UNITED STATES AIR FORCE
AIRCRAFT ACCIDENT INVESTIGATION
BOARD REPORT

F-16CM, T/N 91-0375

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

LOCATION: CENTCOM AOR

DATE OF ACCIDENT: 1 DECEMBER 2014

BOARD PRESIDENT: BRIGADIER GENERAL
JEFFREY B. TALIAFERRO

Conducted IAW Air Force Instruction 51-503

EXECUTIVE SUMMARY
AIRCRAFT ACCIDENT INVESTIGATION

F-16CM, T/N 91-0375
CENTCOM AOR
1 DECEMBER 2014

On 1 December 2014, at 04:58:10 hours local time (L) (02:58:10 hours Zulu time (Z)), the Mishap Aircraft (MA), an F-16CM, Tail Number (T/N) 91-0375, deployed with the 77th Expeditionary Fighter Squadron to a classified base of operation (BO) in the U.S. Central Command Area of Responsibility, impacted the ground 9.5 nautical miles southeast of the BO. The Mishap Flight (MF) was a combat mission in support of Operation Inherent Resolve. The mishap occurred in an unpopulated area. The Mishap Pilot (MP) did not attempt to eject from his aircraft and was fatally injured on impact. The MA was destroyed with a loss valued at $30,796,852. Host nation forces recovered the MP's remains and transported them to U.S. forces at the BO. The mishap caused neither civilian injuries nor damage to civilian property. Many domestic and international media sources reported on the mishap.

The MF took off from the BO on 1 December 2014, at 0421L (0221Z), and flew entirely at night. Upon takeoff, the Mishap Wingman (MW) experienced a landing gear door malfunction requiring the MF to remain near the BO, burn down fuel, and land. During the subsequent recovery to base, the MP unintentionally descended from 3000' mean sea level (MSL) to the ground (1,680' MSL). The MP maneuvered the MA during this 32-second period, but did not attempt to stop the descent until an abrupt pull away from the ground during the last second of flight, which was insufficient to avoid impact.

The MP flew 1000' below the minimum altitude prior to starting the landing approach, reducing the time to recognize and recover from the subsequent unintentional descent. With no radar control, to expedite their combat mission, the MF executed a common practice of joining the instrument approach inside the initial approach fix, against published procedures. The MP did not attempt to eject from the MA and died upon impact.

The Accident Investigation Board (AIB) President found by clear and convincing evidence the cause of this mishap was the mishap pilot's unrecognized descent into the ground resulting in controlled flight into terrain.

Additionally, the AIB President found by a preponderance of the evidence that the MP's initial intentional descent below minimum safe altitude, significantly reducing the time available to recognize and respond to the unrecognized descent, was a factor that significantly contributed to the mishap.

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.

SUMMARY OF FACTS AND STATEMENT OF OPINION
F-16CM, T/N 91-0375
1 DECEMBER 2014

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ACRONYMS AND ABBREVIATIONS

/	per
1CO	Aviation Records
20 FW	20th Fighter Wing
397th ELRS/AFPET	397th Expeditionary Logistics Readiness Squadron/ Air Force Petroleum Agency
407 AEG	407th Air Expeditionary Group
407 AEG/ELRS	407th Air Expeditionary Group/Expeditionary Logistics Readiness Squadron
77 EFS	77th Expeditionary Fighter Squadron
77 FS	77th Fighter Squadron
9 AF	9th Air Force
AB	Afterburner
ACC	Air Combat Command
ACFT	aircraft
ADG	Accessory Drive Gearbox
ADI	Attitude Director Indicator
AF	Air Force
AFB	Air Force Base
AFCENT	Air Forces Central Command
AFE	Aircrew Flight Equipment
AFI	Air Force Instruction
AFIP	Air Force Institute of Pathology
AFMAN	Air Force Manual
AFPAM	Air Force Pamphlet
AFPET	Air Force Petroleum Agency
AFTAT	Air Force Testing and Analysis Tool
AFTO	Air Force Technical Order
AGCAS	Automatic Ground Collision Avoidance System
AGL	Above Ground Level
AI	Air-Speed Indicator
AIB	Accident Investigation Board
AIM	Air Intercept Missile
Alt	altitude
AMMO	ammunition
AMU	Aircraft Maintenance Unit
Angl	angle
AOA	Angle-of-Attack
AOR	Area of Responsibility
ARC	Curving Trajectory
ASSY	assembly
ATAGS	Advanced Tactical Anti-G System
ATC	Air Traffic Control
ATCH	attach
ATO	Air Tasking Order
AUX	Auxiliary
AWM	Awaiting Maintenance
B/R	broken/removed
Baro	Barometric
BATT	Battery
BD	Battle Damage
BIT	Built In Test
BLK	block
BO	Base of Operation
BPO	Basic Post-flight
BRAG	Breathing Regulator/Anti-G
BRU	Bomb Rack Unit
B-Scope	Borescope
C/L	Centerline
C/W	Complied With
C2	Command and Control
CAOC	Combined Air Operations Center
Capt	Captain
CARA ALOW	Combined Altitude Radar Altimeter Altitude Low
CAT	Crisis Action Team
CAUT	Caution
CCV	Squadron Standardization/Evaluation
CDI	Course Deviation Indicator
CENTCOM	United States Central Command
CH, CHKS	checks
CHG	change
CIP	Core Integrated Processor
CKOUT	checkout
CLN	clean
Col	Colonel
COM	Chief of Mobility
COMM	Communication
CP	Coalition Partner
CSFDR	Crash Survivable Flight Data Recorder
CSMU	Crash Survivable Memory Unit
DBU	Digital Backup Unit
Delta P	Differential Pressure Indicator
DISC	discrepancy
DME	Distance Measuring Equipment
Dn, Dwn	down
DO	Director of Operations
DoD	Department of Defense
DPI	Differential Pressure Indicator
DTC	Data Transfer Cartridge
ECM	Electronic Countermeasures
ECP	Entry Control Point
ECS	Environmental Control System

