UNITED STATES AIR FORCE
AIRCRAFT ACCIDENT INVESTIGATION
BOARD REPORT

F-16C, T/N 00-0219

77TH FIGHTER SQUADRON
20TH FIGHTER WING
SHAW AIR FORCE BASE, SOUTH CAROLINA

LOCATION: NEAR BAGRAM AIRFIELD, AFGHANISTAN

DATE OF ACCIDENT: 3 APRIL 2013

BOARD PRESIDENT: BRIGADIER GENERAL ROBERT J. BELETIC

Conducted IAW Air Force Instruction 51-503

EXECUTIVE SUMMARY
AIRCRAFT ACCIDENT INVESTIGATION

F-16C, T/N 00-0219
NEAR BAGRAM AIRFIELD, AFGHANISTAN
3 APRIL 2013

On 3 April 2013 at 18:40:06Z (23:10:06L) the mishap aircraft (MA), an F-16C, tail number 00-0219, deployed with the 77th Expeditionary Fighter Squadron to Bagram Airfield (BAF), Afghanistan impacted a mountainside 10 nautical miles southeast of BAF. The mishap flight was a combat mission in support of ground forces assigned in the United States Central Command's Area of Responsibility. The crash occurred in an unpopulated area. The MA was destroyed with a loss valued at $30,945,228. The mishap pilot (MP) did not attempt to eject from his aircraft and was fatally injured. United States air and ground forces recovered the remains of the MP. The mishap caused neither civilian injuries nor damage to civilian property. Many international media sources reported on the mishap.

The MA took off from BAF on 3 April 2013 at 14:36:47Z (19:06:47L) and flew the entire sortie at night. The MP was the flight lead of a two ship of F-16Cs tasked to provide close air support in eastern Afghanistan. Upon completion of the mission, the MP directed the MW to a two nautical mile trail position. The MP then contacted air traffic control and requested a visual flight rules recovery, whereby the MP assumed responsibility for traffic and terrain avoidance. BAF was reporting a broken cloud layer and light rain. While maneuvering to land, the MP descended below the minimum safe altitude into a mountainous area, which was visually obscured by weather conditions. Prior to impact, the MA provided low altitude warnings, however the MP did not take timely corrective action.

The Accident Investigation Board President found by clear and convincing evidence the cause of the mishap was the MP's failure to perceive mountainous terrain directly in his flight path while flying below the minimum safe altitude using visual flight rules in instrument meteorological conditions (i.e., clouds) resulting in controlled flight into terrain.

SUMMARY OF FACTS AND STATEMENT OF OPINION
F-16C, T/N 00-0219
3 APRIL 2013

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COMMONLY USED ACRONYMS AND ABBREVIATIONS

20 FW	20th Fighter Wing
20 OG	20th Operations Group
455 OGV	455th Expeditionary Operations Group Standardization and Evaluation
74 EFS/CC	74th Expeditionary Fighter Squadron Commander
77 EFS	77th Expeditionary Fighter Squadron
77 FS	77th Fighter Squadron
9 AF	Ninth Air Force
A-10 SOF	A-10 Supervisor of Flying
AB	Afterburner
A/C	Aircraft
ACC	Air Combat Command
ACP	Airspace Control Plan
ADO	Assistant Director of Operations
ADVON	Advanced Echelon
AETF	Air Expeditionary Task Force
AEW	Air Expeditionary Wing
AF	Air Force
AFB	Air Force Base
AFE	Aircrew Flight Equipment
AFI	Air Force Instruction
AFIP	Air Force Institute of Pathology
AFMAN	Air Force Manual
AFTO	Air Force Technical Order
AFTTP	Air Force Tactics, Techniques, and Procedures
AGL	Above Ground Level
AIB	Accident Investigation Board
AIP	Afghanistan Aeronautical Information Publication
ALOW	Altitude Low
AMU	Aircraft Maintenance Unit
AO	Area of Operations
AOR	Area of Responsibility
AR	Aerial Refueling
ASD	Air Sortie Duration
ASOC	Air Support Operations Center
ASR-8	Air Surveillance Radar
ATC	Air Traffic Control
ATIS	Automatic Terminal Information Service
ATO	Air Tasking Order
AUX	Auxiliary
AWT	Air Weapons Teams
BAF	Bagram Airfield
BATC	Bagram Air Traffic Control
BATCC	Bagram Air Traffic Control Chief
BFM	Basic Fighter Maneuvers
BMA	Battle Management Area
BOC	Base Operations Center
BP	Board President
BPO	Pre-flight Inspection
C2	Command and Control
CAF	Combat Air Forces
CAMS	Core Automated Maintenance System
CAOC	Combined Air Operations Center
CAP	Combat Air Patrol
Capt	Captain
CARA	Combined Altitude Radar Altimeter
CAS	Close Air Support
CAT	Crises Action Team
CE	Civil Engineering
CENTRIX	CENTCOM Regional Intelligence Exchange System
CERF	Certified Engine Repair Facility
Comm	Communications
CRC	Control and Reporting Center
CSAR	Combat Search and Rescue
CSFDR	Crash Survivable Flight Data Recorder
CSMU	Crash Survivable Memory Unit
DBRITE	Digital Radar Display
DCA	Defensive Counter Air
DME	Distance Measuring Equipment
DNIF	Duties Not Including Flying
DO	Director of Operations
DoD	Department of Defense
DOV	Squadron Standardization and Evaluation Section
DS	Director of Staff
DTC	Data Transfer Cartridge
DTED	Digital Terrain Elevation Data
ECM	Electronic Countermeasures
ECP	Entry Control Point
EDX	Energy Dispersive X-Ray
EOD	Explosive Ordnance Disposal
EOG	Expeditionary Operations Group
EP	Emergency Procedure
ER	Exceptional Release
FAIP	First Assignment Instructor Pilot
FCIF	Flight Crew Information File
FDR	Flight Data Recorder
FLCS	Flight Control System
FLIP	Flight Instrument Publication
FLO	Family Liaison Officer
FLUG	Flight Lead Upgrade
Freq	Frequency
G	Gravitational Force
GBU	Guided Bomb Unit
GLO	Ground Liaison Officer
Gogs	Night Vision Goggles
GPS	Global Positioning Satellites
GPW	Ground Proximity Warning
HARM	High-Speed Anti-Radiation Missile
HLZ	Helicopter Landing Zone

HTSP	HARM Targeting System Pod
HUD	Head-Up Display
IAF	Initial Approach Fix
IAW	In Accordance With
IC	Incorporating Change
ICAWS	Integrated Caution, Advisory and Warning System
IDF	Indirect Fire
IED	Improvised Explosive Device
IFG	In-Flight Guide
IFOC	In-Flight Operations Check
IFR	Instrument Flight Rules
IJC	International Security Assistance Force Joint Headquarters
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
IMDS	Integrated Maintenance Data System
IP	Instructor Pilot
IR	Infrared
ISAF	International Security Assistance Force
ISB	Interim Safety Board
ISR	Intelligence, Surveillance, and Reconnaissance
JDAM	Joint Direct Attack Munition
JEOC	Joint Emergency Operations Center
JFS	Jet Fuel Starter
JOAP	Joint Oil Analysis Program
JOC	Joint Operations Center
JPRC	Joint Personnel Recovery Center
JTAC	Joint Terminal Attack Controller
JTAR	Joint Tactical Air Strike Request
K	Thousand
KAF	Kandahar Airfield
KATC	Kabul Air Traffic Control
KATCC	Kabul Air Traffic Control Chief
KCAS	Knots Calibrated Airspeed
KTAS	Knots True Airspeed
L	Local Time
LAO	Local Area Orientation
LAP	Local Area Procedure
LIS	Line in the Sky
LM-Aero	Lockheed Martin Aeronautics Company
LMR	Land Mobile Radio
LNO	Liaison Officer
LOAs	Letters of Agreement
Lt Col	Lieutenant Colonel
LZ	Landing Zone
MA	Mishap Aircraft
MACC #1	Mishap Aircraft Crew Chief #1
MACC #2	Mishap Aircraft Crew Chief #2
MAJCOM	Major Command
MCD	Magnetic Chip Detector
MDS	Mission Design Series
MEP	Mission Essential Personnel
METAR	Meteorological Aviation Report
MF	Mishap Flight
MFD	Multi-Function Display
MGRS	Military Grid Reference System
MIDS	Multi-function Information Distribution System
mIRC	Mardam Internet Relay Chat
MOGV	Mishap Standardization and Evaluation
MP	Mishap Pilot
MPC	Mission Planning Cell
MSA	Minimum Safe Altitude
MSAW	Minimum Safe Altitude Warning
MSgt	Master Sergeant
MSL	Mean Sea Level
MSQ	Mishap Squadron
MTC	Mission Training Center
MVA	Minimum Vector Altitude
MW	Mishap Wingman
MWA	Mishap Wingman Aircraft
MWS	Major Weapons System
MX	Maintenance
NAF	Numbered Air Force
ND	Nose Down
NDI	Non-Destructive Inspection
NDL	Network Design Load
NM	Nautical Miles
Nogs	Night Vision Goggles
NORDO	No Radio
NOTAMs	Notices to Airmen
NSTR	Nothing Significant to Report
NVGs	Night Vision Goggles
OEF	Operation ENDURING FREEDOM
OG	Operations Group
OGV	OG Standardization and Evaluation
OI	Operating Instruction
Ops Tempo	Operations Tempo
ORM	Operational Risk Management
OSK	Operations Support Squadron Weapons
PA	Public Affairs
PAPI	Precision Approach Path Indicator
PGCAS	Predictive Ground Collision Avoidance System
PHA	Physical Health Assessment
PIC	Pilot in Command
PIREP	Pilot Report
PJ	Pararescue Jumper
PR	Pre Flight
PR	Personnel Recovery
PRI	Primary
Pro Sup(er)	Production Superintendent
Pro Sup #1	Production Superintendent #1
Pro Sup #2	Production Superintendent #2

