as well as a SAP and JAP general flight briefing (Tab V-1.11 and V-2.10). Following this, the MP began sitting alert as the JAP, scheduled for the remainder of the week (Tab V-1.10 to V-1.11). The MP did not fly on Tuesday, 22 March 2022 (Tabs T-6 and V-1.7). On 23 March 2022, at 09:00 a.m., the MP and MFL conducted a flight briefing for the ACA practice scramble scheduled for that morning (Tab V-1.12). The flight brief covered standard flight administration, known as motherhood, and all applicable AFI 11-214 training rules (Tab V-1.12 and V-2.9 to V-2.10).

c. Preflight

The MF then received a pre-flight (PR) briefing that included an update to weather, Notices to Airmen (NOTAMs), and the airfield status (Tab V-2.9). In accordance with ACA squadron standards, the MFL and MP completed power-on checks, following the changeover brief, to prepare the aircraft for the MF (Tabs V-1.13 and BB-11). The aircraft was in a standard configuration for an ACA alert mission (Tabs K-14, V-2.15 and V-8.28 to V-8.29). The MF started on time IAW the flight brief, and completed all normal ACA ground procedures, without incident (Tab V-1.28 and V-2.22).

d. Summary of Accident

Ground operations included an uneventful start, taxi, and takeoff (Tab V-1.28 and V-2.22). The MF launched IAW with their planned practice alert launch on Runway 17R at Ellington Field (Tab AA-3). The MF was airborne at 10:23 a.m., with no known issues (Tab AA-3). Approximately two minutes after takeoff, local air traffic controllers cleared the MF to fly on a heading of 050 degrees to the Warrior MOA (Tab AA-3). At 10:35 a.m., the MF received clearance to enter the Warrior MOA (Tab AA-3). The tactical portion of the mission involved practicing low/slow intercept training and air-to-air refueling with a Birmingham KC-135 aerial refueling tanker, call sign Dixie (Tab V-2.10 and V-2.46).

The first training event started at 10:43 a.m., with the MP and MFL splitting the MF formation and establishing approximately 30 nautical miles (NM) in range for a practice intercept of a simulated defecting foreign military aircraft (Tabs V-2.26 and AA-3). The MP executed the single-ship intercept of the MFL, while practicing alert intercept radio procedures (Tab V-1.31, V-2.26 and V-8.38). The visual intercept resulted in the MP verbalizing the MFL's aircraft configuration, followed by a terminate call from the MFL (Tab V-1.31 and V-2.26).

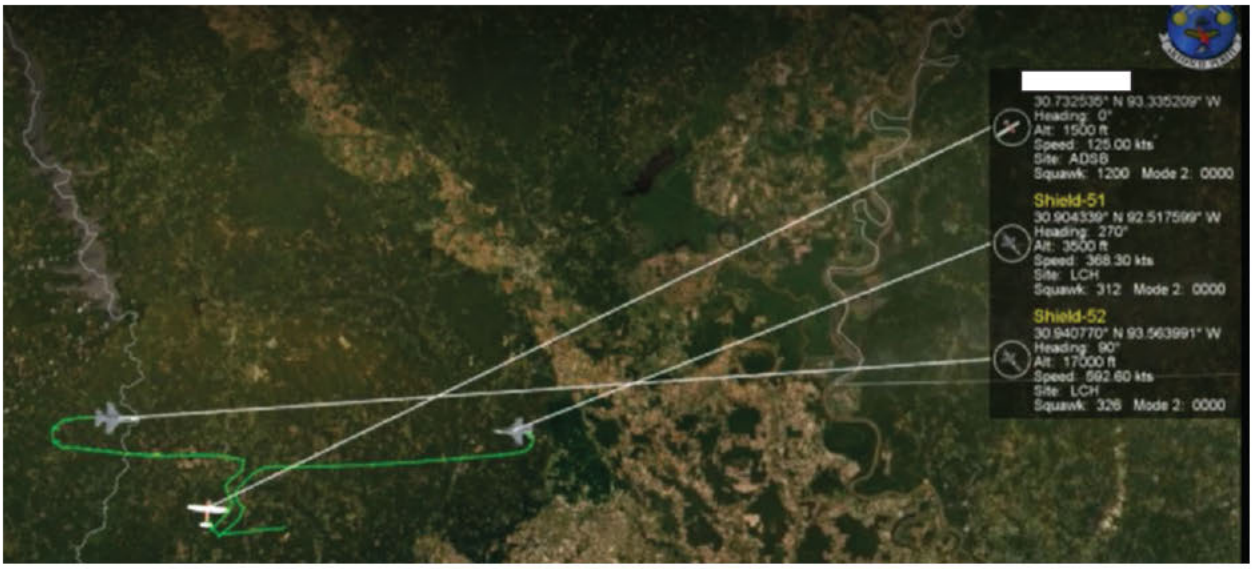

Figure 2: MF Training Intercept and GA location (Tab AA-3)

Following the first training intercept, the MP, Shield 52, located a civilian GA aircraft underneath the Warrior MOA with his onboard radar, flying at an altitude of 1,700 feet (Tabs K-2, V-1.32 and V-2.26 to V-2.27). The MFL directed the formation to proceed with an unplanned, low/slow visual intercept of the non-participating GA aircraft (Tabs R-24 to R-25, V-1.32, V-2.10 and V-2.27 to V-2.28). An intercept of a GA aircraft was not pre-briefed or pre-coordinated by the MF for this training mission (Tabs R-24 to R-25, V-2.10 and V-2.27 to V-2.28). The MFL did not contact the GA aircraft over the radio or coordinate the intercept with their air traffic controlling agency, Fort Polk Control (Tabs N-4 to N-5, V-1.32, V-2.27, V-8.17 to V-8.19 and AA-3 to AA-4). Fort Polk Control is the controlling agency for the Warrior MOA and was in radio contact with both the MF and the GA aircraft throughout the mishap (Tabs N-4 to N-5). The MF had multiple radio calls with Fort Polk Control for normal airspace coordination leading up to the intercept of the GA aircraft (Tabs N-4 to N-5). However, there was no coordination between the MF and Fort Polk Control to coordinate the intercept of the GA aircraft (Tabs N-4 to N-5).

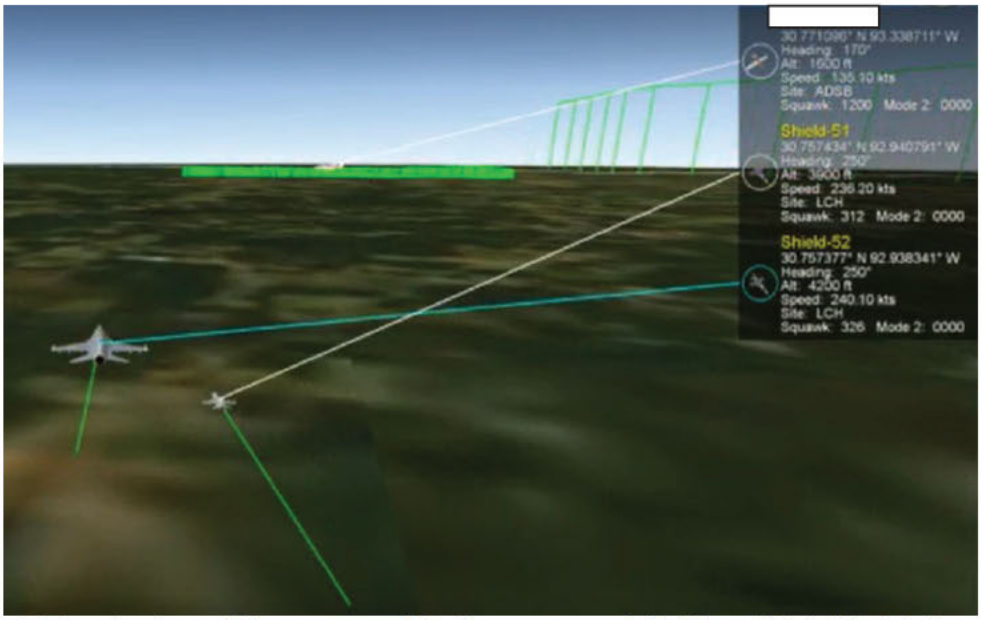

Figure 3: Termination of Intercept and Radar contact of civilian A/C (Tab AA-2 to AA-4)

The GA aircraft was in an established hold for Beauregard Regional Airport, which required him to fly north for four miles, then turn right and fly back south for four miles, turn right, and fly north again (Tab R-25 to R-28).