EFS/CC	Expeditionary Fighter Squadron Commander
ELE	electric
EMI	Electromagnetic Interference
EMP	employee
ENG	engine
EOC	Emergency Operations Center
EOD	Explosive Ordinance Disposal
EOS	Emergency Oxygen System
EP	Emergency Plan
EPS	Emergency Power System
EPU	Emergency Power Unit
ER	Exceptional Release
EST	Eastern Standard Time
EXT	external
F	Fahrenheit
F.O.	Foreign Object
FAF	Final Approach Fix
FCF	Flight Crew Files
FCIF	Flight Crew Information File
FDP	Flight Duty Period
FI	Fault Isolation
FL	Flight Lead
FLCS	Flight Control System
FLP	Flight Duty Period
Flt Doc	Flight Doctor
FOM	Facilitate Other Maintenance
fpm	Feet Per Minute
FPS	Fire Protection System
FRC	Fault Reporting Codes
freq	Frequency
FS	Fighter Squadron
ft	Feet
FUNC	function
G	Gravitational Force
g	gallons
GAAF	Ground Avoidance Advisory Function
GBU	Guided Bomb Unit
GE	General Electric
Gp/CC	Group Commander
GPS	Global Positioning System
GRND	ground
H-70	Hydrazine
HARM	High-speed Anti-Radiation Missile
HBT	Hold Back Tool
HEI	High Incendiary
HFACS	Human Factors Analysis & Classification System
hh:mm:ss.s	hours:minutes:seconds.fractions of seconds
HN	Host Nation
Hndl	Handle
HPC	High Pressure Chamber
HPT	High Pressure Turbine
hr, Hr, H	hour
HRS	hours
HTS	High-speed Anti-Radiation Missile Targeting System
HUD	Heads-Up Display
HUMFAC	Human Factors Consultant
HYB	Hybrid
HYD	Hydraulic fluid
IAF	Initial Approach Fix
IAW	In Accordance With
IC	Incident Commander
ICAO	International Civil Aviation Organization
ICAWS	Integrated Caution, Advisory and Warning System
ICT	Integrated Combat Turn
ID’d	Identified
IF	Intermediate Fix
IFF	Interrogator Friend or Foe
IFR	Instrument Flight Rules
illum	Illumination
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
IMDS	Integrated Maintenance Data System
IMINT	Imagery Intelligence
IMIS	Integrated Maintenance Information System
INFO	Information
inHg	inches of mercury
INS	Inertial Navigation System
INSP	inspection
IP	Instructor Pilot
IRC	Instrument Refreshment Course
ISA	Integrated ServoActuator
ISB	Interim Safety Board
ISB Pilot	Interim Safety Board Pilot Member
ISR	Intelligence, Surveillance, and Reconnaissance
IVO	In the Vicinity of
IVSC	Integrated Vehicle Subsystem Controller
JD7R	JDAM 7 Right
JDAM	Joint Direct Attack Munition
JFS	Jet Fuel Starter
JOAP	Joint Oil Analysis Program
JP-8	Jet Petroleum
JPF	Joint Programmable Fuse
JST	Job Standard
K	Thousand
KCAS	Calibrated Airspeed in Knots
km	kilometers
kts	Knots
L	Local Time
LAO	Local Area Orientation
LAU-129	Launching Unit

LEF	Leading Edge Flap
LF	left
LG	Landing Gear
LM-Aero	Lockheed Martin Aeronautics Company
LN	line
LPS	Loading Procedures
LPT	Low Pressure Turbine
LT	left
Lt Col	Lieutenant Colonel
LUB	lube
LVDT	Linear Variable Differential Transformer
m	meter
MA	Mishap Aircraft
MACC #1	Mishap Aircraft Crew Chief #1
MACC #2	Mishap Aircraft Crew Chief #2
MAIN PWR	Main Power
MAJ	Major
MAJCOM	Major Command
MB	Mishap Base
MCD	Magnetic Chip Detector
MDS	Mission Design Series
MF	Mishap Flight
MFD	Multifunction Display
MFL	Maintenance Fault List
MFR	Memorandum for Record
Mic	microphone
MIL	Military
min	minute
ML	Mishap Location
MLG	Main Landing Gear
mlx	millilux
MMC	Modular Mission Computer
MOC	Maintenance Operations Control
MP	Mishap Pilot
MS	Mishap Sortie
MSA	Minimum Safe Altitude
MSgt	Master Sergeant
MSL	Mean Sea Level
MSQ	Mishap Squadron
MULTI	multiple
MW	Mishap Wingman
N/C/W	Not Complied With
NA	Not Applicable
Nav	Navigation
Nav Aid	Navigational Aid
NCO	Non-Commissioned Officer
ND	Nose Down
NDI	Non-Destructive Inspection
NIT	nitrogen
NLG	Nose Landing Gear
nm	nautical miles
NO	number
NOTAMs	Notice to Airmen
NVG	Night Vision Goggles
NWS	Nose Wheel Steering
O/F	overfly
OBOGS	On-Board Oxygen Generation System
OFP	Operational Flight Program
OG	Operations Group
OGV	Operations Group Standardization/Evaluation
OPR	Officer Performance Report
ops	Operations
Ops Chk	operational check
Ops Sup	Operations Supervisor
Ops Tempo	Operations Tempo
ORM	Operational Risk Management
OROCA	Off Route Obstacle Clearance Altitude
ORTCA	Off Route Terrain Clearance Altitude
OSC	On-scene Commander
OSS	Operations Support Squadron
OVC	Overcast
OXY	Oxygen
PA	Public Affairs
PAPI	Precision Approach Path Indicator
PARS	Pilot Actuated Recovery System
PGCAS	Predicted Ground Collision Avoidance System
PER	Periodic
PERF	perform
PG	page
PH, PHS	Phase
PHA	Physical Health Assessment
PLI	Post Load Inspection
PMP	Packaged Maintenance Plan
PN	part number
POC	Point Of Contact
POS	position
PR	Pre Flight
PR	Preflight
PR/BPO	Preflight/Basic Post-flight
PR/TH	Preflight/Thru-flight
PREV	previous
PRF	Pilot Read File
PS&D	Plans, Scheduling and Documentation
PSI	Pounds Per Square Inch
PWC	Pilot Weather Category
QA	Quality Assurance
QT	Quick Turn
QTY	quantity
R2, R&R	Remove and Replaced
RC-1	Radio Channel 1
RC-2	Radio Channel 2
RC-3	Radio Channel 3
Rdr	Radar
RECEP	receptacle

REF	reference
REG	regulator
REPL	replacement
REQ'D	required
RNDS	rounds
RPM	revolutions per minute
RT	RT
RTB	Return-To-Base
RW-1	Runway 1
RWR	Rear Warning Radar
RWY	Runway
SA	Special Agent
SAMP	sample
SAR	Search and Rescue
SAT	Surface Attack Tactics
SCR	Special Certification Roster
SDO	On Duty Flight Operations Supervisor
SDR	Seat Data Recorder
Self-setup	For an Instrument Approach
SEM/EDX	Scanning Electron Microscope/Energy Dispersive X-Ray
SEPT	Simulator Emergency Procedure Training
SIB	Safety Investigation Board
SIB Maintenance	Safety Investigation Board Maintenance Member
SIB Medical	Safety Investigation Board Medical Member
SIB Pilot	Safety Investigation Board Pilot Member
SIB Recorder	Safety Investigation Board Recorder
SIGINT	Signal Intelligence
SNCO	Senior Non-Commissioned Officer
SNP	sniper
SOF	Supervisor of Flying
Sq Flt/Dr	Squadron Flight Doctor
Sq/CC	Squadron Commander
SRVCD, SER, SERV	serviced
SSgt	Staff Sergeant
Stan/Eval	Standardization and Evaluation
Stk	stick
SYM	symbol
SYS	System
T.O.	Technical Order
T/N	Tail Number
TACAN	Tactical Air Navigation
TBA	Training Business Area
TCN	Transportation Control Number
TCTO	Time Compliance Technical Orders
TERPS	Terminal Instrument Procedures
T-Frame	Turbine frame
TGP	targeting pod
TH	Thru-Flight
Thrott	Throttle
TNKS	tanks
Top 3	On Duty Flight Operations Supervisor
TOT	total
TP	Training Projectile
TSgt	Technical Sergeant
U.S.	United States of America
UPT	Undergraduate Pilot Training
USAFE	United States Air Forces Europe
UXO	Unexploded Ordinance
Vert	Vertical
VFR	Visual Flight Rules
VHF/UHF	Very High Frequency/Ultra High Frequency
VMC	Visual Meteorological Conditions
VVI	Vertical Velocity Indicator
WAI	Walk-Around Inspection
WG	wing
WILCO	will comply
wispy	cirrus cloud
WO	Weapons Officer
WP-1	Waypoint 1
WP-2	Waypoint 2
WP-3	Waypoint 3
WP-4	Waypoint 4
WP-5	Waypoint 5
WP-6	Waypoint 6
XDCR	transducer
XFERRED	transferred
Xmit	transmit
Z	Zulu

The above list was compiled from the Summary of Facts, the Statement of Opinion, the Index of Tabs, and Tabs.