PSI	Pounds Per Square Inch
QA	Quality Assurance
QRF	Quick Reaction Force
RAF	Royal Air Force
RBD	Regional Base Defense
RC	Regional Command
RMM	Recordable Mass Memory
ROZ	Restricted Operation Zone
RPV	Remotely Piloted Vehicles
RTB	Return-To-Base
SA	Situational Awareness
SAR	Search and Rescue
SAT	Satellite
SATCOM	Satellite Communications
SAV	Staff Assistance Visit
SC	South Carolina
SCIF	Sensitive Compartmented Information Facility
SCL	Standard Conventional Load
SEAD	Suppression of Enemy Air Defenses
SEFE	Standardization and Evaluation Flight Examiner
SEM	Scanning Electron Microscope
SEPT	Simulated Emergency Procedures Training
SGP	Chief of Aerospace Medicine
SIB	Safety Investigation Board
SIDO	Senior Intelligence Duty Officer
SII	Special Interest Item
SIPR	Secure Internet Protocol Routing
SOF	Supervisor of Flying
SOP	Standard Operating Procedure
Spatial D	Spatial Disorientation
SQ	Squadron
SPECI	Special Observation
SPINS	Special Instructions
Sq/CC	77th Fighter Squadron Commander
Sq/COW	77th Fighter Squadron Chief of Weapons
Sq/ECP	77 FS Electronic Combat Pilot
Sq/Flt Dr	77th Fighter Squadron Flight Surgeon
Stan/Eval	Standardization and Evaluation
TACAN	Tactical Air Navigation
TAC-ATIS	Tactical Automatic Terminal Information Service
TACSAT	Tactical Satellite
TAD	Tactical Awareness Display
TAF	Terminal Aerodome Forecast
TCTO	Time Compliance Technical Order
TDW	Tower Display Workstation
TEMPO	Temporary Observation
TERPS	Terminal Instrument Procedures
TH	Through-Flight
TIC	Troops in Contact
T/N	Tail Number
T.O.	Technical Order
UAV	Unmanned Aerial Vehicle
UPT	Undergraduate Pilot Training
U.S.	United States
USAF	United States Air Force
USCENTCOM	United States Central Command
UTD	Universal Training Device
VASI	Visual Approach Slope Indicator
VBIED	Vehicle-Borne Improvised Explosive Device
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions
Vol	Volume
VTC	Video Teleconference
Vul	Vulnerability
WIC	Weapons Instructor Course
WTT	Weapons Tactics Trainer
WX	Weather
XCAS	Airborne Alert Close Air Support
Z	Zulu Time (Greenwich Mean Time)

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

SUMMARY OF FACTS

1. AUTHORITY AND PURPOSE

a. Authority

On 4 April 2013, General Gilmary M. Hostage III, Commander, Air Combat Command (ACC), appointed Brigadier General Robert J. Beletic as the Accident Investigation Board (AIB) President to conduct an aircraft accident investigation of a mishap that occurred on 3 April 2013, involving an F-16C aircraft, 10 nautical miles (NM) southeast of Bagram Airfield (BAF), Afghanistan (Tabs V-1.48, Y-3 to Y-4 and AA-5). The aircraft accident investigation was conducted in accordance with Air Force Instruction (AFI) 51-503 at Shaw Air Force Base (AFB), South Carolina (SC); BAF; and Kabul International Airport, Afghanistan, from 11 May 2013 through 31 May 2013. Board members were a Senior Pilot member (Colonel), a Legal Advisor Lieutenant Colonel (Lt Col), a Flight Surgeon Lt Col, a Physiologist Captain (Capt), a Pilot member Capt, a Maintenance member Master Sergeant (MSgt), an Air Traffic Control member MSgt, and a Recorder Technical Sergeant (Tab Y-5).

b. Purpose

This is a legal investigation convened to inquire into the facts surrounding the aircraft or aerospace accident, to prepare a publicly-releasable report, and to gather and preserve all available evidence for use in litigation, claims, disciplinary actions, administrative proceedings, and for other purposes.

2. ACCIDENT SUMMARY

On 3 April 2013 at 23:10:06 local time (L) (18:40:06 Zulu time (Z); L = Z + 4.5 hours) the mishap aircraft (MA), an F-16C, tail number (T/N) 00-0219, deployed with the 77th Expeditionary Fighter Squadron (77 EFS) to BAF impacted a mountainside 10 NM southeast of BAF (Tabs V-1.48, V-24.2, AA-5 and EE-3). The mishap flight (MF) was a combat mission in support of ground forces assigned in the United States Central Command's Area of Responsibility (Tab K-2). The crash occurred in an unpopulated area (Tabs P-3 and V-24.2 to V-24.4). The MA was destroyed with a loss valued at $30,945,228 (Tab P-6). The mishap pilot (MP) did not attempt to eject from his aircraft and was fatally injured (Tab AA-5). United States (U.S.) air and ground forces recovered the remains of the MP (Tab V-24.2 to V-24.4). The mishap caused neither civilian injuries nor damage to civilian property (Tab P-3). Many international media sources reported on the mishap (Tab DD-3 to DD-7).

3. BACKGROUND

The MA belonged to the 77th Fighter Squadron (77 FS), 20th Fighter Wing (20 FW), Ninth Air Force (9 AF), ACC stationed at Shaw AFB, SC (Tab EE-3).

a. Air Combat Command (ACC)

ACC is the primary force provider of combat airpower to America's warfighting commands. To support global implementation of national security strategy, ACC operates fighter, bomber, reconnaissance, battle-management, and electronic-combat aircraft. It also provides command, control, communications and intelligence systems, and conducts global information operations (Tab CC-3).

b. Ninth Air Force (9 AF)

Ninth Air Force is responsible for organizing, training, and equipping Airmen to meet the demands of today's expeditionary taskings while preparing for tomorrow's challenges. Ninth Air Force is responsible for ensuring the agile combat support capabilities of eight wings and three direct reporting units. These units encompass more than 400 aircraft, and 29,000 active duty and civilian personnel. Ninth Air Force is also responsible for the operational readiness of sixteen 9th-Air-Force-gained National Guard and Air Force Reserve units (Tab CC-7).

c. 20th Fighter Wing (20 FW)

20 FW provides combat ready airpower and Airmen, to meet any challenge, anytime, anywhere. The wing is capable of meeting all operational requirements worldwide, maintains a state of combat readiness and operates as host unit at Shaw AFB, SC by providing facilities, personnel and material (Tab CC-9).

d. 77th Fighter Squadron (77 FS)

The 77 FS maintains a mission-ready, multi-role capability to mobilize, deploy and tactically employ forces worldwide for any contingency in support of U.S. national objectives. It is responsible for providing the people and resources necessary for conventional air-to-surface, air superiority, suppression of enemy air defenses, destruction of enemy air defenses, and maritime operations (Tab CC-11).

e. F-16C – Fighting Falcon

The F-16 Fighting Falcon is a compact, multi-role fighter aircraft. It is highly manuerverable and has proven itself in air-to-air combat and air-to-surface attack. It provides a relatively low-cost, high-performance weapon system for the U.S. and allied nations. The F-16C is the single-seat combat variant of the aircraft (Tab CC-13).

f. Bagram Airfield (BAF)

BAF is in eastern Afghanistan near Kabul, the capital of Afghanistan. BAF is in the center of a horseshoe of mountainous terrain and has a field elevation of 4,895 feet mean sea level (MSL).