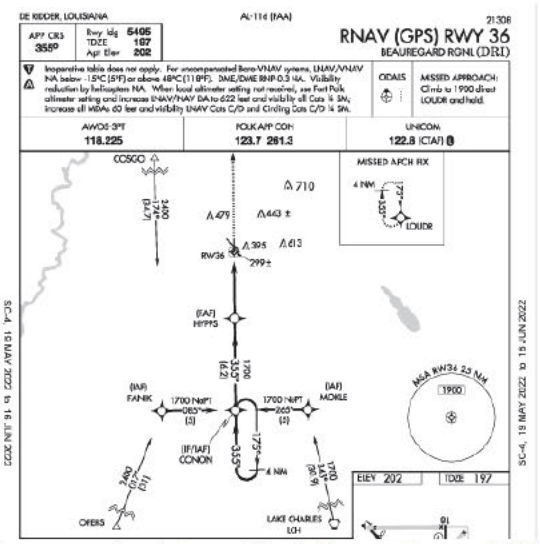

Figure 4: RNAV 36 approach plate and holding pattern of GA aircraft (Tab N-4)

The GA aircraft's north to south holding pattern complicated the intercept geometry for the MF by compressing the range between the MFL and MP (Tabs R-27 to R-28 and AA-3). At 10:54 a.m., Fort Polk Control gave their first radio call highlighting the proximity of the GA aircraft to the MF (Tab N-4). At this time, the MF had visually acquired the GA aircraft and was approaching 1.2 NM of the GA aircraft (Tabs N-4 and AA-3). Based on attempting to maintain position behind the GA aircraft, the MFL flew below the required minimum airspeed for approximately 90

seconds. The MFL did not recognize or correct these minimum airspeed violations (Tabs V-2.29 to V-2.30 and AA-3).

Figure 5: GA aircraft turning into MFL and collapsing range between MFL and MP (Tab AA-3)

The geometry and turns of the GA aircraft resulted in an approximate 0.7 NM trail separation between MP and MFL, with the MFL flying at 166 knots, below the minimum airspeed training requirements (Tabs V-2.35 to 2.36 and AA-3). There is no definitive data to capture the MP's exact airspeeds at this time, but the Seat Data Recorder (SDR) recorded two instances of the MA flying below the minimum airspeed requirements for training (Tab AA-7). The MFL read the first five of six digits of the GA aircraft's T/N over the interflight radio to the MP (Tab V-2.34 to V-2.36). Unable to get the remaining identifier of the T/N, the MFL then initiated a climbing turn above the GA aircraft to the northeast, to proceed to the MF's planned air-to-air refueling training event (Tabs V-2.34 to V-2.36 and AA-3 to AA-4).

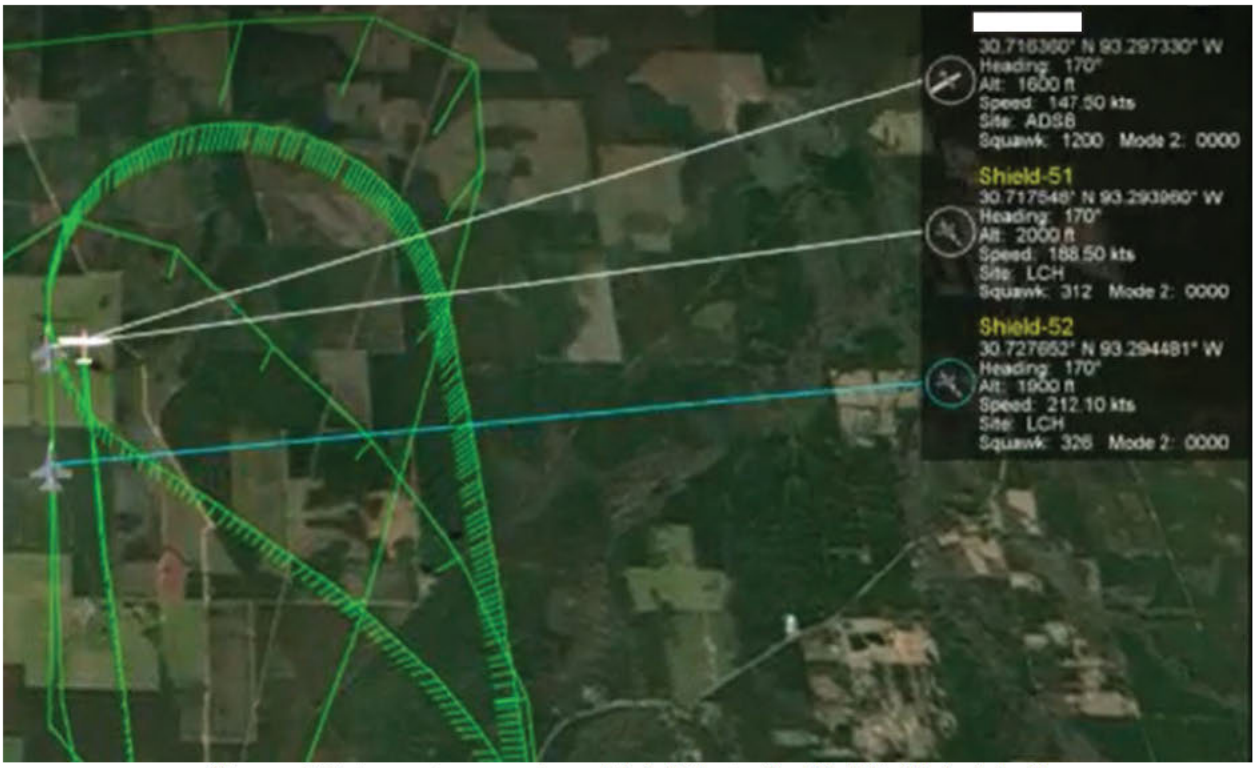

Figure 6: Intercept geometry with MP in trail of MFL (Tab AA-3)

As the MFL flew north in a right bank turn, the MP continued his intercept to read the last digit of the GA aircraft's T/N (Tabs R-25 and V-2.34 to V-2.36). As the MP closed in, the GA aircraft that was heading north to maintain its holding position turned right to head south back to Lake Charles (Tabs R-25 and V-1.38). The MP followed the GA aircraft through the right turn, reading the final digit of the T/N at 10:57 a.m. (Tabs V-1.38 and AA-3). Upon MP verbalizing the final digit, the MFL "terminated" the exercise at 10:57 a.m. (Tab V-1.38). The MA SDR shows a stall warning indication occurred at 10:57 a.m., with the MA flying below minimum airspeed (Tabs L-4 and AA-3). The MA was approximately 300 feet above the GA aircraft at this time, as opposed to the 1,000 feet required when executing an intercept from the side or front (Tabs R-24 to R-25 and V-4.46).

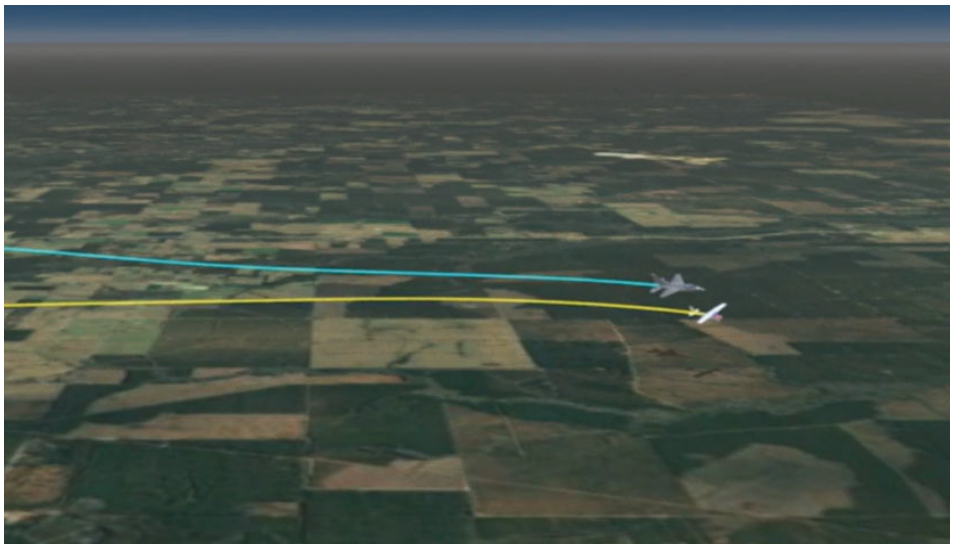

Figure 7: MP intercept of the GA aircraft just prior to stall (Tab AA-3)