SUMMARY OF FACTS

1. AUTHORITY AND PURPOSE

a. Authority

On 2 December 2014, Major General James N. Post III., Vice Commander, Air Combat Command (ACC), appointed Brigadier General Jeffrey B. Taliaferro to conduct an aircraft accident investigation of a mishap that occurred on 1 December 2014 involving an F-16CM aircraft in the United States (U.S.) Central Command (CENTCOM) Area of Responsibility (AOR) (Tab Y-2). The aircraft accident investigation was conducted in accordance with Air Force Instruction (AFI) 51-503, *Aerospace Accident Investigations*, at Shaw Air Force Base (AFB), South Carolina, from 7 January 2015 through 02 February 2015. Accident Investigation Board (AIB) members were a Flight Surgeon Medical Member (Lieutenant Colonel), a Pilot Member (Major), a Legal Advisor Member (Major), a Maintenance Member (Master Sergeant), and a Recorder Member (Staff Sergeant) (Tab Y-9).

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 1 December 2014 at 04:58:10 hours local time (L) (02:58:10 hours Zulu time (Z)) the Mishap Aircraft (MA), an F-16CM, Tail Number (T/N) 91-0375, deployed with the 77th Expeditionary Fighter Squadron, to a classified base of operation (BO) in the CENTCOM AOR, impacted the ground 9.5 nautical miles (nm) southeast of the BO airfield (Tabs Q-9 through Q-10, AA-13, AA-15 through AA-16). The Mishap Flight (MF) was a combat mission in support of Operation Inherent Resolve in the CENTCOM AOR (Tabs K-2, AA-13, AA-25). The mishap occurred in an unpopulated area (Tabs S-12, S-15, AA-13). The Mishap Pilot (MP) did not attempt to eject from his aircraft and died immediately upon impact (Tabs H-2, H-11, J-15 through J-16, V-9.3). The MA was destroyed with a loss valued at $30,796,852 (Tab P-4 through P-7). Host nation forces recovered the remains of the MP and transported them to U.S. forces at the BO (Tabs R-81, V-4.17 through V-4.18, V-11.2). The mishap caused neither civilian injuries nor damage to civilian property (Tabs P-3, S-3 through S-21). Many U.S. and international media sources reported on the mishap (Tab DD-3 through DD-20).

3. BACKGROUND

The MA belonged to the 77th Fighter Squadron (77 FS), 20th Fighter Wing (20 FW), Ninth Air Force (9 AF), ACC (Tab Q-9). The MP was a member of the same unit (Tab G-4).

a. Air Combat Command (ACC)

The mission of ACC is to support global implementation of national security strategy (Tab CC-3). ACC operates fighter, bomber, reconnaissance, battle-management and electronic-combat aircraft (Tab CC-3). It also provides command, control, communications and intelligence systems, and conducts global information operations (Tab CC-3).

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

b. United States Central Command (CENTCOM)

U.S. Central Command (CENTCOM) is one of nine unified commands in the United States military (Tab CC-17). Six of these commands, including CENTCOM, have an area of responsibility (AOR), which is a specific geographic region of the world where the combatant commanders may plan and conduct operations as defined under the Unified Command Plan (Tab CC-17).

Located between the European and Pacific combatant commands, CENTCOM's Area of Responsibility (AOR) covers the "central" area of the globe and consists of 20 countries -- Afghanistan, Bahrain, Egypt, Iran, Iraq, Jordan, Kazakhstan, Kuwait, Kyrgyzstan, Lebanon, Oman, Pakistan, Qatar, Saudi Arabia, Syria, Tajikistan, Turkmenistan, United Arab Emirates, Uzbekistan, and Yemen (Tab CC-17).

c. Ninth Air Force (9 AF)

9 AF is responsible for ensuring the agile combat support capabilities of eight wings and three direct reporting units (Tab CC-4, CC-7). These units encompass more than 350 aircraft, and 28,000 active-duty and civilian personnel (Tab CC-7). 9 AF is also responsible for the operational readiness of 16 Ninth Air Force-gained National Guard and Air Force Reserve units (Tab CC-4, CC-7).

d. 20th Fighter Wing (20 FW)

20 FW provides combat-ready airpower and Airmen to meet any challenge, anytime, anywhere (Tab CC-9). The wing is capable of meeting all operational

requirements worldwide, maintains a state of combat readiness and operates as the host unit at Shaw Air Force Base by providing facilities, personnel and materiel for more than 12,000 Airmen, Soldiers and family members and retirees (Tab CC-9).

e. 77th Fighter Squadron (77 FS)

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 (CC-11). The 77 FS 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).

f. 77th Expeditionary Fighter Squadron (77 EFS)

77 EFS is a deployed unit of the 77 FS (Tabs Q-9, R-2, R-15, V1.2, CC-13). The 77 EFS provides combat mission capabilities to CENTCOM (Tab 13). The 77 EFS is aligned under the 407th Air Expeditionary Group (Tabs V-8.2, CC-13).

g. Base of Operation (BO)

The airfield that the MP and the MA operated from is a remote location inside the borders of a coalition partner nation (Tabs V-8.3, AA-13). The airfield is supported by a tower controller, but has no radar approach control (Tab V-8.3). The terrain around the BO is relatively flat (Tab AA-13).

h. F-16CM – Fighting Falcon

The F-16CM Fighting Falcon is a compact, multi-role fighter aircraft (CC-13). It is highly manueverable and has proven itself in air-to-air combat and air-to-surface attack (CC-13). It provides a relatively low-cost, high-performance weapon system for the United States and allied nations (Tab CC-13 thorugh CC-15).

4. SEQUENCE OF EVENTS

a. Mission

The 77th Expeditionary Fighter Squadron deployed to a classified BO in October 2014 (Tab G-10). The MP had been flying at this BO since 14 October 2014 (Tab G-10). Prior to the mishap, the MP had flown 18 flights, 17 flights occurring at some point during the night, and 5 where the MP landed at night (Tab G-45, G-47). The MP's most recent flight landed three days prior to the mishap (Tab G-11 through G-12). The mishap flight (MF) consisted of two F-16CMs flying in support of Operation Inherent Resolve (Tab AA-25). The Top-3 (on-duty squadron operations supervisor, acting on behalf of the squadron's Director of Operations) authorized the MF (Tab K-2).

b. Planning

The MP received a local area orientation (LAO) academic briefing with the rest of the 77 EFS as part of their deployment preparation training prior to flying in the CENTCOM AOR (Tab AA-19). The LAO briefing trained personnel on the BO's airfield and local flying procedures, including the subject of instrument approaches into the airfield (Tab AA-19).