BAF has a single runway oriented northeast to southwest. Due to its close proximity, Kabul Approach provides radar air traffic control services to both BAF and Kabul airports (Tab AA-3).

4. SEQUENCE OF EVENTS

a. Mission

The mishap squadron (MSQ), the 77th EFS, initially deployed to Kandahar Airfield (KAF), Afghanistan in October 2012 (Tab FF-4). Due to runway maintenance, the MSQ moved from Kandahar to BAF on 30 March 2013 (Tabs V-2.2 and FF-4). On 30 March 2013, the MP flew a sortie to reposition the fighters to Bagram (Tabs G-14 and V-3.8). The MP's only local sortie prior to the mishap was on 1 April 2013, when the MP flew as a wingman on a night combat mission (Tabs G-14 and V-1.9). The MF of 3 April 2013 was scheduled, planned and briefed as a night combat sortie (Tab V-1.20). The MF consisted of two F-16Cs providing close air support (CAS) (Tab K-2). The Top-3 (the on-duty squadron supervisor who acts on behalf of the Director of Operations) authorized the MF (Tab K-14).

b. Planning

One week prior to moving from KAF to BAF, BAF's Operations Group Standardization and Evaluations (OGV) gave the MSQ Local Area Orientation (LAO) academic briefings via video teleconference (VTC) (Tab V-5.1). All MSQ pilots attended the academics, including the MP and the mishap wingman (MW) (Tab V-1.7). The BAF local area academics were accomplished in accordance with published regulations and covered the mountainous terrain, minimum safe altitudes (MSAs), weather, and recovery procedures (Tab V-4.2). The MSQ, including the MP and MW, had relevant mission materials consisting of an Afghanistan country map with detailed MSAs, a local "smart card" with communications and navigation information, and in-flight guide (IFG) (Tab V-1.8, V-1.14, and V-10.2).

On 3 April 2013, the MP and MW attended the required weather, intelligence, and ground liaison officer briefings (Tab V-1.20). The MP conducted the flight briefing and used the MSQ standard briefing guide. The MF was tasked to provide close air support in Afghanistan (Tab K-2). The content and timing of the brief were standard and covered the required topics. Due to the weather forecast, the potential for instrument meteorological conditions (IMC) was emphasized (Tab V-1.21). In accordance with AFI 11-202, Volume 3, Attachment 1 IMC is defined as low visibility conditions, such as clouds. The MP specifically briefed Instrument Flight Rules (IFR) flight recovery to an Instrument Landing System (ILS) approach at BAF based on the forecasted weather (Tab V-1.22). In accordance with Air Force Manual (AFMAN) 11-217, Volume 3, Attachment 1, IFR is defined as a set of rules governing the conduct of flight under IMC; ILS is defined as precision instrument approach system allowing pilots to land during IMC.

c. Preflight

On 3 April 2013, the MF met in the MSQ at 1205L (Tab V-1.20). The MF checked their aircrew flight equipment (AFE), received an initial briefing from the Top-3, and reviewed Notices to Airmen in accordance with standard procedures (Tab V-1.20, V-1.23, and V-10.3). After completing the flight brief, the MF gathered its mission materials including: Afghanistan MSA

maps, IFG, and Flight Information Publications (Tabs Q-10 and V-1.22 to V-1.23). The MP and MW then signed out their night vision goggle devices (NVGs) (Tab H-4). The MF proceeded back to the Top-3 and received the final "step" briefing (V-1.26). This briefing was in accordance with standards and included a weather update and a review of maintenance trend data for their aircraft (Tab V-1.26 to V-1.27).

The MP's ground operations were normal and in accordance with technical order (T.O.) 1F-16CM-1CL-1 (Dash 1 Checklist) (Tab V-1.27). No maintenance discrepancies were noted (Tab V-21.1). The MA configuration consisted of two 370-gallon wing fuel tanks, four 500-pound bombs, one air-to-air missile, a Sniper Advanced Targeting Pod, and a High Speed Anti-Radiation Missile (HARM) Targeting System Pod (Tabs J-3 and V-10.3).

d. Summary of Accident

The MF taxied on time and departed BAF at 19:06:47L (Tabs J-4 and V-1.26). The MF departed using Visual Flight Rules (VFR) via a standard tactical departure and encountered little to no weather. In accordance with AFMAN 11-217, Volume 2, paragraph 1.1.2.1, VFR is defined as a set of rules governing the conduct of flight clear of clouds. Takeoff, departure and the tactical portion of the sortie were uneventful. No munitions were expended and no enemy contact was reported (Tab V-1.28 to V-1.29).

At 22:58:01L, 68 NM from BAF, MP began to Return to Base (RTB) at an appropriate VFR altitude of 18,500 feet MSL (Tab AA-5). The MP directed the MW into a 2 NM trail formation (Tabs N-7 and AA-5). The MF remained in this formation until the mishap occurred (Tab N-7 to N-11). The MP cleared the MW to remove his NVGs at his discretion (Tab N-2). However, the MW stated he kept his NVGs on throughout the recovery (Tab V-1.54).

The MP cleared the MW off frequency to check out with the Control and Reporting Center, obtain the current BAF Automatic Terminal Information Service (ATIS) weather broadcast, and report maintenance codes back to squadron operations. In accordance with AFMAN 11-217, Volume 3, paragraph 1.2.6, ATIS is a voice communication capability able to broadcast weather information. At the same time, the MP initiated contact with Kabul Approach Control and requested a VFR straight-in to runway 03. Kabul Approach approved the MF direct to BAF VFR. During this exchange, the MW was on a different radio frequency completing his assigned duties and did not hear this communication (Tabs N-3 to N-7 and AA-5).

At 23:04:59L, 36 NM from BAF, Kabul Approach contacted the MP and asked him to repeat his approach request (Tabs N-3 to N-4 and AA-5). The MP again requested a visual straight-in runway 03 at BAF. Kabul Approach acknowledged the straight-in request, and approved the MP VFR altitude at his discretion (Tab N-4). The MW was still on a different radio frequency and therefore he assumed the MF had been granted an IFR clearance to BAF (Tabs N-3 to N-5 and V-1.37). The MW stated, using NVGs, he could see the MF approaching IMC conditions at 16,000 feet MSL and sporadic lightning ahead of the MF (Tab V-1.36).

At 23:05:38L, 32 NM from BAF, the MP radioed the MW that he was beginning a shallow descent and began a five degree nose low descent (Tabs J-CSMU and N-4). The MP utilized maximum afterburner (AB) and idle power with speed brakes in order to burn down fuel

(Tabs J-CSMU and V-1.46). The MW acknowledged and replied he had the current ATIS. The MW then relayed the ATIS to the MP as "Tango, runway three, it's wet. Winds are 220 at 5. We got scattered ceilings at 4000 and 5000, light rain and 3022" (Tab N-4). In accordance with Air Force Handbook 11-203, Volume 2, paragraph 2.2.5, cloud bases in the terminal area are expressed in feet above ground level (AGL). BAF ATIS stated:

> Bagram Tower information Tango 1755Z, wind estimated 320/5, visibility unrestricted, light rain shower, scattered 4000, scattered 5500, broken ceiling 7000, broken 8500, temperature 11, dew point 3, altimeter 3022, expect ILS approach, runway three in use, wet runway, wind advisory, winds forecast greater than 15 knots, less than 25 knots, lightning watch, lightning potential within 5 miles of the airport. Runway closure is scheduled between 2200Z and 0100Z. Advise on initial contact you have Tango (Tab N-4 to N-5).

Twenty-one NM from BAF, the MP asked the MW, "Where are the clouds?" The MW responded with, "5000, 7000 broken 10,000" (Tabs N-4 and AA-5).