The MP testified that because he had completed the intercept and was climbing in altitude above the GA aircraft, he went to raise the trailing edge flaps by flipping the Alternate Flaps (ALT Flaps) switch from EXTEND to NORM (Tab V-1.38). The ALT Flaps extend switch is used to manually lower the trailing edge flaps in the F-16 to improve the slow speed handling by increasing lift and allowing a higher power setting (Tab V-6.10) However, the SDR reveals that the MP did not alter the ALT Flaps switch, but selected the Digital Backup (DBU) switch instead (Tab AA-3 and AA-6). Upon transition to DBU, F-16 flight control laws default to their false (not active) state, irrespective of the actual airspeed (Tab J-78). Thus, with the selection of DBU, the trailing edge flaps automatically began retracting, irrespective of the actual ALT Flaps switch position (Tab J-78). This retraction created a momentary loss of lift (Tab J-78). In this critical phase of flight, the rapid and sudden, but expected and normal, movement of the trailing and leading edge flaps when selecting DBU caused the aircraft to shudder (Tab AA-8). This shudder, unanticipated by the MP, was normal and indicative of a correctly operating flight control system (FLCS) responding to the selection of DBU (Tab AA-3).

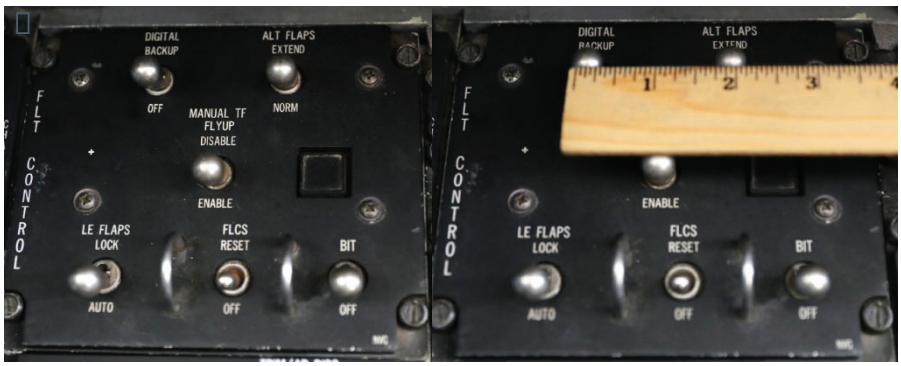

Figure 8: Flight Control Panel, proximity and similarity of DBU and ALT Flaps switch (Tab Z-3 to Z-4)

At 10:57 a.m., four seconds after the selection of DBU, the MP initiated a successful ejection at approximately 2,396 feet MSL, with no significant injuries (Tabs V-1.39, V-8.53 and AA-4).

e. Impact

The MA impacted the ground at approximately 10:57 a.m. in a sparsely wooded area, approximately 154 NM east-northeast of Ellington Field and was destroyed upon impact (Tabs J-74 and S-10). Based upon impact site analysis, and the major aircraft components being upright, the MA impacted the terrain at a steep angle while in an upright orientation (Tab J-73 to J-74). The limited distribution of aircraft wreckage towards the west from the shallow initial impact crater indicates a low speed, low energy impact from the east (Tab J-73). Impact analysis concluded that the MA impacted the terrain in a steep, slow, upright approach and possible rotation (Tab J-74).

Figure 9: Crash Site Overview (Tab S-2)

f. Egress and Aircrew Flight Equipment (AFE)

All AFE performed its intended function, without incident or hindrance to pilot recovery (Tab J-48). The MP initiated a successful Mode I ejection within the performance standards of the Advanced Concept Ejection Seat (ACES) II, with no anomalies noted (Tab H-30, H-39 and H-43). The MP initiated ejection at approximately 2,396 feet MSL, at 111 knots (Tabs V-1.39 and AA-4). All AFE and escape system components recovered from the mishap site were in good condition and functioned as designed (Tab J-35 to J-36 and J-48).

A detailed evaluation of all escape system components provided no indications that AFE played a role in this mishap (Tab J-48).

g. Search and Rescue (SAR)

After the MFL completed his intercept with the GA aircraft, he began looking for the MF's planned tanker for air-to-air refueling training (Tab V-2.35). For three minutes and 27 seconds, the MFL remained unaware that the MP had ejected (Tabs V-2.35 and AA-4). The MP testified that he made a bailout call prior to ejecting; however, that radio transmission was not heard by the MFL, any of the controlling agencies, or recorded on the MFL's head-up display (HUD) (Tabs N-5, V-1.39 and AA-4). At 10:59:30 a.m., approximately two minutes after ejection, the MFL queried for the MP on the radio, but received no response (Tab N-5). The MFL queried Fort Polk Control as to whether they had contact with the MA Identification Friend or Foe (IFF) information, known as a "squawk" (Tab N-5). Fort Polk Control responded they did not see the MA's IFF squawk (Tab N-5). Approximately two minutes later, the MFL detected the MP's Emergency Locator Transmitter (ELT) beacon, and notified Fort Polk Control that he had an "ELT out here and [saw] a fiery hole out in the field" (Tab N-5). The MFL referenced the smoke and declared an emergency at approximately 11:07 a.m., asking Fort Polk Control if they had any rescue choppers available (Tab N-7 to N-8).

Figure 10: Parachute Post-Ejection Resting Position (Tab J-31)

The MP landed in a tree, disconnected his AFE gear, and retrieved his personal cell phone (Tabs J-32 and V-8.49). The MP's first action was to use his cell phone to call squadron operations at Ellington Field (Tab V-8.46). At no point during the recovery did the MP utilize his survival radio or any of the survival equipment, as it was left suspended in the trees (Tab V-8.49). The MP notified the squadron Supervisor of Flying (SOF) of his ejection and his condition (Tab V-8.48 and V-8.50). The SOF then called Fort Polk Control to relay this information (Tab V-8.49 and N-8). The SOF directed Fort Polk Control to contact the MFL to relay a notification that squadron

operations was in contact with the MP (Tab V-8.49). The MP passed his approximate location coordinates using Google pins from his personal cell phone to the SOF (Tab V-8.50).

The 1st Battalion, 5th Aviation Regiment, C Company, a Black Hawk helicopter unit supporting the Joint Readiness Training Center and the United States Army Garrison, Fort Polk, LA, was preparing for a nine-line medevac rehearsal exercise when a call came in from the Fort Polk Warrior Operations Center (WOC) (Tabs R-36 and CC-27). The initial call came into the Aviation Company at 11:08 a.m., and the WOC gave the rescue helicopter launch approval at 11:15 a.m. (Tab R-17 and R-36 to R-37). After launching from Fort Polk, the helicopter proceeded under the direction of Fort Polk Control to fly in the approximate vicinity of the MA and MP (Tab R-17). The helicopter searched the area for approximately 20 minutes, trying to locate the crash site and downed MP (Tab R-17). During the search, the helicopter received multiple quasi directions, and coordinate formats reverted from degrees and minutes to military grid reference system (MGRS) (Tabs R-17 and V-8.50 to V-8.51). Eventually, the helicopter was directed to proceed within the vicinity of a nearby cemetery, and eventually was able to spot the MP parachute, and MP, surrounded by vehicles on the ground (Tab R-18). With no suitable landing area, the responding medic was hoisted down and made contact with the MP for an initial assessment (Tab R-18 and R-39). The medic made a preliminary assessment, checking vital signs of the MP, and determined there were no broken bones (Tab R-38). The MP and medic were then hoisted up to the helicopter (Tab R-18 and R-39). With the MP on board, the helicopter flew the MP to the Bayne Jones Army Community Hospital at Fort Polk, LA (Tab R-18).

h. Recovery of Remains

Not applicable.