Pilots use an instrument approach procedure to land when visibility is limited either by weather or darkness (Tab BB-37). A pilot can use an instrument approach procedure to fly a route from one geographic location, or fix, to another location until in a position to land (Tab BB-37). Each segment of the approach has a defined path and altitude to safely transition to landing (Tab BB-37). An instrument approach procedure normally begins at an initial approach fix (IAF), then progresses closer to the airfield at a lower altitude to an intermediate fix (IF), and then a final approach fix (FAF) (Tab BB-37). In this mishap, the MP used an instrument landing system (ILS) approach procedure (Tab R-6, R-11, R-17). The ILS provides the pilot precise lateral and vertical guidance from the FAF until landing (Tab BB-35). The localizer provides lateral ILS course guidance and vertical ILS guidance is provided by the glideslope (Tab BB-29). Instrument approach procedures also define minimum safe altitudes (MSA) within 25 nm of the airfield that provide 1000' obstacle clearance for each geographic sector, or area, around the airfield (Tab BB-30).

The 77 EFS leadership published a Pilot Read File (PRF) item on 13 October 2014 that outlined their expectations for landing at the BO if an instrument approach was required (Tab AA-27). The PRF is a collection of guidance issued by either the squadron commander or director of operations that pilots must read prior to flying (Tab V-8.7). The PRF guidance directed pilots to fly direct to the IAF at or above the documented minimum safe altitude (MSA) until receiving final approach guidance (Tab AA-27). The MP reviewed the 13 October 2014 PRF item (Tab G-14).

On 1 December 2014, the MP and MW attended the required intelligence briefing and then conducted their standard flight brief (Tab R-5). The MF dressed and met at the flying operations desk on time to receive their operations supervisor briefing (Tab R-27). The operations supervisor briefing included a review of operations notes, notices to airmen (NOTAMs), weather, operational risk management (ORM), and recent maintenance for the MA, T/N 91-0375, and the MW's aircraft (Tabs R-27, AA-21).

The weather at the BO for their takeoff time called for 9,000 meter (m) visibility with mist, winds variable at 3 knots (kts), a temperature of 43° Fahrenheit (F), a dew point of 39° F and 1.66 millilux (mlx) illumination (Tab F-2, F-8). For comparison, while 2 mlx is equivalent to a moonless clear night sky, 270-1000 mlx is the equivalent of a full moon (Tab W-3).

The MP and mishap wingman (MW), were issued all required, relevant mission materials prior to leaving for their flight (Tab R-5). The MP and MW were driven out to their aircraft, with their gear, and then conducted pre-flight ground operations (Tab R-5).

The MA was configured with two 370-gallon wing fuel tanks, four 500-pound bombs, four air-to-air missiles, a Sniper Advanced Targeting Pod, an Electronic Counter Measures pod, and a HARM Targeting System pod (Tab P-4 through P-5).

c. Preflight

During pre-flight ground operations, the MP noted a discrepancy with the MA's hydraulic system and called for assistance from maintenance personnel (Tab R-5). The hydraulic system discrepancy required the MP to shut down the MA to allow maintenance personnel to change a hydraulic filter (Tab R-5). Meanwhile, the MW taxied his aircraft to the arming area where he waited for the MP while the discrepancy was corrected (Tab R-5). Once maintenance personnel resolved the discrepancy, the MP restarted the MA with all systems functioning correctly and met the MW in the arming area five minutes prior to their scheduled take off time (Tab R-5).

d. Summary of Accident

The MF took off at 0221Z on a radar trail departure (Tab R-5). AFI 11-2F-16, V3, page 28, defines radar trail as a 2-3 nm spacing between aircraft while the trailing aircraft tracks the leading aircraft with radar. Once in the air, the MW attempted to raise his landing gear, but was unable to do so completely due to a landing gear door malfunction, and immediately radioed the MP to inform him of the situation (Tab R-5). The MP directed the MF to orbit above the BO airfield at 8,000' to 10,000' and passed the tactical lead of the MF to the MW (Tab R-5). The MP performed a visual check of the MW's landing gear and assisted the MW by helping him accomplish the emergency checklist procedures (Tab R-5 through R-6). The MW was able to extend his landing gear in a normal configuration and no other malfunctions existed (Tab R-5 through R-6). The MW continued the rest of the mishap flight from the lead position with his gear down in accordance with emergency checklist procedures (Tab R-5 through R-6).

The MP then coordinated with the operations supervisor at the BO and the tower controller to burn down fuel while holding above the BO in order reduce the weight of the aircraft for landing (Tab R-5 through R-6). During this process, the MF employed liberal use of afterburner to expedite fuel consumption (Tab R-6). The MP's plan was to land as soon as possible so that he and the MW could move to spare aircraft in order to launch again for their combat mission tasking (Tab R-6).

While holding over the BO, the MP expressed concern to the MW that due to the pre-dawn hour, the MF was likely waking up BO inhabitants as they flew overhead (Tab R-6). The MP coordinated with the tower controller for clearance to move the MF east to a point approximately 20 nm away from the BO, Waypoint (WP)-1, where they continued to burn down fuel (Tab R-6). After approximately 10 minutes of holding at the new point, the MP called the BO control tower at 0252Z to request permission to return to base (RTB) (Tab N-5). The communication between the MP and the BO control tower was as follows:

MP: "[tower], [MP], request to descend to 4,200' to intercept the I-L-S, runway 3-1 full stop"

Tower: "[MP], [tower], eh, roger report localizer established."

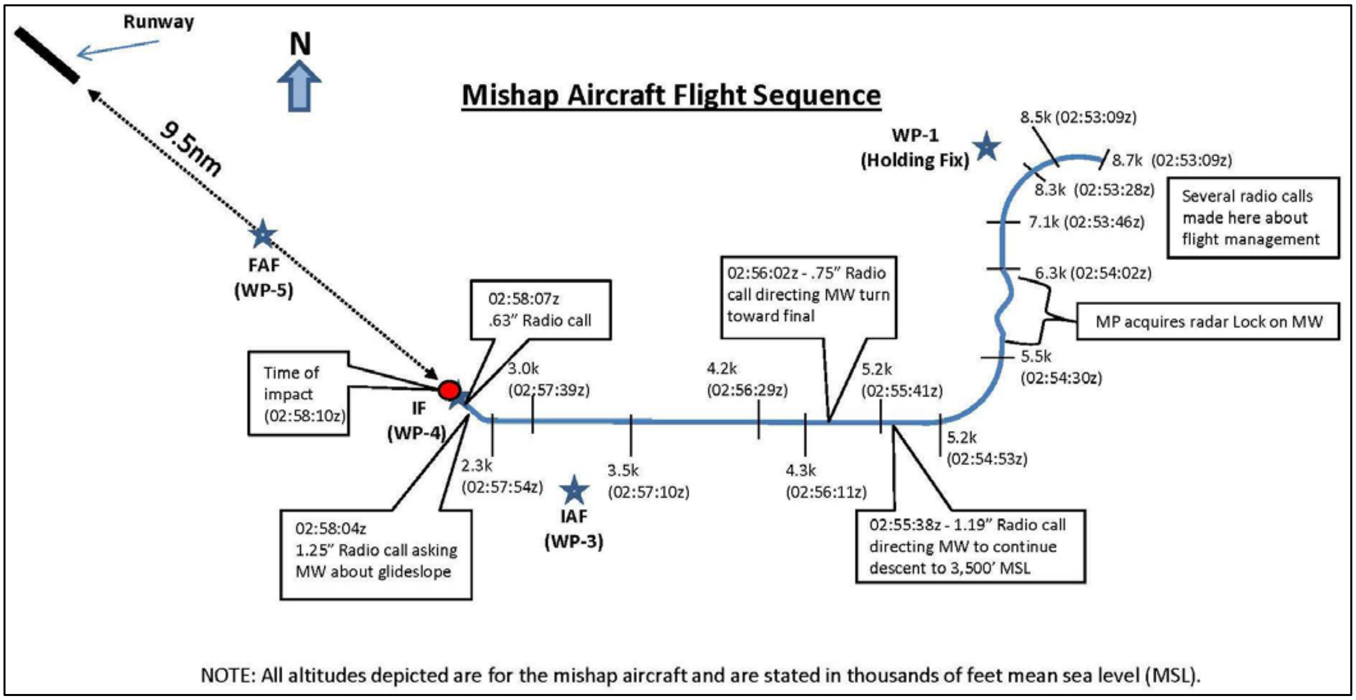
MP: "[MP], WILCO" (Tab N-5).