At 23:07:08L, the MP entered IMC descending through 16,000 feet MSL at 21 NM from BAF (Tabs V-1.31 and AA-5).

At 23:07:22L, as the MW entered IMC, the MW asked the MP what altitude they were cleared to (Tabs N-4 and AA-5). The MW assumed the MP had already received an IFR clearance. The MW stated his assumption was based on the MP's briefed ILS recovery plan and the fact they entered IMC (Tab V-1.37). The MP replied with a broken radio call stating the MF is "vis, uh, our discretion" (Tab N-9). The MW stated this was the first indication his IFR recovery assumption was incorrect (Tab V-1.38).

At 23:08:01L, 17 NM from BAF, Kabul Approach directed the MF to continue its VFR descent (Tab N-4). The MW stated this was his second indication the MF may not have been on an IFR clearance. He was still unclear if the MF was VFR or IFR (Tab V-1.39).

At 23:08:05L, 16 NM from BAF, the MP received the first audible altitude warning from the MA (Tabs N-4 and AA-5). The warning was generated from the MA's line-in-the-sky (LIS) system, and is designed to alert the MP one time when descending through a pre-set altitude, in this case 15,000 feet MSL (Tab J-5). At 23:08:31L, 14 NM from BAF, the MW received the same warning (Tabs N-10 and AA-5).

At 23:08:17L, the MP descended through 14,200 MSL, the published MSA (Tab AA-3 and AA-5).

At 23:08:58L, 13 NM from BAF, Kabul Approach directed the MF to BAF Tower frequency. Immediately following this communication, the MP told the MW he was attempting to intercept a 10 NM final. The MP checked the MF in on BAF Tower frequency and contacted BAF Tower (Tabs N-5 and AA-5). The MW testified he became concerned the MF was on a VFR clearance. The MW "knew something was not right" and was waiting for radio availability to query the MP (Tab V-1.44).

At 23:09:20L, 12 NM from BAF, BAF Tower requested the MF proceed to a five mile straight-in final with an altitude restriction of at or below 6,000 feet MSL at 2 NM Distance Measuring Equipment (DME). In accordance with AFI 11-217, Volume 1, paragraph 4.5, DME is the distance from the airport navigational aid. The MP acknowledges BAF Tower's request and again repeats his intent to intercept a 10 NM final approach (Tabs N-5 and AA-5).

At 23:09:43L, 11 NM from BAF, the MP received the second audible altitude warning. This warning was from the MA's altitude low (ALOW) system, which was set at the squadron standard of 1,800 feet AGL (Tabs J-6, V-10.2, and AA-5). Anytime the MA's AGL altitude descended below 1,800 feet AGL, the MA emitted "altitude, altitude" (Tab J-9). Over the next six seconds, the MP received this warning two additional times (Tab N-5). This warning was re-voiced as the MA flew over uneven, mountainous terrain despite a constant descent (Tab J-9 and J-CSMU).

At 23:09:55L, 10 NM from BAF, the MW asked the MP if he was still in the weather (Tabs N-5 and AA-5). The MP replied that he was, and asked if the MW was also in the weather. The MW replied yes, and began to shallow his descent profile because he was concerned about terrain (Tabs N-5 to N-6 and V-1.44).

At 23:10:02L, 10 NM from BAF, the MA's Predictive Ground Collision Avoidance System (PGCAS) emitted a "pull up, pull up" audible alert while flashing an "X" in the MA's head-up display (HUD) and both multi-function displays (MFDs) (Tabs N-6 and AA-5). The predictive feature of PGCAS was not available at the time of the mishap because the MA was off the digital terrain database (Tab J-7). The non-predictive portion of PGCAS provided the warning when the radar altimeter detected an AGL altitude less than the selected minimum terrain clearance (MTC), which was set to 450 feet AGL (Tab J-7). The MP selected military power and pulsed the control stick, resulting in a modest two degree nose high climb (Tab J-CSMU).

At 23:10:06L, 10 NM from BAF, the MP selected maximum AB and simultaneously impacted the mountainside (Tabs J-CSMU and AA-5).

The MW averaged 1,560 feet higher than the MP throughout the descent (Tab AA-6). At the time of the MA impact, the MW observed a bright flash through his NVG and could see a "tinge of red" from underneath his NVG (Tab V-1.44). Having seen this visual cue coupled with his terrain clearance concerns and uncertainty of the type of clearance, the MW selected military power and immediately executed a nose high climb (Tabs V-1.44 and AA-6). The MW avoided the mountain by 1,540 feet AGL (Tab AA-6).

e. Impact

The MA impacted mountainous terrain at 23:10:06L 10 NM southeast of BAF (Tabs V-1.48 and AA-5). At the time of the impact, the MA had the same configuration as it did upon takeoff, with 4,700 pounds of fuel remaining (Tabs J-3 and AA-6). Upon impact, the MA's flight conditions were: altitude 8,760 feet MSL; two degree climb; 1,800 feet per minute positive vertical velocity; 244 knots calibrated airspeed; maximum AB; and 1.8 G's (Tab J-CSMU).

f. Egress and Aircrew Flight Equipment

Flight data recordings show the MP was on the controls through the time of impact. There was no ejection attempt (Tab AA-5).

The NVGs and NVG bracket were in good working order. The MP signed out an NVG set before the mishap sortie. The NVGs, along with all of the MP's AFE, were within T.O. specifications and had a current inspection by qualified technicians (Tab H-4).

g. Search and Rescue (SAR)

At 23:10:06L, upon MA impact, the MW lost radar contact with the MA. The MW attempted to check in with the MP multiple times, with no response (Tab N-11 to N-12). Concurrently, there were radio transmissions on BAF Tower frequency about a fire just south of the runway (Tab N-11). The MW contacted Tower and Approach and picked up IFR vectors to an ILS landing. While recovering, the MW continued to attempt to contact the MP and queried Approach and Tower if they were in contact with the MP (Tab N-12). The MW landed uneventfully (Tab V-1.48).

The MW then contacted Top-3 and asked if the MP had landed and called in his codes. Top-3 notified the MW that the MP had not called down with his codes. At approximately the same time, the Supervisor of Flying (SOF) informed Top-3 that Tower and Approach Control lost contact with the MP and witnessed a fireball just south of the runway. At this point, the Top-3 "locked down" the squadron, notified maintenance supervision, the squadron commander, and the director of operations and began working through the appropriate checklists (Tab V-3.11).

The SOF ran the downed aircraft checklist and the flight safety officer contacted the Joint Personnel Recovery Center. The SOF coordinated for assets to investigate the fire south of the runway. After determining this fire was not the MA, he rerouted the assets to the area where contact with the MA was lost (Tab V-6.3 to V-6.4 and V-8.10 to V-8.11).

The search continued through the night. Just after sunrise on the morning of 4 April 2013, the debris field was located where radar contact was lost. After a Pathfinder Quick Reaction Force secured the site, the Interim Safety Board team flew out to the mishap location (Tab V-24.2). The crash site was on the side of a steep mountain, at an elevation of 8,760 feet MSL, making recovery challenging (Tabs J-CSMU and V-24.2). Over the course of the next three days, the team secured the crash survivable flight data recorder (CSFDR), mapped out the wreckage using Global Positioning Satellites (GPS) and photography, and retrieved portions of the wreckage (Tabs J-CSMU and V-24.2 to V-24.4).

h. Recovery of Remains

Between 4 and 5 April 2013, a team of U.S. Army and U.S. Air Force experts recovered the MP's remains and returned them to BAF (Tab V-24.2 to V-24.3). On the evening of 5 April 2013, BAF conducted a ramp ceremony in honor of the MP (Tab V-2.16 and V-24.2 to V-24.4). A ramp ceremony is conducted on the flightline at the departure of the remains to afford dignity and respect to the deceased servicemember (Tab BB-20).

5. MAINTENANCE

a. Forms Documentation

Air Force Technical Order (AFTO) 781 series forms, Integrated Maintenance Data System (IMDS), and Time Compliance Technical Orders (TCTO) document aircraft maintenance and provide a record of inspections, servicing, configuration, status and flight records related to a specific aircraft (Tab U-3).