5. MAINTENANCE

a. Forms Documentation

Air Force Technical Order (AFTO) 781 series forms collectively document all maintenance actions, inspections, servicing, configuration, status, and flight activities for the maintained aircraft (Tab U-2 to U-69). Automated Maintenance Information Systems (MIS) are used to document maintenance actions and track fleet health (Tab AA-9). MIS include Integrated Maintenance Data System (IMDS), which automates aircraft history, aircraft scheduling, and aircrew debriefing processes and provides a common interface for entering base level maintenance data into other standard logistics systems (Tab AA-9). Review of active 781 series forms and IMDS for the 30 days preceding the mishap revealed no overdue inspections or open Time Compliance Technical Orders (TCTOs) that would affect the MA's flight operations or performance (Tab D-11 to D-18). IMDS and the MA's AFTO 781s showed no historical record findings that contributed to this mishap (Tabs D-2 to D-18 and U-2 to U-69).

b. Inspections

The PR Inspection and a combined Basic Post-flight/Pre-flight Inspection (BPO/PR) include visually examining the aerospace vehicle and operationally checking certain systems and

components “to ensure no serious defects or malfunctions” exist (Tab AA-9). Phase inspections (PH) are a thorough inspection of the entire aerospace vehicle, performed every 400 hours (Tab AA-9). Walk-Around Inspections (WAI) are an abbreviated PR Inspection and are completed, as required, prior to launch, IAW the applicable Technical Orders (TO) (Tab AA-9). Alert Acceptance inspections contain minimum inspection requirements and are used when placing or maintaining aircraft on alert status (Tab AA-9).

A BPO/PR was accomplished on 16 March 2022, at Tulsa International Airport (TIAP), 11:30 a.m., with no discrepancies noted (Tab U-36). A WAI was accomplished on 17 March 2022, 08:00 a.m., at TIAP, with no discrepancies noted (Tab U-36). A BPO/PR was accomplished on 17 March 2022, 11:00 a.m., at Ellington Field, with no discrepancies noted (Tab U-36). An Alert Acceptance Inspection was accomplished on 17 March 2022, 11:30 a.m., at Ellington Field, by both the crew chief and Quality Assurance, with no discrepancies noted (Tab U-36 and U-52). A WAI was accomplished daily from 18 March through 21 March 2022, 10:00 a.m., at Ellington Field, with no discrepancies noted (Tab U-46). A WAI was accomplished on 22 March 2022, 10:30 a.m., at Ellington Field, with no discrepancies noted (Tab U-46). A scheduled 30-Day Egress inspection was complied with on 23 March 2022, at Ellington Field, with no discrepancies noted (Tab D-8 and D-11). Aircrew accepted the aircraft on 23 March 2022, at Ellington Field, at 09:00 a.m. and 10:00 a.m., with an “Exceptional Release” signed, followed by the aircraft being released from maintenance to the pilot for flight (Tab D-8 and D-9). Before the MF, the total operating time of the MA was 6299.4 hours (Tab D-3 and D-10). The MA flew 213.7 hours since its last phase inspection was performed, at 6085.7 flight hours (Tab D-11).

c. Maintenance Procedures

A review of the MA’s active and historical AFTO 781 series forms and IMDS revealed all maintenance actions complied with standard approved maintenance procedures and TOs (Tab D-2 to D-18). The Crash Survivable Flight Data Recorder (CSFDR) was recovered and returned to the United States Air Force Safety Center, but there was no data recorded for the MF (Tab J-76). It was identified from the Digital Flight Control System (DFLCS) data that the ALT Flaps switch was selected to the EXTEND position at flight time 00h:33m:11s into the flight and remained in the extended position until Point of Impact (POI) (Tab J-15). The DBU Switch was manually selected at 00h:34m:16.5s, 4 seconds prior to the MPs ejection, and remained selected until POI (Tab J-80). The MA was equipped with Automatic Ground Collision Avoidance System (AGCAS) and Pilot-Activated Recovery System (PARS), but neither was available, due to the ALT Flaps switch being in the extended position (Tabs J-15, V-1.22, V-2.38 and V-5.14 to V-5.15). There was no existing issue with the Integrated Servo Actuators, pre- and post-mishap, that would affect the performance of the MA (Tab AA-9).

d. Maintenance Personnel and Supervision

The 138th Maintenance Group maintained the MA at its home station at Tulsa, OK, and at the ACA location of Ellington Field (Tab V-11.5). There are no indications that the maintenance performed at either home station or the ACA location contributed to the mishap (Tab D-2 to D-18). Training of maintenance personnel was not a contributing factor to this mishap (Tab AA-9).

All documented maintenance records for those who performed maintenance on the aircraft prior to the mishap were accurate and up to date (Tab AA-9).

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

According to the Air Force Petroleum (AFPET) office, Joint Oil Analysis Program (JOAP), samples taken from the MA leading up to the mishap showed that the results were well within the allowable limits (Tab U-79 to U-81). Due to the impact energy of the aircraft, an accurate sample was not able to be obtained from the MA without contamination being present (Tab S-2 to S-10). Fuel samples were taken from the MA's servicing fuel truck, with no discrepancies noted (Tab U-74 and U-77). Oil samples were taken from the oil cart used to service the aircraft, with no discrepancies noted (Tab U-70 and U-73). Hydraulic samples were taken from the hydraulic cart used to service the aircraft, with no discrepancies noted (Tab U-71). Liquid Oxygen samples were taken from the oxygen cart used to service the aircraft, with no discrepancies noted (Tab U-72).

f. Unscheduled Maintenance

Unscheduled maintenance is any maintenance accomplished between scheduled maintenance and scheduled inspections, excluding TCTO accomplishment (Tab AA-9). A review of the MA's active and historical maintenance records revealed four significant unscheduled maintenance events during the 45 days preceding the mishap (Tab U-2 to U-69). There is no evidence to indicate any unscheduled maintenance contributed to the mishap (Tabs D-2 to D-18 and U-2 to U-69).

On 11 February 2022, it was identified on the MA that the external fuel tanks would not transfer fuel during engine operations (Tab U-2). During this event, the refuel spool, fuel level sensing unit, and air ejector pumps were all replaced (Tab U-2 to U-17). The internal/external vent and pressurization valves were both replaced as well (Tab U-10 and U-14). All maintenance associated with this event was accomplished with operational check-outs and no further reoccurrence (Tab U-2 to U-17). On 5 March 2022, the MA ground aborted its flight, due to the Hydraulic/Oil pressure caution light going out prior to the aircraft engine reaching 25% power, requiring the low oil pressure switch to be replaced (Tab U-18 to U-21). This reoccurred on 8 March 2022, resulting in a ground abort, which required the engine matrix assembly to be replaced and all operational check-outs being accomplished, with no further occurrence (Tab U-23 and U-26 to U-29). On 14 March 2022, the antiskid light was intermittently illuminating, requiring replacement of the wheel speed sensor and operational check-outs being accomplished, with no further occurrence (Tab U-30 to U-34). After this maintenance, the MA flew two uneventful sorties (Tab U-35 to U-55 and U-62 to U-69).

6. AIRFRAME

a. Structures and Systems

The MA was destroyed upon impact with the ground (Tab H-32). Lockheed Martin Aeronautics Company and the Air Force Safety Center completed post mishap data recovery and analysis of several components (Tab J-71 to J-72). Analysis of flight data records indicated there was no

evidence of any flight control, electrical, or hydraulic malfunctions that would have contributed to the mishap (Tab J-81).

b. Evaluation and Analysis

The CSFDR system consists of two units of non-volatile memory: a crash survivable memory unit (CSMU) and a signal acquisition unit (SAU) (Tab J-74). The CSMU contains Type 1 data consisting of discrete events and analog parameters that have been recorded for the primary purpose of mishap investigation (Tab J-74). Recording normally starts when the F-16's main generator comes online after ground engine start, and normally stops 90 seconds after weight-on-wheels (WOW) occurs during landing (Tab J-75). Although the CSMU was recovered, due to an unknown system fault, no CSFDR data was recorded for the MA; therefore, no CSM or SAU data was available for review (Tab J-75 to J-76).

The DFLCS memory is recorded in two different formats: Flight Profile (FP) and System Status (SS) and is stored within the SDR (Tab J-76). FP records knots calibrated airspeed (KCAS), pressure altitude and true heading every 15 seconds after takeoff (Tab J-76). The SDR memory was recovered and downloaded for analysis (Tab J-71).