Between 02:52:36Z and 02:54:00Z, the MP made several radio calls, informing the operations supervisor of the MF's intent to land and directing the MW to begin the enroute descent to the south (Tabs L-2, R-27 through R-28). The MP made three 60 degree banks with little heading change in what appeared to be an attempt to gain a radar lock on the MW at 02:54:02Z (Tabs L-2, S-22, AA-9). The MF maintained radar trail formation with the MP in trail (Tab M-3 through M-8). At 02:54:30Z the MP descended through 5,500' mean sea level (MSL) and directed the MF to proceed west, to WP-3, the IAF located 15 nm southeast of the field on final (Tabs L-2, R-11). The radar tracks of the MF show a course that continues inside of the IAF, toward an IF labeled WP-4 (Figure 1-1). Upon completion of this turn to the west, the MP lowered his landing gear, and stabilized at 5,200' MSL for 48 seconds (Tab R-6). Then at 02:56:02Z, the MP made a 1.19 second call to the MW directing him to turn towards final (Tabs L-2, R-6, Z-3). The MW remained in front of the formation and continued his enroute descent down to approximately 3,000' MSL and intercepted the localizer course at approximately 10 nm from the runway (TabM-3 through M-8). The MP maintained 2-3 nm radar trail throughout the descent, passing 4,000' MSL at 02:56:35Z, and only leveled off momentarily at 3,500' MSL before continuing his descent (Tabs L-2, S-22).

At 02:57:39Z the MP passed through 3,000' MSL while still heading west with the throttle set near idle and a descent rate of approximately 2,700 feet per minute (FPM) (Tab L-2). During the last 32 seconds of flight, from 3000' MSL to impact, the MA maintained a continuous descent (Tab L-2). At 02:57:54Z, 16 seconds from impact, descending through 2,300' MSL, the MP turned approximately 40 degrees to intercept final approach course, using up to 42 degrees of bank (Tab L-2). Near the end of this turn, 6 seconds prior to impact, the MP called the MW on the radio to ask if he was receiving the ILS glideslope (Tabs L-2, R-6, S-22). During the last second of flight, the MP initiated a 4G level pull away from the ground. However, this action was executed too late to avoid impact with the ground (Tabs L-2, S-22).

The MW continued the instrument approach and landed uneventfully. Shortly after the MW landed, the MW, BO control tower, and operations supervisor made several radio calls on interflight, tower and guard frequencies in an attempt to contact the MP, but received no replies (Tab R-6, R-28).

Figure 1. Visual Representation of last 5 minutes, 1 second of MA's flight (Tab Z-3)



e. Impact

The MA impacted the ground at 02:58:10Z with landing gear extended and lined up on the approach course, 9.5 nm short of the end of the landing runway (Tabs M-7, S-3, AA-13). At last recorded data, 0.5 seconds prior to impact, the MA's flight parameters were: 1,760' MSL, zero degrees pitch, 2,220 fpm vertical velocity down, 216 kts calibrated airspeed, engine revolutions per minute (RPM) at 83%; and 4G's, with 4,300 pounds of fuel remaining, (Tab L-2). Weather reported at the airfield at the time of impact was 12 kilometers (km) visibility, winds variable at 3 kts, skies clear, and illumination of 2.68 mlx, extremely dark (Tabs F-8, W-3).

f. Egress and Aircrew Flight Equipment (AFE)

Flight data recordings show the MP was moving the controls through the time of impact (Tab S-22). There was no ejection attempt (Tabs H-2, H-11.2, J-15 through J-16, L-2).

The MP's night vision googles (NVGs) and the bracket used to connect them to the helmet were in good working order (Tab H-3). The MP signed out a NVG set before the mishap sortie (Tab H-3). The NVGs, along with all of the MP's other aircrew flight equipment (AFE), were within Technical Order (T.O.) specifications and had a current inspection accomplished by qualified technicians (Tab H-3). However, it is impossible to determine whether the MP was using his NVGs at the time of the mishap (V1.12, V8.6).

g. Search and Rescue (SAR)

The MA impacted the ground at 02:58:10Z (Tab AA-13). After the MW and tower controllers were unable to contact the MP on any radio frequency, a tower controller called the operations supervisor at approximately 0303Z asking if they were in contact with the MP (Tab R-28). At 0304Z, the MW called the operations supervisor and stated that he did not see the MP land behind him (Tab R-28). The operations supervisor attempted to contact the MP over the radio several times, then called back to the tower at 0306Z to ask if they had seen or heard of the MP; they had not (Tab R-28).

With no ability to track the location of the MA, the operations supervisor immediately requested the launch of a host nation search and rescue (SAR) helicopter based out of separate location and sent for 77 EFS and 407 AEG leadership (Tab R-28). Leadership met at the operations desk at 0313Z and initiated the mishap checklist at 0327Z (Tabs R-28, FF-3). During this time, a formation of coalition partner nation F-16s located the downed aircraft 9.5 nm southeast of the airfield and established an on scene command (OSC) (Tabs V-11.2, AA-11, AA-13, AA-15). The OSC aircraft were able to identify the MA at the mishap site and located the MP's body among the wreckage (Tabs V-11.2, AA-11).

While the mishap checklist was initiated, the SAR helicopter arrived at the BO, loaded host nation medical personnel, and departed directly for the mishap site (Tab V-11.2). The SAR helicopter crew was first to make contact with the MP at approximately 0430Z and informed U.S. leadership that the MP was deceased shortly thereafter (Tab V-4.17).

h. Recovery of Remains

Upon hearing the MP was deceased, 77 EFS supervision requested the SAR helicopter crew take photos of the mishap site and recover the MP's body (Tab V-4.17). The SAR helicopter crew recovered the MP's body, but did not take photos of the mishap site (Tab V-4.17, AA-11).

At 0530Z a U.S. Air Force physician and several members of 77 EFS leadership met the SAR helicopter as it landed back at the BO (Tab V-4.18). The physician examined the MP and made the official determination that the MP was deceased, declaring an official time of death of 0536Z (Tab R-81). At 0621Z, the MP's body was transported to U.S. mortuary affairs facilities at the BO (Tab R-81).

i. Mishap Site Security

Near the time the SAR helicopter departed from the mishap site, a formation of U.S. F-16's took over as OSC above the mishap site and provided over-watch for a security team that departed the BO by ground vehicle to secure the MA and its ordnance (Tab V-9.2, V-10.1). A security perimeter was established around the mishap site by U.S. and host nation military and police personnel to secure the mishap site (Tabs S-1 through S-22, V-9.2).