AFTO 781 series aircraft maintenance forms assigned to the MA were thoroughly reviewed. No discrepancies relevant to the mishap were noted. Aircraft engine, flight controls, and hydraulic components were all within prescribed inspection periods. A detailed review of AFTO 781 historical records for the 90 days preceding the mishap revealed no evidence of mechanical, structural, or electrical discrepancies (Tab U-3).

A review of IMDS historical records and current TCTOs revealed one administrative error. An incorrect maintenance status symbol was entered into IMDS; this symbol did not affect the airworthiness of the MA (Tab U-3). There was no evidence to suggest that compliance with AFTOs, or maintenance historical records were a factor in this mishap.

b. Inspections

Phase inspections are scheduled maintenance inspections performed on Air Force aircraft at specific flying hour intervals. The Block 50 F-16C requires a 400-hour phase inspection cycle to inspect the aircraft components and airframe for damage, structural integrity and correct systems operation (Tabs D-2 and BB-15). The MA accumulated 161.5 hours since the last required 400-hour inspection and was within the required inspection interval at the time of the mishap (Tab D-2).

The total operating hours for the single aircraft engine installed on the MA was 6,857.8 and it accumulated 312 hours since the last required 400-hour inspection. The engine was within the required inspection interval at the time of the mishap. The engine was last installed in the MA on 4 February 2013 and all inspections on the 781K in the AFTO Forms binder were current (Tabs D-2 and U-3).

In accordance with Technical Order (T.O.) 00-20-1, a Thru-Flight (TH) “inspection is a ‘between flights’ inspection and will be accomplished after each flight when a turnaround sortie or a continuation flight is scheduled and a basic post-flight inspection is not required” (Tab BB-14). A timely TH inspection was accomplished on 3 April 2013 at 1501L and a qualified production superintendent accomplished an Exceptional Release (Tab U-15).

c. Maintenance Procedures

A review of the MA’s AFTO 781 series forms and IMDS revealed all maintenance actions on the MA were accomplished in compliance with standard approved maintenance procedures and technical orders (Tabs D-3 to D-22 and U-3). There was no evidence to indicate that maintenance procedures were a factor in this mishap.

d. Maintenance Personnel and Supervision

All maintenance activities reviewed were normal and all personnel involved in the preflight, servicing, inspecting, and launch of the MA were qualified and proficient in their duties. The Special Certification Roster was reviewed to ensure maintenance personnel were qualified for servicing, inspecting, troubleshooting, and releasing the aircraft for flight. Maintenance training records (AF Forms 623 and 797) were reviewed and revealed no training deficiencies (Tab U-3).

e. Fuel, Hydraulic, and Oil Inspection Analyses

Fuel truck number 89L01185 was isolated as the last fuel truck to service the MA. Fuel from this truck, all equipment items, and storage areas were isolated and sampled. All test samples passed in accordance with T.O. 42B-1-1 (Tabs U-9 and BB-10 to BB-11).

The Non-Destructive Inspection (NDI) section performs two tests: Joint Oil Analysis Program (JOAP) Atomic Emission Spectrometry and Scanning Electron Microscope/Energy Dispersive X-Ray (SEM/EDX). JOAP records for the two sorties prior to the mishap sortie on 3 April 2013 were reviewed and the results were well within limits (Tab U-8). The MA was also serviced by oil cart #1 after the sorties and lab results from this cart were within limits (Tab U-7). SEM/EDX analysis on the magnetic chip detector (MCD) inspections after the first and second sortie returned normal (Tab U-19).

Post-accident results on the fuel, hydraulic, and oil systems of the MA were not performed due to destruction of the MA.

f. Unscheduled Maintenance

The MA flew two sorties on 3 April 2013, prior to the mishap. The most recent unscheduled maintenance performed on the MA was after the second flight of the day on 3 April 2013 (Tab D-20). The engine required a MCD inspection by NDI after the first flight, which was analyzed and was within limits (Tab U-19). Routine pre-flight and TH inspections were performed by qualified maintenance personnel and all aircraft systems and components requiring servicing or inspection were properly documented (Tabs D-10 to D-21, U-3, and U-15). There was no evidence that unscheduled maintenance procedures were relevant to the mishap.

6. AIRFRAME, MISSILE, OR SPACE VEHICLE SYSTEMS

a. Structures and Systems

Prior to impact, the MP reported the MA was “Code-1” (Tab N-2). The CSFDR and the Digital Video Recorder were recovered from the crash site. Lockheed Martin engineers evaluated the data from this component and concluded the electrical, hydraulic, flight control and ground collision avoidance systems were operating normally when the MA impacted the mountain. Due to impact and post-crash fire, many parts were badly damaged or unrecoverable. None of the recovered parts indicated a malfunction, nor was there any indication that the pre-crash condition of the aircraft systems or structures were a factor in the mishap (Tab J-11).

There was no indication hostile fire damaged the MA. The MP was flying over rugged, mountainous terrain, at night, and in IMC (Tabs V-1.9, V-1.36 and V-24.2). These environmental conditions alone would have made a successful engagement by a hostile force unlikely. Additionally, there were neither intelligence reports of enemy activity nor claims of responsibility. These factors, coupled with the data from the CSFDR, cockpit videos, communication recordings, and ATC radar tapes make it unlikely that enemy fire was relevant to the mishap (Tabs J-CSMU, M-2 to M-4, N-2 to N-12, and AA-5 to AA-6).

(1) Hydraulic Power System

Crash Survivable Memory Unit (CSMU) recordings showed no indications of low System A or B hydraulic pressure during the available data (last 90 minutes of flight). This indicated that both System A and System B hydraulics were operating normally (Tab J-8).

(2) Fuel System

CSMU data showed normal fuel flow and fuel quantity information until impact (Tab J-8).

(3) Flight Control System

CSMU data indicated that the flight control system was functioning normally (Tab J-8).

(4) Emergency Power System

CSMU data indicated there were no electrical or hydraulic failures that would require emergency power and the emergency power unit was not operating during the available data (Tab J-8).

b. Evaluation and Analysis

Not applicable.

7. WEATHER

a. Forecast Weather

The Weather Flight provided the mission execution forecast on 3 April 2013 (Tab F-2).

At MF takeoff (19:06:47L), the forecast weather for BAF at the MF's expected landing time was winds from the south at nine knots, unrestricted visibility, scattered clouds at 6,000 feet AGL, and a broken cloud cover at 14,000 feet AGL. Local weather advisories, watches, and warnings included a surface wind advisory for winds between 15 and 25 knots along with a weather watch for lightning within 5 NM of BAF. A temporary (TEMPO) condition was also forecast from 2030L to 2330L, covering the MF's expected landing time. The TEMPO forecast included light rain, thunderstorms, scattered clouds at 6,000 feet AGL with cumulonimbus clouds, and a broken ceiling at 10,000 feet AGL (Tab F-7).

b. Observed Weather

Figure 1 below shows the composite weather reflectivity data for BAF eight minutes prior to the mishap. Areas of green and blue represent areas of precipitation (Tab F-11). The black line represents the MA's flightpath (Tabs J-CSMU and M-2 to M-4). The grey circle is an area of no reflectivity directly over BAF (Tab F-11).

Prior to the mishap, the most recent weather observation at BAF was a special observation (SPECI) taken at 2246L. The SPECI included winds from the northeast at 7 knots, unrestricted visibility, few clouds at 4,000 feet AGL, scattered clouds at 6,000 feet AGL, broken ceiling at 7,500 feet AGL, and overcast clouds at 9,500 feet AGL. In addition, there was a wind advisory for winds between 15 and 25 knots and a lightning watch for lightning within 5 NM of BAF (Tab F-7). There was a waning crescent moon that was 38% visible (Tab W-3).

At 23:04:30L, the MW received the ATIS weather broadcast (Tab N-8). The MW relayed the ATIS to the MP as: "Tango, runway three, it's wet. Winds are 220 at 5. We got scattered ceilings at 4000 and 5000, light rain and 3022" (Tab N-4). At 23:07:22L, the MP asked the MW, "Where are the clouds?" The MW responded with "5000, 7000 broken 10,000" (Tabs N-4 and AA-5). Although the actual ATIS differed from the reports the MW passed over the radio, both reports stated cloud cover, wet runway, and the correct altimeter setting (Tab N-4).

The MW testified that during RTB, there was an easily visible 16,000 foot AGL undercast and a thunderstorm to the northwest of their position (Tab V-1.36). The MF descended into and remained in IMC until the MA impacted the mountainside (Tab V-1.31 to V-1.37).