Since no CSM data was available, the SDR data was provided to Lockheed Martin Aeronautics Company engineers to model flight performance for a variety of potential control inputs by the MP (Tab J-72). This data showed ALT Flaps was selected, indicating the trailing edge flaps were manually put down and remained down until the last SDR record (Tab J-72 to J-73). Approximately four seconds prior to the final recording, the SDR indicated a manual transition to DBU FLCS mode (Tab J-72 to J-73).

The MA digital video recorder (DVR) and data transfer cartridge (DTC) were recovered, but sustained severe damage in the aircraft fire, resulting in an unsuccessful data recovery (Tab AA-2). MFL's DVR and Data Transfer Cartridge (DTC) were recovered and used for this investigation (Tab AA-2). There was no applicable data on MP DTC, but the sequence of events and training rule violations were observed on MFL's DVR (Tab AA-2).

7. WEATHER

a. Forecast Weather

On 23 March 2022, the forecast for Ellington Field at the time of MF's takeoff predicted winds out of the west at 8 knots, with clear skies (Tabs F-2 and AA-10). The forecast at the expected time of MF's arrival to the Warrior MOA predicted winds at lower altitudes to be out of the west at 30 to 40 knots, with clear skies (Tabs F-3 and AA-10). The forecast at the expected time of MF's arrival back to Ellington Field predicted winds out of the northwest at 15 to 25 knots, with clear skies (Tabs F-2 and AA-10).

b. Observed Weather

At the time of the MF's takeoff from Ellington Field, the weather observation was approximately winds out of the west at 12 knots, with clear skies, and a temperature of 57 degrees Fahrenheit

(Tabs F-2 and AA-10). During mission execution in the Warrior MOA, the MF's weather observation was winds out of the west at 15 to 25 knots, with clear skies, and a temperature of 59 degrees Fahrenheit (Tabs F-3 and AA-10). The landing weather observation at Ellington Field was winds out of the west at 14 to 21 knots, with clear skies, and a temperature of 60 degrees Fahrenheit (Tabs F-2 and AA-10).

c. Space Environment

Not applicable.

d. Operations

There was no evidence located that indicated the MF was operating outside of its prescribed weather limits; after reviewing all weather conditions, there is nothing to indicate weather played any part in the mishap (Tab AA-10).

8. CREW QUALIFICATIONS

At the time of the mishap, the MP was a current and qualified F-16 ACA Instructor Pilot and met required flying continuity training (Figure 12) (Tabs G-2 to G-4, G-64, T-1, T-2, V-1.4 and V-1.9). The MF that occurred on 23 March was the first flight of the alert period for the MP (Tab V-1.7). The MP's most recent flight before the MF was a continuation training flight on 10 March 2022, at home station in Tulsa (Tabs G-4 and T-6). Based on 30-day Ready Aircrew Program (RAP) lookback, the MP was on probation, having only four, as opposed to the required six, flights (Tab V-1.9, V-8.8 and V-9.8 to V-9.9). Combat Mission Ready pilots can remain qualified as ACA alert pilots while on probation (Tabs T-2, V-5.8 and V-8.7 to 8.8). As such, over the 90 days preceding the MF, MP had enough flights to maintain currency (Tabs R-11, R-13 and T-4). Based on his flights 90-day lookback, he remained Combat Mission Ready and qualified to sit ACA (Tabs G-2 to G-4, T-4, V-8.8 to V-8.9 and V-9.8). The MP had a total of 1,384.3 flight hours, with 1,194.6 flight hours specifically in the F-16 (Tab G-3). The MP was current on all ground training items required to fly (Tab K-4 to K-7).

	Hours	Sorties
30 days	7.1	4
60 days	20.8	7
90 days	36.6	15

Figure 11: MP's Supplemental 30/60/90 Day History

9. MEDICAL

a. Qualifications

The MP's Aeromedical Services Information Management System listed MP as "medically qualified" for flying duties; he held a current DD Form 2992, Medical Recommendation for Flying or Special Operational Duty, with no duty limiting conditions notated (Tab AA-11). A review of

MP's medical records revealed an unresolved concern raised in 2015; however, there is nothing to suggest this concern contributed to the mishap (Tab AA-11). The medical review revealed no other factors relevant to the mishap (Tab AA-11).

b. Health

The MP was in good health at the time of this mishap (Tab AA-11). A review of the MP's medical and dental records, day of mishap, 72-hours prior history, and 7-days prior history did not reveal any illnesses or duty limiting conditions (Tabs G-87 to G-99 and AA-11). The MP's Aeromedical Service Information Management System report did not reveal any illness or duty limiting conditions at the time of the mishap (Tab AA-11). There is no evidence to indicate the MP's health was a factor in this mishap, as documented in his latest Physical Health Assessment on 12 September 2021 (Tab AA-11).

c. Pathology

Toxicology samples were obtained and submitted to the Armed Forces Medical Examiner System for analysis (Tabs G-63, AA-11 and EE-2 to EE-11). These tests identify drugs of abuse by immunoassay, along with ethanol, methanol, isopropanol, and acetone levels, found in the blood and urine (Tabs G-63 and AA-11). The MP, MFL, and all mishap aircraft maintenance members (MAMC) were tested, and all results were negative (Tabs G-63, AA-11 to AA-12 and EE-2 to EE-11).

d. Lifestyle

The 72-hours prior, and 7-days prior, histories were reviewed for MP (Tab G-87 to G-99). There was no evidence located to indicate lifestyle factors were relevant to the mishap (Tab G-87 to G-99).

e. Crew Rest and Crew Duty Time

Air Force pilots are required to have proper crew rest, as defined by Air Force Manual (AFMAN) 11-202, Volume 3, ACC Supplement, *Flight Operations*, Chapter 2, prior to performing inflight duties (Tab BB-24). Crew rest consists of a minimum 12-hour non-duty period before the designated flight duty period starts (Tab BB-24). During this time, aircrew may participate in meals, transportation, or rest, which allows for the opportunity for at least eight hours of continuous sleep (Tab BB-24). There is nothing to suggest that MP did not comply with published crew rest guidelines at the time of the mishap (Tab AA-12).

10. OPERATIONS AND SUPERVISION

a. Operations

The 138 FW Det-1 was conducting ACA operations in support of Operation Noble Eagle (ONE) from Ellington Field, separated from the unit's main operations at Tulsa, OK (Tab V-8.5). To support ACA mission requirements, Tulsa-based alert pilots fly to Ellington Field throughout the month, to conduct temporary duty (TDY) for 3-, 4-, or 7-day alert tours (Tab V-8.10). The normal operations tempo at Ellington Field is practice ACA scrambles typically occurring twice weekly

(Tab V-8.11). The pilots assigned to the alert detachment fly six flights total per month (whether while on alert at Ellington Field or home station at Tulsa), which is one additional sortie to the minimum required, per the RAP tasking message (Tab V-5.20, V-5.30 to V-5.31 and V-10.21 to V-10.22). Pilots sitting alert must be Combat Mission Ready or Basic Mission Capable, with probation status serving as an acceptable crew state (Tab V-5.7 to V-5.8 and V-8.7).

b. Supervision

On the day of the mishap, supervision of the 138 FW Det-1 operations was IAW AFI 11-418, *Operations Supervision*, directives (Tab BB-2). The MF had all required authorization, supervision, and documentation for the planned sortie (Tab K-2 to K-6). There was a combined SOF and operations supervisor on duty, which is allowed IAW AFI 11-418 directives, based on the number of aircraft flying at the detachment at the time of the mishap (Tab K-2, V-8.48 and BB-10).

11. HUMAN FACTORS ANALYSIS

a. Introduction

The AIB considered all human factors relevant to this mishap, as prescribed in the Department of Defense (DoD) Human Factors Analysis and Classification System 7.0 (DoD HFACS 7.0) (Tab BB-70). The DoD HFACS 7.0 is a framework that identifies potential areas of assessment during an accident investigation and lists potential human factors that can play a role in an aircraft mishap (Tab BB-70). A human factor is any environmental, technological, physiological, psychological, psychosocial, or psychobehavioral factor a human being experiences that contributes to, or influences, performance during a task (Tab BB-70).