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 (Tabs D-3 through D-19, U-19).

A detailed review of AFTO Form 781 historical records for the MA for the 30 days preceding the mishap revealed no evidence of engine, mechanical, flight control anomalies, structural or electrical discrepancies on the MA relevant to the mishap (Tab U-3 through U-4).

In addition, a detailed review of IMDS historical records, for the previously stated timeframe, was used to validate and confirm that aircraft engine, flight controls, and hydraulic components were all within prescribed inspection periods and that TCTO compliance was adhered to (Tab U-3 through U-4). Only one inspection was identified as coming due (Tab U-3 through U-4). There is no evidence to suggest that compliance with AFTOs, or maintenance historical records were a factor in this mishap (Tab U-3 through U-4).

b. Inspections

Phase inspections are regularly scheduled maintenance performed on U.S. Air Force aircraft at specific flying hour intervals (Tab BB-9). The Block 50 F-16CM has a 400-hour phase inspection cycle in accordance with T.O. 1F-16CJ-6, page 1-89 (Tab BB-9). The last phase inspection for the MA was accomplished on 18 September 2014 and the MA had 57.5 hours remaining before its next 400-hour phase inspection, which was within the required inspection interval at the time of the mishap (Tabs D-2, U-3 through U-4).

The MA had 6,843.6 total flight hours at the time of the mishap (Tab D-15). The engine, a General Electric F-100-GE-129, serial number GE0E538194, had 539.9 hours total operating time, with 778 Jet Fuel Starter starts by the time of mishap (Tab D-15).

In accordance with T.O. 00-20-1, page 2-3, a Thru-Flight inspection is "a 'between flights' inspection and will be accomplished after each flight when a turnaround sortie or continuation flight is scheduled and a basic Post-Flight inspection is not required" (Tab BB-8). In addition, T.O. 00-20-1, page 5-26, paragraph 5.12.2.2.7.3, states an "Exceptional Release is required before flight" (Tab BB-10). An Exceptional Release is a thorough AFTO 781 aircraft forms review conducted by an authorized maintenance personnel to ensure the aerospace vehicle is safe for flight (Tab BB-10).

The MA's assigned crew chief conducted a timely Thru-Flight (TH) inspection on the MA after the flight preceding the mishap flight on 30 November 2014 at 2100L, in accordance with T.O. 1F-16CJ-6WC-1-11, cards 3-001 thru 3-041, approximately 8 hours before the mishap flight (Tab D-3). The only significant discrepancy identified by the crew chief, outside of the need for routine fuel and oil servicing, was an extended Hydraulic A-system case drain filter bowl housing Delta "P" indicator (Tab D-10). This is an early indication that a filter may need to be changed in the near future (Tab BB-6). The Delta “P” indicator was reset and the discrepancy was documented so that it would be monitored for the next three flights in accordance with T.O. 1F-16CJ-2-29FI-00-1, page 1-26 (Tabs D-10, BB-6). All completed maintenance was verified by the production superintendent and the Exceptional Release was accomplished and properly annotated in the 781H aircraft form in accordance with T.O. 00-20-1, page 5-26, paragraph 5.12.2.2.7.3 (Tabs D-3, BB-10).

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 (Tab U-3 through U-4). There is no evidence to indicate that maintenance procedures were a factor in this mishap (Tab U-3 through U-4).

d. Maintenance Personnel and Supervision

All maintenance activities reviewed were normal and all personnel involved in the Thru-Flight, servicing, inspecting, and launch of the MA were qualified and proficient in their duties (Tab U-3 through U-4). The Special Certification Roster (SCR) was reviewed to ensure maintenance personnel were qualified for servicing, inspecting, troubleshooting, and releasing the aircraft for flight (Tab U-3 through U-4). Automated maintenance training records (AF Forms 623 and 797) in the Training Business Area (TBA) were reviewed and revealed no training deficiencies (Tab U-3 through U-4).

e. Fuel, Hydraulic, and Oil Inspection Analyses

During execution of the mishap checklist, fuel, and all equipment items, and storage areas were isolated and sampled in accordance with T.O. 42B-1-1, page 5-4 (Tab BB-12 through BB-13). Fuel truck number 96L-165 was isolated as the last fuel truck to service the MA (Tab D-10). All fuel samples met specification requirements of tests conducted and were deemed not a contributing factor to the mishap (Tab U-7 through U-10).

In accordance with AFI 21-101, *Aircraft and Equipment Maintenance Management*, 26 July 2010, with Air Force Guidance Memorandum, dated 22 April 2014, pages 91-92, paragraph 5.9.4, and pages 295-297, paragraph 14.31, directs maintenance personnel to perform two tests: 1.) Joint Oil Analysis Program (JOAP) and 2.) Atomics Emission Spectrometry and Scanning Electron Microscope/Energy Dispersive X-Ray (SEM/EDX). JOAP records for the sorties prior to the mishap sortie were reviewed and the results were well within limits (Tab U-11). The MA was also serviced during both the Pre-Flight and Thru-flight inspections on 30 November 2014 by oil carts #63 & #62, respectively, prior to the mishap flight, and lab results from those carts were within limits (Tabs D-5, U-13, U-15). SEM/EDX analysis of the magnetic chip detector (MCD) inspection sample taken after the MA’s most recent flight prior to the mishap returned normal as well (Tab U-17).

Post-accident tests on the fuel, hydraulic and oil systems of the MA were not performed due to total destruction of the MA (Tab V-9.3).

f. Unscheduled Maintenance

AFI 21-101, pages 294-295, states, "'Red Ball' maintenance normally occurs two hours prior to launch" and during the recovery process after flight before engine shutdown. The term "Red Ball" as discussed in AFI 21-101, page 294, is a traditional descriptor, recognized throughout the aircraft maintenance industry as a situation requiring "a sense of urgency and priority actions." In accordance with T.O. 00-20-1, page 5-26, paragraph 5.12.2.2.7.3.2, an Exceptional Release must be re-accomplished by a certified individual, when "an additional symbol is entered" in the aircraft forms because additional maintenance was performed after the aircraft was previously released for flight (Tab BB-10).

The most recent unscheduled maintenance performed on the MA prior to its launch on the mishap flight was the removal and replacement of the Case Drain filter element due to the second extension of the A-system case drain filter bowl Delta "P" indicator (Tab D-12). As previously stated, the original corrective maintenance action during the Thru-Flight was that the filter bowl housing Delta "P" indicator was reset (Tab D-10). Since the indicator extended for the second time within a four-flight period, it triggered a requirement for an inspection of the filter element, in accordance with T.O. 1F-16CJ-2-29FI-00-1, page 1-26 (Tab BB-6). The MP was notified of the extended Delta "P" indicator by the maintenance personnel and immediately asked to shut down the engine to allow the "Red Ball" maintenance to be accomplished (Tabs R-88, V-12.3). The results of the filter element inspection mandated its removal and replacement; this was accomplished in accordance with T.O. 1F-16CJ-2-29JG-10-1, Function (29-11-06), pages 2-67 thru 2-78 (Tabs D-12, BB-16 through BB-26). The Production Superintendent verified all maintenance conducted and the Exceptional Release was re-accomplished and properly annotated in the 781 series aircraft forms in accordance with T.O. 00-20-1, page 5-26, paragraph 5.12.2.2.7.3.2 & AFI 21-101, pages 294-295 (Tabs D-3, BB-10). The MA was restarted immediately after the Exceptional Release and the aircraft launch process proceeded without further disruption (Tabs R-88, V-12.3).