After the mishap occurred, the next weather observation taken was at 2325L. This observation stated winds from the northeast at 4 knots; unrestricted visibility; scattered clouds at 6,000 feet AGL and 7,000 feet AGL; broken ceiling at 9,500 feet AGL and broken at 13,000 feet AGL; and temperature 10 degrees Celsius. The previous advisories for winds between 15 and 25 knots and lightning within 5 NM of BAF were still in effect (Tab F-7).

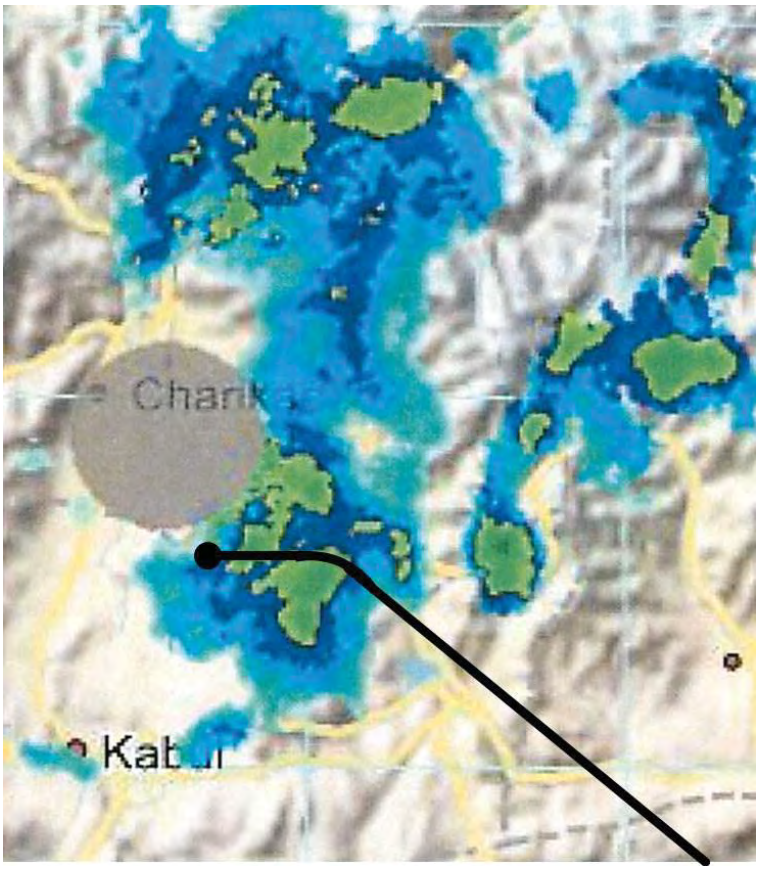

Figure 1: Weather Radar Composite Reflectivity (2302L) and MF Flight Path (Tabs F-7, J-CSMU and M-2 to M-4)

c. Space Environment

Not applicable.

d. Operations

There is no evidence that any F-16C weather-related operational limits (thunderstorm penetration speeds, flight in icing conditions, etc.) were exceeded (Tab AA-6).

8. CREW QUALIFICATIONS

a. Mishap Pilot (MP)

MP was a current and qualified flight lead in the F-16C (Tab G-2). He had 1,014.2 hours of flying time (Tab G-4). Specifically, the MP had 723 hours of primary F-16C time, 400.5 combat hours, 139.5 night hours, and 132.7 hours using NVGs (Tab G-4 and G-14). The MP completed the two-ship flight lead upgrade in August 2012 (Tab T-20). During the deployment, the MP flew 31 of his 85 sorties as the flight lead (Tab T-13 to T-18).

The MP was an outstanding young officer and well-respected fighter pilot. He had many friends in the squadron and was enthusiastic about flying the F-16 (Tabs DD-3 and V-11.1).

Recent flight time is as follows (Tab G-4):

	Hours	Sorties
Last 30 Days	45.7	10
Last 60 Days	97.5	22
Last 90 Days	127.5	32

b. Mishap Wingman (MW)

The MW is a current and qualified flight lead in the F-16C (Tab G-2). At the time of the mishap, he had 1,758.0 hours of total flying time, 964.4 hours of primary F-16C time, 400.6 combat hours, 241 night hours, and 232.4 hours using NVGs. In addition, the MW had 569.2 hours of non-F-16C instructor time (Tab T-6 to T-11).

Recent flight time is as follows (Tab T-7 to T-11):

	Hours	Sorties
Last 30 Days	82.7	18
Last 60 Days	109.4	27
Last 90 Days	162.8	41

9. MEDICAL

a. Qualifications

The MP was medically qualified to perform flying duties at the time of the mishap. The MP's annual Preventative Health Assessment (PHA) was current and a review of the Aeromedical Information and Medical Waiver Tracking System database demonstrated a current and valid waiver. This review plus observations from his squadron flight surgeon did not show any evidence of residual Traumatic Brain Injury symptoms from an earlier injury (Tabs V-2.17, V-11.1 and X-3). The MP had no physical or medical restrictions and was worldwide qualified at the time of the mishap (Tab X-3).

The MW was medically qualified to perform flying duties at the time of the mishap. The MW's annual PHA was current and a review of the Aeromedical Information and Medical Waiver Tracking System database demonstrated a current and valid waiver. The MW had no physical or medical restrictions and was worldwide qualified at the time of the mishap (Tab X-3 to X-4).

b. Health

Not applicable.

c. Pathology

The MP died of multiple injuries as a result of the crash (Tab X-5). Toxicology testing was conducted following the mishap. All toxicology testing on the MP and MW were negative (Tab X-3).

d. Lifestyle

The MP followed a regimented health program including regular exercise and healthy diet (Tabs V-1.20 and X-3). There is no evidence to suggest that any lifestyle factors were relevant to the mishap.

e. Crew Rest and Crew Duty Time

All aircrew are required to have proper crew rest prior to performing flying duties as outlined in AFI 11-202, Volume 3, paragraphs 9.4.5 and 9.8. Proper crew rest is defined as a minimum of a 12-hour non-duty period before the designated flight duty period begins. During this time, an aircrew member may participate in meals, transportation, or rest as long as he or she has had at least 10 hours of continuous restful activity with an opportunity for at least 8 hours of uninterrupted sleep. The MP demonstrated no abnormalities the night prior to the mishap and was perceived to be well rested on the day of the mishap (Tabs V-1.53 to V-1.54, V-4.2, V-11.1 to V-11.2, and X-3). The MW demonstrated no abnormalities the night prior to the mishap and felt well rested on the day of the mishap (Tabs V-1.53, V-4.2, and X-3 to X-4).

10. OPERATIONS AND SUPERVISION

a. Operations

The MSQ pilots, to include the MP and MW, received pertinent training and instruction on operating at BAF prior to their relocation, as described in paragraph 4.a above (Tab V-4.2). Living conditions at BAF were described as good, with particular satisfaction with food services as compared with those at KAF (Tab V-19.2). There were no signs of mission fatigue (Tab V-2.14). The MSQ was scheduled to redeploy at the end of April (Tab V-2.13).

The MP was experienced and flew, on average, every third day. The mishap sortie's flight duration was of average length (Tab G-2 and G-4).

On 30 March 2013, the MP flew a ferry sortie to BAF (Tabs G-14 and V-3.8). The MP's flight lead made it a point to identify areas of high terrain (Tab V-3.8). On 1 April 2013, the MW led the MP on a two-ship combat mission. Upon RTB, the flight flew over BAF and executed a full IFR recovery, specifically so they could see the significant terrain features surrounding BAF (Tab V-1.10).

b. Supervision

Mission oversight was in accordance with AFI 11-418 (Tab V-1.13). All MSQ pilots were required to review all governing flight publications before their first BAF sortie. The commander was responsible for the squadron's supervision. The MP completed his publications

review and was cleared to fly at BAF by MSQ Standardization and Evaluations (Tab G-24). MSQ Top-3 supervision conducted day-to-day operations supervision. Operations supervision was present during both day and night shifts. MSQ Top-3 validated Go/No-Go items, authorized the flight, and briefed the MP and MW prior to departure (Tabs K-14 and V-1.21). A Top-3 shift change occurred after the MF departed on its mission. The new Top-3 was on duty during the initial response and recovery effort after the mishap (Tab V-3.9).