The framework is divided into four main categories: Acts, Preconditions, Supervision, and Organizational Influences (Tab BB-70). Each category is subdivided further into related human factor subcategories (Tab BB-70). The main categories allow for a complete analysis of all levels of human error, and demonstrate how such errors may interact together to contribute to a mishap (Tab BB-70). The AIB reviewed a substantial amount of evidence during its investigation, to include, but not limited to, cockpit voice recorder transcripts, FDR information, video recordings, and witness interviews (Tab BB-70). The human factors relevant to this mishap are defined below (Tab BB-70).

b. Applicable Human Factors

There were no recorded mechanical, electrical, hydraulic, or FLCS faults during the MF for the MA (Tabs J-72 and AA-9). The following three human factors contributed to the mishap: 1) The MF failed to identify/correct risky or unsafe practices; 2) The MF committed routine violations; and 3) The MP executed the wrong choice of action during an operation (Tab BB-70).

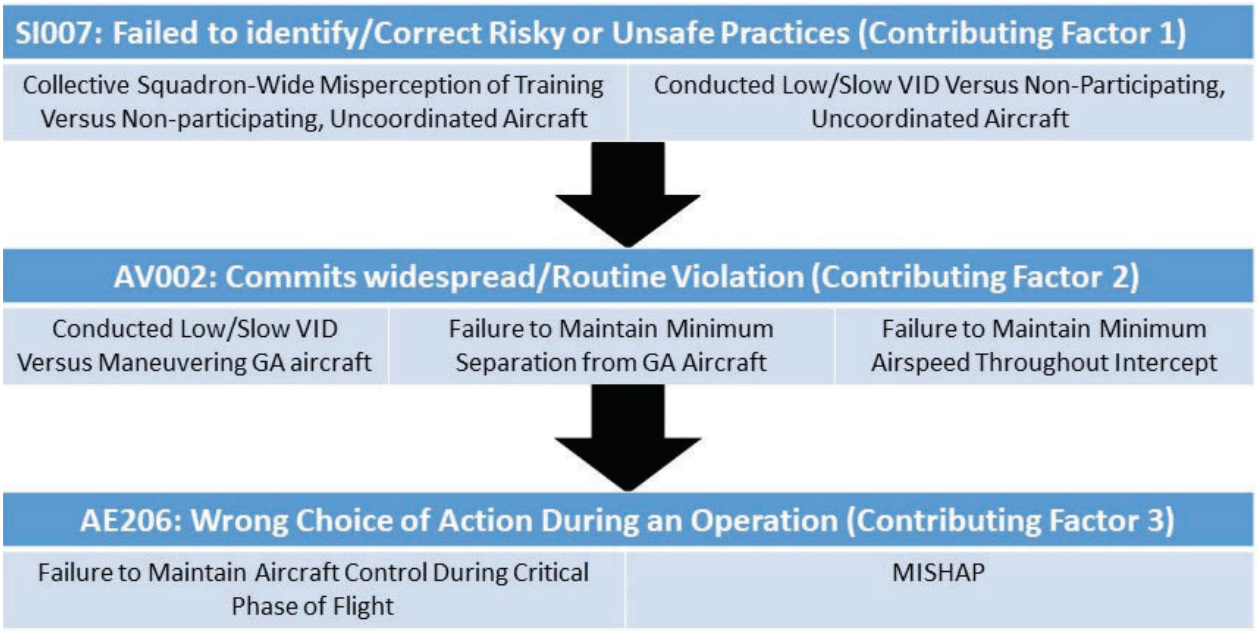

Figure 12: Mishap Sequence of Events

(1) Contributing Factor 1- SI007 (Failed to Identify/Correct Risky or Unsafe Practices)

Failing to identify or correct risky or unsafe practices is a factor when a supervisor fails to identify or correct risky behaviors or unsafe tendencies, or fails to institute remedial actions, including hazardous practices, conditions, or guidance (Tab BB-85).

While not common practice in the 138 FW Det-1, numerous witness interviews demonstrated a lack of common understanding as to whether performing low/slow VID intercepts against non-participating and uncoordinated aircraft is a permitted practice (Tab V-1.15 to V-1.16, V-2.12, V-4.17, V-4.49, V-6.7, V-7.8, V-8.16 to V-8.17, V-9.13 and V-10.11). Whether military or civilian aircraft, AFI 11-214 states that low/slow VID intercepts for training should occur between aircraft that are non-maneuvering or maneuvering within coordinated parameters (Tab BB-2 to BB-3). Because there was no coordination between aircraft, there was no way for the MF to know or predict the GA aircrafts maneuvers, violating the intent of the training rule requirement for a non-maneuvering aircraft (Tab V-1.32). The MFL and MP, both qualified F-16 instructor pilots at the time of the mishap, failed to identify or correct an unsafe practice by continuing to execute a low/slow VID against a non-participating and uncoordinated aircraft (Tabs T-1, V-1.13, V-1.32, V-2.10, V-2.26 and BB-85).

(2) Contributing Factor 2- AV002 (Commits Widespread/Routine Violation)

Committing widespread or routine violations is a factor when a procedure or policy violation is systemic in a unit or setting, and not based on a risk assessment for a specific situation (Tab BB-76). It needlessly commits the individual, team, or crew to an unsafe course of action (Tab BB-76). These violations may have leadership sanction and may not routinely result in disciplinary or

administrative action (Tab BB-76). Habitual violations of a single individual or small group of individuals within a unit can constitute a routine or widespread violation, if the violation was not routinely disciplined, or was condoned by supervisors (Tab BB-76).

On the day of the mishap, and throughout the course of the intercept of the GA aircraft, there were multiple violations of AFI 11-214 (Tabs AA-3 and BB-1). AFI 11-214, paragraph 4.9, states that fighter and trainer aircraft acting as training aids shall be 'NON-MANEUVERING,' demonstrating that coordination must take place between ACA fighters and aircraft, prior to using such aircraft as training aids (Tab BB-2 to BB-3). No coordination took place between the MF and the intercepted GA aircraft (Tabs R-24 to R-25, V-2.10 and V-2.27 to V-2.28). Consequently, no coordination was relayed to the GA aircraft to remain non-maneuvering throughout the MF intercept (Tabs R-27 to R-28, V-1.16, V-1.32, V-2.10, V-2.26, V-8.18 and V-8.41 to V-8.42). As a result, the GA aircraft conducting an instrument holding pattern at Beauregard Regional Airport, resulted in multiple unpredictable turns (Tabs R-24, R-27 to R-28, V-8.41 and AA-3 to AA-4). These uncoordinated turns further increased the level of difficulty for the MF during their intercept (Tabs R-24, R-27 to R-28, V-8.41 and AA-3).

According to AFI 11-214, paragraph 4.9.1, ACA aircrew will maintain a minimum of 1,000 feet vertical separation throughout the VID, when directed to conduct an intercept from the side or front (beam or front conversion) (Tab BB-3). Due to the GA aircraft maneuvers, intercept geometry alternated between the GA aircraft and the MF from behind, side, and front (stern, beam, and front) throughout the course of the intercept (Tabs R-27 to R-28, AA-3 and BB-3). Despite this requirement, the MF did not maintain 1,000 feet vertical separation throughout the intercept (Tabs R-25 and AA-3). Immediately prior to the mishap, the MA was within approximately 300 feet of the GA aircraft (Tabs N-5 and R-25).

Finally, AFI 11-214, paragraph 4.9.2.6, dictates a minimum airspeed for ACA low/slow VID procedures below 5,000 feet AGL (Tab BB-3). An extended period elapsed, approximately 90 seconds, where the MFL was flying slower than the minimum airspeed required in the F-16 (Tab AA-2 to AA-3). The SDR from the MA shows that during the intercept, the MP flew slower than the minimum airspeed at least twice (Tabs J-79, AA-3 and AA-7).

(3) Contributing Factor 3- AE206 (Wrong Choice of Action During an Operation)

Making a wrong choice of action during an operation is a factor when the individual, through faulty logic or erroneous expectations, selects the wrong course of action (Tab BB-7).