After the mishap, the Maintenance Fault List (MFL) downloaded from the MA's Crash Survivable Flight Data Recorder (CSFDR), recovered from the mishap site, indicated that there were no flight control system, Global Positioning System (GPS), or engine faults recorded during the mishap flight (Tab J-12). There were a few additional MFLs downloaded from the CSFDR, but ultimately were inconsequential (Tab U-5).

6. AIRFRAME, MISSILE, OR SPACE VEHICLE SYSTEMS

a. Structures and Systems

The MP reported to the operations supervisor that the MA was "Code-1," just prior to 02:54:02Z, before beginning his descent, indicating the MP did not have maintenance concerns with the MA (Tab R-28). Along with the CSFDR, the MA's Seat Data Recorder (SDR) was recovered from the mishap site (Tab J-5 through J-6, J-12). Lockheed Martin engineers evaluated the data from these components and concluded that the electrical system, hydraulic system and flight control system were operating normally when the MA impacted the ground (Tab J-19). As a result of the impact with the ground, most of the parts that make up the MA were badly damaged or totally destroyed (Tabs S-16 through S-21, V-9.3, AA-53). None of the recovered parts indicated any system malfunction, nor was there any indication that a pre-crash condition of these aircraft systems or the aircraft's structures was a factor in the mishap (Tab J-5 through J-19).

There is no indication that hostile fire damaged the MA (Tab V-7.14). The MP was flying over level terrain, towards his final approach for landing at night (Tab S-12 thru S-21). There were neither intelligence reports of enemy activity nor claims of responsibility by hostile forces (Tab V-7.14). These factors, coupled with the data from the CSFDR, SDR, and witness testimony indicate there was no enemy action related to the mishap (Tabs J-19, V-7.14).

(1) Hydraulic Power System

CSFDR and SDR recordings showed no indication of low System A or B hydraulic pressure indicating that both System A and B hydraulics were operating normally (Tab J-16, J-23).

(2) Fuel System

CSFDR data showed normal fuel flow and fuel quantity information until impact (Tab J-15, J-23).

(3) Flight Control System

SDR data indicated that the flight control system was functioning normally (Tab J-13).

(4) Emergency Power System

CSFDR data indicated there were no electrical or hydraulic failures that would require emergency power and the emergency power unit (EPU), was not operating during the available data, which is an indication of normal system operation (Tab J-16).

(5) Ground Collision Avoidance System

CSFDR data from the MA indicated that all ground avoidance systems were functioning normally throughout the mishap flight, up to the point of impact (Tab J-16 through J-19). Since the landing gear handle was in the down position, in preparation for landing, Ground Avoidance Advisory Function (GAAF), Predicted Ground Collision Avoidance System (PGCAS), Automatic Ground Collision Avoidance System (AGCAS), and the Combined Altitude Radar Altimeter (CARA) Altimeter Low Warning (ALOW) audio cue of "altitude-altitude" warning the MA of his approach to the surface of the earth were automatically disabled as per normal system operation (Tab J-19). Only the flashing "AL 2000" in the corner of the HUD would have occurred when the radar altimeter sensed the aircraft descended below 2,000' above ground level (AGL) (Tab J-19).

7. WEATHER

a. Forecast Weather

The 77 EFS's weather personnel provided the mission execution forecast to the MF on 30 November 2014 (Tab F-2). At the MF's takeoff time of 02:21:22Z, the forecasted weather for the airfield was 9,000m visibility with mist, winds variable at 3 kts, temperature at 43° F, dew point at 39° F, barometric pressure at 30.21 inches of mercury (inHg) with an ice foreign object damage advisory (Tab F-2). At the MF's expected landing time after sunrise, the forecast was unlimited visibility, skies clear and winds variable at 6 kts, a temperature of 57° F, a dew point of 45° F, and barometric pressure at 30.26 inHg (Tab F-2).

b. Observed Weather

The weather observed during the MF's takeoff at 02:21:22Z, was clear skies, 9,160m visibility with mist, a temperature of 42.6° F, a dew point of 38.3° F, and barometric pressure of 30.23 inHg with ice foreign object damage procedures in effect (Tab F-2, F-11). Observed weather on the airfield at the time of the mishap was clear skies, 12,563m visibility, no significant weather, a temperature of 37.7° F, a dew point of 33.2 ° F, and barometric pressure at 30.24 inHg (Tab F-2, F-11).

8. CREW QUALIFICATIONS

a. Mishap Pilot

The MP was current and qualified in the F-16CM with his last Instrument Check accomplished on 16 September 2013, last mission check accomplished on 26 August 2014, and last Instrument Refresher Course current through 30 September 2015 (Tabs G-22, G-42, T-5). The MP had 741.8 total hours of flying time (Tab G-12).

Specifically, the MP had 596.7 hours of primary F-16CM time, 122.4 of which were combat hours, 176.3 of which were night hours, and 155.7 hours of which were flown using NVGs (Tabs G-12, T-3). The MP completed the night flight lead upgrade on 18 October 2013, and was current for night flying, with his most recent night flight occurring three days prior to the mishap, and his most recent night landing occurring 19 days prior to the mishap (Tab G-3, G-47). The MP completed instructor pilot upgrade training on 25 August 2014 (Tab G-3). During the current deployment, the MP flew with NVGs during 18 of his 19 sorties (Tab G-45).

The MP was an outstanding young officer and well-respected fighter pilot (Tab R-52). He was selected for flight commander and instructor upgrade before his peers, and was known to be "one of the best in the squadron" (Tab R-52). Squadron leadership indicated he was likely the next pilot in the squadron to be selected for attendance at the highly sought after U.S. Air Force Weapons School (Tab R-63). The MP often spent extra time with his younger wingmen to help them improve their flying abilities (Tab R-76). The MP was a natural leader and always took great care to mentor the pilots in his flight (Tab R-52).

Recent flight time is as follows (Tab G-5):

	Hours	Sorties
Last 30 Days	59.0	9
Last 60 Days	135.4	20
Last 90 Days	146.4	26

b. Mishap Wingman

The MW is a current and qualified wingman in the F-16CM, with his last instrument check accomplished on 9 May 2014, last mission check accomplished on 02 April 2014, and his Instrument Refresher Course current through 30 September 2015 (Tabs G-49, T-5). At the time of the mishap, the MW had 395.2 hours of total flying time, 301.9 hours of primary F-16CM time, 132.2 of which were combat hours, and 67.1 hours using NVGs (Tab G-20).

Recent flight time is as follows (Tab G-17):

	Hours	Sorties
Last 30 Days	54.5	11
Last 60 Days	107.2	20
Last 90 Days	117.3	26

9. MEDICAL

a. Qualifications

At the time of the mishap, the MP was fully medically qualified for flight duty without medical restrictions (Tab X-3). The MP's annual Preventative Health Assessment (PHA) was current and a review of the MP's medical records revealed a current and valid waiver granted for use of medication to treat a non-disqualifying medical condition (Tab X-3). The MP's AF Form 1042, Medical Recommendation for Flying or Special Operational Duty, was current (Tab T-7). The MP's most recent flight physical determined he was medically qualified for flight duties and worldwide military duty (Tab X-3).