There is no evidence to suggest supervision was a factor in this mishap.

11. HUMAN FACTORS

a. Introduction

AFI 91-204, Attachment 5, contains the Department of Defense Human Factors Analysis and Classification System which lists potential human factors that can play a role in aircraft mishaps.

b. Applicable Factors

(1) Risk Assessment – During Operations

In accordance with AFI 91-204, Attachment 5, "Risk Assessment – During Operation" is a factor when the individual fails to adequately evaluate the risks associated with a particular course of action and this faulty evaluation leads to an inappropriate decision and subsequent unsafe situation. This failure occurs in real-time when formal risk-assessment procedures are not possible.

Following the tactical portion of the mission, the MF began to RTB at 23:00:26L. At 23:02:08L, the MP made radio contact with Kabul Approach Control while the MW was simultaneously monitoring another radio frequency to check out with the tactical control agency, obtain ATIS information, and call in aircraft codes to squadron operations. The MP requested a VFR recovery from Kabul Approach. Kabul Approach approved the VFR request. Then at 23:05:02L, Kabul Approach clarified with the MP as to his intentions for landing. MP requested a visual straight-in for runway 03 at Bagram. Approach answered, "Roger, VFR altitude is your discretion" (Tab N-2 to N-4 and N-9). This approval is consistent with standard Kabul Approach procedures (Tab V-16.3).

After receiving the current weather and seeing a 16,000 foot MSL undercast, the MP elected to operate under VFR in IMC (Tabs N-4, N-9 and V-1.36). The MW testified that through the NVGs he could see the cloud they were flying into and it was definite cloud penetration (Tab V-1.40). At 23:08:17L, the MP descended below the published MSA (Tab AA-3 and AA-5).

The MP operated under VFR in IMC in the terminal area for 2 minutes 44 seconds and below the published MSA for 1 minute 49 seconds without taking corrective action (Tabs N-3 to N-5, AA-3, and AA-5).

The MP likely failed to adequately evaluate the risks associated with flying VFR in IMC and below the MSA and subsequent unsafe situation.

(2) Caution/Warning Ignored

In accordance with AFI 91-204, Attachment 5, "Caution/Warning Ignored" is a factor when a caution or warning is perceived and understood by an individual but is ignored by the individual leading to an unsafe situation.

The MA systems warned the MP of low altitude conditions at 23:09:43L, 23 seconds before impact (Tab J-6). Within six seconds, the MA alerted the MP two additional times, yet the MP continued to descend (Tabs J-CSMU and N-5). These low altitude warnings would not have been present if the MA remained above MSA (Tabs J-9 and AA-3). Four seconds prior to impact, the MP received a "pull up, pull up" warning and a large, flashing "X" symbol mnemonic in the HUD and both MFDs (Tabs J-7, N-6 and AA-5). At this point, data indicates the MP did perceive this final warning since he applied aft pressure. Despite the severity of this warning however, the MP only pulsed the control stick with 2.0 to 17.5 pounds of aft pressure instead of applying full aft pressure (Tab J-7).

(3) Vision Restricted by Meteorological Conditions

In accordance with AFI 91-204, Attachment 5, "Vision Restricted by Meteorological Conditions" is a factor when weather, haze, or darkness restricted the vision of an individual to a point where normal duties were affected.

The mishap occurred at 23:10:06L with a waning crescent moon that was 38% visible (Tab W-3). The MW stated the weather from 20 to 30 NM from BAF was enough to "get your attention and look for ice." Further, he said, "There's no way you're getting back VFR maintaining any kind of VFR cloud clearance getting back" (Tab V-1.30 and V-1.46). The darkness and weather conditions limited the MP's ability to see the mountainous terrain.

The AIB was unable to determine if the MP was using NVGs at the time of impact; however, the MW stated that during previous sorties, the MP would notify the MW once he had taken them off in accordance with Air Force procedures. As the MW had not received this call during the mishap sortie, it was likely the MP was still using NVGs (Tab V-1.50). When using NVGs in weather, there is a significant increase in scintillation (often referred to as "sparkles"). This scintillation would have further restricted the MP's ability to see both inside and outside the cockpit and caused a distraction (Tab V-1.39).

At 23:09:55L the MW asked the MP if he was still in the weather to which the MP responded "affirm," then asked the MW if he was as well. The MP was IMC and would have been unable to see the mountain prior to impact (Tab N-11).

(4) Negative Transfer

In accordance with AFI 91-204, Attachment 5, "Negative Transfer" is a factor when an individual reverts to a highly learned behavior used in a previous system or situation and that response is inappropriate or degrades mission performance.

The MP and MW spent the first five months of their deployment flying out of KAF. The area around KAF had very little elevated terrain (Tab V-1.4 to V-1.6). Four days before the MF, the MP's squadron moved to BAF, which has high terrain (Tab AA-3). The MF was only the MP's second sortie flown out of BAF (Tab V-1.9 and V-1.19). As the MP flew 40 night approaches into KAF, and only one prior night approach into BAF, it is possible he reverted to a mental model of flat terrain (Tab G-12 to G-15).

Figure 2: KAF (minimal terrain) (Tab Z-3)

Figure 3: BAF (mountainous terrain) (Tab Z-5)

Evidence shows an additional negative transfer occurred. While operating outside of a terminal area during tactical portions of any sortie, pilots flew under VFR due to the limitations of the airspace system in Afghanistan. Throughout the deployment, MSQ pilots routinely flew in IMC, above the MSA, while under VFR as this was necessary to complete their combat requirements. These requirements included cruising en-route, air-to-air refueling, and tactical holding (Tab V-1.15, V-2.8, and V-2.12).

The negative transfer of this learned behavior likely contributed to the MP inappropriately entering and remaining IMC in the terminal area while under VFR.

(5) Expectancy

In accordance with AFI 91-204, Attachment 5, "Expectancy" is a factor when an individual expects to perceive a certain reality and those expectations are strong enough to create a false perception of the expectation.

The MW assumed the MP was on an approved IFR approach as the MF began descending through clouds (Tab V-1.37 and V-1.44). The MW switched frequencies to obtain ATIS and did not hear the MP's request and Kabul Approach's approval for a VFR recovery (Tabs N-3, N-8 to N-9, and AA-5). The MW further expected an IFR approach for the following reasons:

- In the mission brief prior to flight, the MP briefed the MF would recover IFR to an ILS absent "glorious" weather (Tab V-1.5 and V-1.22);
- AFI 11-202, Volume 3, ACC Supplement, paragraph 8.1.4, states: "Pilots shall fly under IFR if operating fixed-wing aircraft at night, unless the mission cannot be flown under IFR;" and
- The MW assumed the MP would not descend into IMC without an IFR clearance (Tabs V-1.37, V-1.44, and AA-5).

The MW's expectations for an IFR recovery were strong enough to create a false perception that the MF would actually recover IFR. Therefore, the MW disregarded the initial indications the MF was on a VFR recovery (Tab V-1.37 to V-1.41). By the time the MW realized the flight was operating VFR in IMC and started to query the MP, it was too late.

12. GOVERNING DIRECTIVES AND PUBLICATIONS

a. Publically Available Directives and Publications Relevant to the Mishap

(1) Air Force Handbook 11-203, Volume 2, *Weather for Aircrews*, 16 May 2002
(2) Air Force Instruction 11-202, Volume 3, *General Flight Rules*, 20 October 2010
(3) Air Force Instruction 11-202, Volume 3, ACC Supplement, *General Flight Rules*, 28 November 2012
(4) Air Force Instruction 11-214, *Air Operations Rules and Procedures*, 14 August 2012
(5) Air Force Instruction 11-2F-16, Volume 1, *F-16 Pilot Training*, 11 August 2011
(6) Air Force Instruction 11-2F-16, Volume 3, *F-16 Operations Procedures*, 18 February 2010

(7) Air Force Instruction 11-418, *Operations Supervision*, 15 September 2011, Incorporating Change (IC) 1, 1 March 2013
(8) Air Force Instruction 51-503, *Aerospace Accident Investigations*, 26 May 2010
(9) Air Force Instruction 91-204, ACC Supplement, *Safety Investigations and Reports*, 16 November 2007, Certified Current 7 July 2010
(10) Air Force Manual 11-217, Volume 1, *Instrument Flight Procedures*, 22 October 2010
(11) Air Force Manual 11-217, Volume 2, *Visual Flight Procedures*, 22 October 2010
(12) Air Force Manual 11-217, Volume 3, *Flying Operations*, 23 February 2009, Certified Current 9 April 2012