The SDR shows that 4 seconds prior to ejection, the DBU was manually selected in the cockpit (Tabs J-72 to J-73, AA-3 to AA-4 and AA-7). The MP testified that upon completion of the intercept of the GA aircraft, he climbed in altitude away from the GA in order to rejoin with MFL (Tab V-1.38). As the MA climbed away from the GA, the MP went to raise the trailing edge flaps by moving the ALT Flaps switch from EXTEND to NORM (Tab V-1.38). However, the MA's SDR revealed a stall warning occurred, caused by an extremely slow airspeed (Tabs J-79 and AA-7). Rather than moving the ALT Flaps switch to NORM, the SDR definitively shows a manual selection of the DBU switch to BACKUP, while the intended ALT Flaps switch action remained unchanged in the EXTEND position (Tab J-72 and J-79 to J-80).

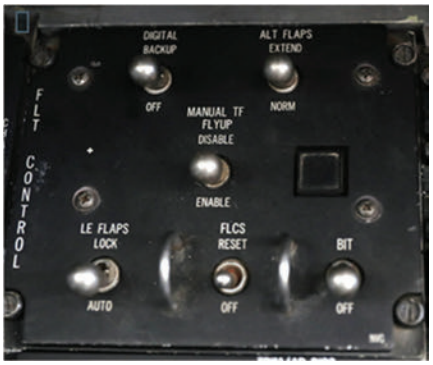

Figure 12: Picture of Flight Control Panel and Proximity of the switches discussed (Tab Z-3)

(4) Human Factors Analysis of Simulation Data

In order to validate the impact of the human factors, the AIB completed over 25 flight simulations at the Tulsa Air National Guard F-16CM Mission Training Center (MTC) (Tab AA-8). The MTC simulators give a full immersive experience where pilots can replicate parameters in order to experience what a past pilot would have experienced, in real time (Tab AA-8). The BP and Pilot Member, both current and qualified F-16 instructor pilots, participated in a simulation at Tulsa to replicate the known parameters of this mishap (Tab Y-2 and Y-5). After the mishap, parametric data and technical reports provided relevant details of the MA, including the altitudes, airspeeds, and aircraft configuration at the time of the mishap to be used in simulation (Tab AA-8). These parameters were input into the simulator in order to see the response MP would have experienced during the mishap (Tab AA-8). Additionally, throughout these simulations, a wide range of parameters were tested, including various throttle settings, flight control inputs, aircraft pitch attitudes (climbing and descending), and switch combinations (Tab AA-8). The purpose of these various inputs was to focus on the DBU and ALT Flaps switches and how they caused the aircraft to respond to different combinations while in a low/slow environment (Tab AA-8). The flight simulations were designed to replicate actual aircraft indications from the MA that were captured on the SDR and analyzed within the post mishap engineering report (Tabs J-70 to J-82 and AA-8).

The flight simulations confirmed the engineering report's conclusion that a "high departure resistance" existed, meaning the MA was still in a flyable state, prior to ejection (Tab AA-8). Additionally, the simulations demonstrated that when DBU was selected under the replicated conditions of the mishap, there was a noticeable shudder and movement of the aircraft, indicative of the flight controls responding properly to the selection of DBU (Tab AA-8).

In addition to validating the aircraft's response to the selection of DBU, the simulations explored numerous aircraft conditions, to confidently validate that the aircraft was not out of control and could have been recovered by MP (Tab AA-8). These simulated aircraft conditions included: the selection of less than full throttle power; prolonged flight below minimum airspeed requirements (low airspeed) with increasing amounts of turn (bank angle); selection of the DBU switch while ALT Flaps switch was in EXTEND; and a sustained maximum effort climb input (on the limiter of the F-16 flight control system) (Tab AA-8). It was determined that eliminating any one of these

factors present at the time of the mishap, to include increasing airspeed, reducing turn angle, or lowering the aircraft's nose, would have prevented the mishap from occurring (Tab AA-8).

12. GOVERNING DIRECTIVES AND PUBLICATIONS

a. Publicly Available Directives and Publications Relevant to the Mishap

(1) AFMAN 11-2F-16, Volume 1, F-16 Pilot Training
(2) AFMAN 11-2F-16, Volume 3, F-16 Operations Procedures
(3) AFMAN 11-202, Volume 3, General Flight Rules
(4) AFI 11-202, Volume 3, ACC Supplement, General Flight Rules
(5) AFI 11-214, Air Operations Rules and Procedures
(6) AFI 11-418, Operations Supervision
(7) AFI 48-123, Medical Examinations and Standards
(8) AFI 51-307, Aerospace and Ground Accident Investigations
(9) DAFI 91-204, Safety Investigations and Reports

NOTICE: All directives and publications listed above are 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) 138 FW Det-1 Fighter Alert Force Evaluation / Rule of Engagement Academics
(2) AFI 11-418, 138 FW Supplement, Operations Supervision
(3) AFTTP 3-3.F-16, Combat Aircraft Fundamentals – F-16
(4) T.O. 1F-16CM-1, Flight Manual USAF Series F-16C/D Blocks 40, 42, 50, and 52 Aircraft
(5) T.O. 1F-16CM-1CL-1, Flight Crew Checklist USAF Series F-16C/D Blocks 40, 42, 50, and 52 Aircraft
(6) T.O. 1F-16CM-1-2, USAF Supplemental Flight Manual, 1 December 2012
(7) T.O. 1F-16CM-34-1-1CL-1, Flight Manual Checklist, Avionics and Nonnuclear Weapons Delivery Flight Crew Procedures, USAF Series F-16C/D Aircraft Blocks Blocks 40, 42, 50, and 52 Aircraft

c. Known or Suspected Deviations from Directives or Publications

The MF violated AFI 11-214 by intercepting a non-participating and uncoordinated GA aircraft that was actively and lawfully practicing holding and instrument approach maneuvers at Beauregard Regional Airport (Tabs R-24 to R-25 and V-2.26 to V-2.27). AFI 11-214, paragraph 4.9, requires that fighter and trainer aircraft acting as training aids be 'NON-MANEUVERING' (Tab BB-2 to BB-3).

The MF intercepted the GA aircraft using less than 500 feet of separation between the MF and the GA aircraft (Tabs R-24 to R-25 and AA-3). As acknowledged by MP and MFL, and outlined in AFI 11-214, paragraph 4.9.1, ACA aircrew will maintain a minimum of 1,000 feet vertical separation throughout the VID when directed to conduct an intercept from the side or front (beam or front conversion) (Tabs V-1.19, V-2.28 and BB-2 to BB-3). The MF did not maintain 1,000 feet vertical separation, as required, throughout the intercept (Tab AA-3).

The MF was repeatedly, and for prolonged periods of time, slower than AFI 11-214, paragraph 4.9.2.6., dictated as required minimum airspeed for ACA low/slow VID procedures below 5,000 feet AGL (Tabs AA-3 and BB-2).

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18 August 2022

KEVIN M. LORD, Colonel, USAF
President, Accident Investigation Board

STATEMENT OF OPINION

F-16CM, T/N 89-2142
BEAUREGARD PARISH, LOUISIANA
23 MARCH 2022

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 23 March 2022, at approximately 10:58 a.m., the mishap aircraft (MA), a block 42 F-16CM, tail number (T/N) 89-2142, assigned to the 138th Fighter Wing (FW), 125th Fighter Squadron, Tulsa Air National Guard (ANG) Base, Oklahoma, crashed into a wooded area in Beauregard Parish, Louisiana (LA). The mishap pilot (MP) was operating out of the 138th Fighter Wing, Detachment 1 (138 FW Det-1), Ellington Field Joint Reserve Base (Ellington Field), Houston, Texas, while conducting a practice Aerospace Control Alert (ACA) mission. The MP successfully ejected and sustained only very minor injuries. The MA was destroyed upon impact.

The mishap flight's (MF) mission was to practice an ACA launch of two F-16s, out of Ellington Field, as part of their North American Aerospace Defense Command (NORAD) mission. The MP was number two of a two-ship formation flight. Following the ACA launch, the MF conducted continuation training in their designated training airspace, the Warrior Military Operating Area (MOA), located near Beauregard Parish, LA. The MF planned to practice intercepts. The first exercise was uneventful, with the Mishap Flight Lead (MFL) acting as a training aid for the MP to practice ACA intercept procedures. After this exercise, the MP discovered a general aviation (GA) aircraft below the MOA at 1,700 feet mean sea level (MSL). The MFL directed the formation to perform a low/slow visual intercept of the GA aircraft. During this unplanned and uncoordinated GA intercept, the MP failed to maintain positive aircraft control throughout a low airspeed state. The MP incorrectly assessed that the MA had departed controlled flight below the 6,000 feet Above Ground Level (AGL) uncontrolled ejection minimums, resulting in the MP ejecting.

The total destruction of the aircraft significantly limited the ability to analyze physical evidence from the MA. Evidence including switch positions on the Flight Control Panel, head-up display (HUD)/digital video recorder (DVR) data, and the Data Transfer Cartridge (DTC) were not available for analysis, based on damage sustained in the post impact fire of the MA. The signal acquisition unit (SAU) was not functional on the MA, and therefore, no crash survivable memory (CSM) was available for review. However, the seat data recorder (SDR) memory was recovered and downloaded for analysis. SDR data definitively shows that the alternate flaps (ALT Flaps) switch was selected, and remained selected, until the last SDR record. Approximately four seconds prior to the final recording, the SDR indicated a manual transition by the MP to the Digital Backup (DBU) Flight Control System (FLCS) mode. The recordings revealed no significant mechanical,

electrical, hydraulic, or FLCS faults took place during the MF. Additionally, I relied on witness interviews, radar data, the MFL's DVR data, as well as F-16 Mission Training Center simulator data, to reach an evidence-based causal conclusion.

I find, by a preponderance of the evidence, the cause of the mishap was a human factor of the 'wrong choice of action during an operation,' resulting in the failure of the MP to properly maintain positive control of the MA throughout the low airspeed state. In addition, while attempting to select ALT Flaps, the MP inadvertently selected DBU, resulting in an incorrect assessment that the MA had departed controlled flight and a misperceived inability to recover the MA, leading MP to eject. I also find, by a preponderance of the evidence, two additional human factors as substantially contributing to the mishap: 1) the MFL and MP failed to identify or correct risky or unsafe practices by intercepting a non-participating GA aircraft; and 2) the MFL and MP committed violations of AFI 11-214 training rules.

2. CAUSES

Clear and convincing evidence suggests the MP improperly attempted to maintain positive control of the MA during a low airspeed state, while completing a low/slow visual identification (VID) intercept. During this intercept, both the MFL and MP had multiple unrecognized and uncorrected AFI 11-214 training rules violations for minimum airspeed and minimum range for separation of aircraft between the F-16 and the GA aircraft. After verbalizing the last digit of the GA aircraft's T/N on the MF's interflight radio, the MP pitched up and started a climb up and away from the GA aircraft. In this low speed and low altitude environment, while in close proximity to the GA aircraft, the MP reached down to his left side in the cockpit to move the ALT Flaps switch from EXTEND to the NORM position to retract the trailing edge flaps. However, instead of retracting the trailing edge flaps, the MP inadvertently selected the DBU switch. Despite MP's testimony, the SDR confirms that at the time of ejection, the ALT Flaps switch was in EXTEND, and the DBU switch was in BACKUP.

Upon transition to DBU, F-16 flight control laws default to their false (not active) state, irrespective of the actual airspeed. Thus, with the selection of DBU, the trailing edge flaps automatically began retracting, irrespective of the actual ALT Flaps switch position. This retraction created a momentary loss of lift. Additionally, with the selection of DBU, the leading edge flaps (LEF) move to optimize for a cruise conditions at approximately 20,000 feet MSL. In this critical phase of flight, the rapid and sudden, but expected and normal, movement of the trailing and leading edge flaps when selecting DBU, caused the aircraft to shudder. This shudder, unanticipated by the MP, was normal and indicative of a correctly operating FLCS responding to the selection of DBU. However, the unexpected aircraft movement, coupled with the slow speed condition, resulted in an incorrect assessment by the MP of an uncommanded aircraft response. Based on the MA's low altitude, it is my assessment that at this point, the MP made the decision to immediately eject.

I find, by a preponderance of the evidence, the cause of the mishap was the MP's failure to effectively maintain positive control of the MA throughout the low speed, low altitude environment. The selection of the DBU switch to BACKUP, and a lack of proficiency with the handling characteristics of the F-16 at low altitude and slow airspeeds, resulted in an incorrect

assessment of an uncommanded aircraft response, which resulted in the MP choosing to eject from the MA.

3. SUBSTANTIALLY CONTRIBUTING FACTORS

a. The MFL and MP Failed to identify/correct risky or unsafe practices by intercepting a non-participating GA aircraft

Through the course of interviews with the mishap unit, there was a lack of consensus regarding whether the intercept of a non-participating, uncoordinated GA aircraft operating outside a MOA is a permissible training event. However, a thorough understanding of the existing training rules makes it clear that any simulated target of interest (TOI) must be non-maneuvering, or only maneuver with full coordination between the TOI, the controlling agency, and the ACA interceptors. None of this coordination took place prior to the intercept of the MF, nor did any coordination take place between the MF and the GA aircraft, as the intercepted TOI. Nor did any coordination take place between the MF and the controlling agency, until the end of the intercept, when the MF was already within a mile of the TOI. If any coordination had been accomplished, the MF would have been made aware that the GA aircraft was established in a holding pattern and would be accomplishing multiple turns into the MF, further complicating an already very complicated intercept. Additionally, since no planning existed for an actual low/slow intercept during this mission, no in-depth discussion of the tactics and techniques occurred that would highlight executing an intercept of this kind. If the MFL or MP, also an instructor pilot, had demonstrated appropriate flight leadership, the MF would not have accomplished this intercept in the first place. A thoroughly pre-briefed intercept of this kind would have likely led to a better-executed intercept plan and tactic. Therefore, I find that 'failing to identify or correct risky or unsafe practices' was a substantially contributing factor that resulted in the loss of the MA.

b. MFL and MP committed violations of AFI 11-214 training rules

Both the MFL and MP are current and qualified F-16 instructor pilots. Either one of them should have recognized they were executing an intercept against a non-participating, uncoordinated aircraft, while simultaneously accomplishing a challenging mission that had not been briefed as their mission for that day. During the intercept, both pilots had various training rule violations for minimum airspeed and separation of aircraft. Additionally, there was no standard or briefed technique on how the formation would execute the low/slow intercept. Specifically, it was not discussed or briefed if the ALT Flaps switch would be used or if the gear would be put down to assist in slow speed maneuvering. The MFL accomplished neither of these techniques, and without the ALT Flaps switch in EXTEND, he did not get the stall warning horn he expected to identify his slow airspeed. Consequently, the MFL, without the ALT Flaps switch in EXTEND, flew well below the minimum airspeed for training for the final 90 seconds of the intercept. Without the video recording to validate, it is my assessment, based on the position of the MA, the MP was creating similar violations to stay within formation with MFL in the accomplishment of the intercept. Based on the available data we know, the MA violated minimum airspeed requirements twice.

Additionally, the MF did not execute an appropriate tactic to maintain contact with the TOI, based on the GA aircraft's airspeeds and maneuvering. By not executing the proper tactic, both the MFL

and MP ended up much closer to each other, the TOI, and much slower than permitted by the training rules. Furthermore, having all three aircraft in such close proximity at low altitude and low airspeeds led to a highly challenging and dynamic environment. All these factors combined to further task saturate the MP as he tried to manage his airspeed, altitude, range from his flight lead and the TOI. Therefore, I find that 'committing routine violations' resulted in a situation that led to the incorrect selection of the DBU switch to BACKUP at low altitude and low airspeed, which caused the aircraft to respond unexpectedly, and resulted in the MP's decision to eject.

4. CONCLUSION

I find, by a preponderance of the evidence, the cause of the mishap was MP's ejection from the MA, following his incorrect assessment that the MA had departed controlled flight. The MP inadvertently placed the DBU switch to BACKUP, resulting in an incorrect assessment that the aircraft had departed controlled flight and a misperceived inability to recover the MA before initiating ejection. Also, by a preponderance of the evidence, I find two substantially contributing factors to the mishap, 1) lack of flight leadership and 2) lack of flight discipline, in MFL and MP's violation of various training rules, including intercepting a non-participating GA aircraft, and incorrectly handling the F-16 in a low speed and low altitude environment.

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18 August 2022

KEVIN M. LORD, COL, USAF
President, Accident Investigation Board

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