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

b. Other Directives and Publications Relevant to the Mishap

(1) Air Force Tactics, Techniques and Procedures (AFTTP) 3-3.F-16, *Combat Aircraft Fundamentals*, 29 June 2012
(2) HQ USCENTCOM Regulation 638-1, *Deceased Personnel Mortuary Affairs Support*, 5 March 2007
(3) Islamic Republic of Afghanistan Aeronautical Information Publication (AIP), 57th Edition, 7 March 2013
(4) Memorandum, Updated Modafinil Policy for Management of Fatigue Among Aircrew and Special Operational Duty Personnel (HQ USAF/SG and HQ USAF/XO Joint Memo, "Modafinil and Management of Aircrew Fatigue," 2 Dec 03), 31 August 2006
(5) T.O. 00-20-1, *Aerospace Equipment Maintenance Inspection, Documentation, Policies, and Procedures*, 1 September 2010
(6) T.O. 1F-16-1-2-1, *Flight Manual*, 1 July 2009, IC 1, 1 May 2011
(7) T.O. 1F-16-2-34SD-00-1, *Navigation System*, 1 April 2006
(8) T.O. 1F-16CJ-6, *Scheduled Inspections and Maintenance Requirements*,1 October 2012
(9) T.O. 1F-16CM-1CL-1, *Flight Crew Checklist*, 15 April 2007, IC 6, 1 July 2011
(10) T.O. 1F-16CM-34-1-1, *Nonnuclear Weapon Delivery Manual*, 1 July 2011
(11) T.O. 33-1-37-2, *Joint Oil Analysis Program Manual*, Volume 2, 31 July 2012
(12) T.O. 42B-1-1, *Quality Control of Fuels and Lubricants*, 13 August 2012, IC 1, 19 November 2012

c. Known or Suspected Deviations from Directives or Publications

The MF deviated from AFI 11-202, Volume 3, paragraph 7.3 and table 7.2, when it entered IMC instead of remaining more than 1,500 meters horizontally and 300 meters vertically from clouds on a VFR clearance. This was discussed in paragraph 11.b.1 above.

The MF deviated from AFI 11-2F-16, Volume 3, paragraph 3.15.1, by flying IMC below the MSA without terrain following radar. This was discussed in paragraph 11.b.1 above.

The MF deviated from AFTTP 3-3.F-16, paragraph 9.13.16, by flying in IMC while using NVGs. This was discussed in paragraph 11.b.3 above.

13. ADDITIONAL AREAS OF CONCERN

The AIB identified one additional area of concern.

There were gaps in the Digital Terrain Elevation Data (DTED) coverage on the night of the mishap (Tab V-25.1). The "OFF MAP" and "NO GPW" (ground proximity warning) mnemonics in the HUD prior to and during the recovery into BAF, properly conveyed to the MP and MW the fact that the DTED was incomplete. This affected neither the LIS warning nor the three ALOW warnings. However, had the DTED data been complete, PGCAS would have provided earlier altitude warning than the MP actually received (Tabs J-7, J-10, V-25.1, and AA-5). It is possible that had the MP received this earlier, DTED-derived PGCAS warning, he would have reacted and climbed in time to avoid the mountain.

Robert J. Beletic

31 May 2013

ROBERT J. BELETIC
Brigadier General, USAF
President, Accident Investigation Board

STATEMENT OF OPINION

F-16C, T/N 00-0219
10NM SOUTHEAST OF BAGRAM AIRFIELD, AFGHANISTAN
3 April 2013

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

I find by clear and convincing evidence the cause of the mishap was the Mishap Pilot's (MP) failure to perceive mountainous terrain directly in his flight path while flying below the minimum safe altitude using visual flight rules in instrument meteorological conditions (i.e., clouds) resulting in controlled flight into terrain.

2. DISCUSSION OF OPINION

On 3 April 2013 at 23:10:06L (18:40:06Z) the mishap aircraft (MA), an F-16C, tail number (T/N) 00-0219, deployed with the 77th Expeditionary Fighter Squadron to Bagram Airfield (BAF), Afghanistan, impacted a mountainside 10 nautical miles (NM) southeast of BAF. The mishap flight (MF) was a combat mission in support of ground forces assigned in the United States Central Command's Area of Responsibility. The crash occurred in an unpopulated area. The MA was destroyed with a loss valued at $30,945,228. The MP did not attempt to eject from his aircraft and was fatally injured. United States air and ground forces recovered the remains of the MP. The mishap caused neither civilian injuries nor damage to civilian property.

The MA took off from BAF on 3 April 2013 at 19:06:47L (14:36:47Z) and flew the entire sortie at night. The MP was the flight lead of a two ship of F-16Cs tasked to provide close air support in Afghanistan. Upon completion of the mission, the MP directed the MW to a two nautical mile trail position. The MP then contacted air traffic control and requested a visual flight rules (VFR) recovery, whereby the MP assumed responsibility for traffic and terrain avoidance. BAF was reporting a 7,000 foot above ground level broken cloud layer and light rain. While maneuvering to land, the MP descended below the published minimum safe altitude (MSA) into a mountainous area visually obscured by weather conditions. Prior to impact, the MA provided low altitude warnings, however the MP did not take timely corrective action.

VFR is a set of rules governing the conduct of flight clear of clouds; Instrument Meteorological Conditions (IMC) means low visibility conditions, in this case clouds. The MP operated under VFR in IMC in the terminal area for 2 minutes 44 seconds and below the published MSA for 1 minute 49 seconds without taking corrective action. The MA's radar altimeter provided low warnings to the MP 23 seconds, 20 seconds, and 17 seconds prior to impact; yet the MP continued his descent. Digital Terrain Elevation Data (DTED) was not available for this location

in Afghanistan, therefore the predictive feature of the Predictive Ground Collision Avoidance System (PGCAS) was not available to the MP. However, the PGCAS, using non-predictive radar altimeter data, provided a final altitude warning which began four seconds prior to and continued until impact. The MP did not react in accordance with the severity of the situation and began only a modest climb.

The MP failed to properly assess the risk of recovering under VFR in IMC into BAF. The risk assessment failure was most likely due to a human factor known as "Negative Transfer." While operating outside of a terminal area during tactical portions of any sortie, pilots flew under VFR due to the limitations of the airspace system in Afghanistan. Throughout the deployment, mishap squadron pilots routinely flew in IMC, above the MSA, while under VFR, as this was necessary to complete their tactical requirements. The mishap squadron spent the first five months of its deployment flying out of Kandahar Airfield (KAF), which is surrounded by relatively flat terrain and normally had clear weather. Five days before the mishap, the mishap squadron moved to BAF. BAF is surrounded by high mountainous terrain and often has poor weather in its terminal area. The MP negatively transferred both the learned tactical VFR in IMC to the BAF terminal area and his KAF flat terrain mental model to the BAF mountainous terrain reality. These negative transfers occurred despite the fact that operations and leadership had provided all the proper briefings and information to fully inform the MP of the mountainous terrain and IMC recovery procedures.

The MW did not intervene due to the human factor known as "Expectancy." The MW assumed the MP was on an approved Instrument Flight Rules (IFR) clearance as the MF descended into IMC. Under IFR, air traffic control (ATC) assumes responsibility for terrain and traffic collision avoidance. The MW did not hear the MP's request and subsequent ATC approval of a VFR recovery as the MW was on a different radio frequency. He expected to recover IFR to an instrument approach as the MP had briefed. The MW also assumed the MP would not descend into IMC nor fly below the MSA in IMC without being on an IFR clearance. The MW's expectations of an IFR recovery were strong enough to create a false perception that the MP was actually recovering by IFR despite indications to the contrary. By the time the MW realized the flight was operating VFR in IMC and started to query lead, it was too late.

3. CONCLUSION

I developed my opinion by analyzing applicable Air Force directives and guidance, engineering analyses, witness testimony, flight data, F-16C flight simulations, animated simulations, and information provided by technical experts. **I find by clear and convincing evidence the cause of the mishap was the MP's failure to perceive mountainous terrain directly in his flight path while flying below the minimum safe altitude using visual flight rules in instrument meteorological conditions (i.e., clouds) resulting in controlled flight into terrain.**

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31 May 2013

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