Additionally, the MW was fully medically qualified for flight duty without medical restrictions (Tab X-3). The MW's annual PHA was current and review of the MW's medical records demonstrated current and valid waivers at the time of the mishap (Tab X-3). The MW's most recent flight physical determined he was medically qualified for flight duties and worldwide military duty (Tab X-3).

Physical and medical qualifications were not factors in the mishap (Tab X-3).

b. Health

The AIB's Medical Advisor Member reviewed the medical and dental records of the MP and MW, as well as the MP's and MW's 72-hour history (Tabs R-58, R-63, X-3). The MP was in good health and had no recent performance limiting illnesses prior to the mishap (Tab X-3). The MW was in good health and had no recent performance limiting illnesses prior to the mishap (Tab X-3). Review of the MP's and MW's PHA, Individual Medical Readiness, Composite Healthcare System and Automated Information Management Waiver Tracking System databases showed that the MP and MW had current PHAs (Tab X-3). Review of testimony, written statements and medical records, demonstrates there is no evidence that any medical condition contributed to this mishap (Tab X-3).

c. Pathology

Review of the Armed Forces Medical Examiner's autopsy report indicates that the MP immediately died of multiple injuries sustained when the aircraft that he was piloting impacted the ground (Tab X-5). The toxicology screen was negative (Tab X-5).

d. Lifestyle

Witness testimony, as well as review of 72-hour histories of the MP, MW, and pertinent maintenance personnel, revealed no lifestyle factors, including unusual habits, behavior, or stress were a factor in the mishap (Tab R-4 through R-5, R-26 through R-27, R-36, R-45, R-47, R-54, R-58, R-63, R-74).

e. Crew Rest and Crew Duty Time

U.S. Air Force Pilots are required to have proper "crew rest," as defined by AFI 11-202, Volume 3, *General Flight Rules*, dated 07 November 2014, paragraph 2.1, prior to performing in-flight duties. AFI 11-202, paragraph 2.2, defines normal crew rest as a minimum 12-hour non-duty period before the designated flight duty period (FDP) begins. During this time, an aircrew member may participate in meals, transportation, or rest as long as he or she has the opportunity for at least eight hours of uninterrupted sleep in accordance with AFI 11-202, paragraph 1.2.

A review of the MP's recent daily event history was obtained and corroborated by multiple witnesses and data sources (Tabs R-4 through R-5, R-26 through R-27, R-36, R-45, R-55 through R-56, R-58, R-63, R-67, R-77 through R-78, V-1.13, V-1.16, V-2.2, V-3.7). The MP complied with crew rest and duty day requirements on the day of the mishap (Tabs R-4 through R-5, R-26, R-36, V-1.13, V-1.16). The MP was established on a night schedule and did not suffer from stress, pressure, fatigue or lack of rest prior to the mishap sortie (Tab R-26, R-36, R-54 through R-55, R-63, V-1.13, V-1.16, V-2.2, V-3.7, X-3).

A review of the duty cycles of the MW leading up to the mishap indicated that the MW had adequate crew rest (Tab R-4 through R-5, R-26, R-36, R-55). The MW stated he was well-rested and had no complaints or illnesses (Tab R-4 through R-5, R-26). The MW complied with the crew rest and duty day requirements on the day of the mishap (Tab R-4 through R-5, R-26, R-36). Fatigue was not indicated in the MW and is not a factor in this mishap (Tab X-3). The MW did not suffer from stress, pressure, fatigue or lack of rest prior to or during the mishap sortie (Tabs R-4 through R-5, R-26, R-36, X-3).

10. OPERATIONS AND SUPERVISION

a. Operations

The MP was familiar with operations at the BO, this being his 19th flight at that location over a period of approximately one and a half months (Tab G-45 through G-48). The MP's last night landing was 19 days prior to the mishap, which was his fifth night landing at the BO during the deployment (Tab G-45 through G-48). Due to the expected duration of the flight, the MP had planned and briefed a daytime landing back at the base of operation (Tab V-1.4). The MP was established on a night schedule and had served as operations supervisor the previous night (R-45).

b. Supervision

The MP was current and qualified for the mishap flight (Tab G-35 through G-44). Operations supervision completed appropriate go/no-go procedures and was satisfied that the MP was ready to fly (Tabs K-2, R-27, V-7.3).

Published instrument procedures provided sufficient guidance to safely fly the instrument approach to land at the BO (Tab AA-17). On 13 October 2014, the 77 EFS supervision provided written guidance to all pilots, including the MP, with instructions for night landings emphasizing the need to start the instrument approach at the IAF (Tabs G-14, AA-27). Additionally, squadron supervision re-issued similar guidance approximately two weeks later on 25 October 2014, and at about that same time began working with the 77 EFS and the 407th Air Expeditionary Group's Chief of Standardization and Evaluation to issue a Flight Crew Information File (FCIF) item that would further strengthen that guidance (Tabs V-4.5, V-7.8, AA-29). That FCIF item was not yet published at the time of the mishap (Tab V-4.5, V-7.11, V-8.7).

Nevertheless, 77 EFS supervision was aware that some pilots did not adhere to these procedures. (Tab V-4.6, V-6.8, V-6.12, V-7.10). Instead of beginning the approach at the IAF as directed by the published instrument approach and 77 EFS instructions, several pilots utilized a method of joining the instrument approach closer to the FAF (Tab V-6.12, V-7.10). This method was intended to compensate for the lack of radar approach control at the BO so aircrews could "self set-up" their own intercept or dog-leg to the final approach course closer to the airfield in order to land quicker (Tab V-4.8, V-6.8, V-8.4, V-8.5). While not a necessary service, at many locations radar approach control directs headings for pilots to follow, or vectors, that allows them to start the approach closer to the airfield, fly less of the instrument approach, and land sooner (Tab BB-32 through BB-33). Despite published 77 EFS guidance to the contrary, this "self set-up" approach by members of the 77 EFS was a common practice within the squadron (Tab V-6.12, V-7.10). At a minimum, some pilots perceived that the 77 EFS leadership's informal focus, in regards to night approaches, was to meet approach requirements by the FAF (3,000' MSL at 5.4 distance measuring equipment (DME)) (Tabs V-3.5, V-4.6, V-6.8, AA-3).

The MP utilized the "self set-up" approach during the mishap flight, and did not start the instrument approach from the IAF as indicated by the published instrument approach (Tabs M-4 through M-7, S-22). The MP's stated plan on the mishap flight was to begin the landing approach at 3,500' MSL at 10 nm, 5 nm closer than the IAF (Tabs R-6, AA-3). While the MW is unable to recall all of the specific altitudes the MP directed him to on the descent, flight data retrieved from the MA and ground radar sources indicate both aircraft continued to approximately 3,000’ MSL before being established on a segment of the instrument approach (Tabs M-5 through M-7, R-18, S-22, V-1.7). This descent occurred at a point where the MSA for the sector is 3,700’ MSL and the minimum published altitude at the IAF is 4,000’ MSL (Tab AA-17). The MP also directed the MW to turn to a dog-leg to intercept the final approach course prior to receiving localizer guidance and prior to being established on the approach (Tabs R-18, V-1.8, V-1.10). The MP initiated his turn to intercept the final approach course approximately 3 nm inside of the IAF at 2,300’ MSL, well below the published initial approach fix minimum altitude of 4,000’ MSL or the intermediate fix minimum altitude of 3,500’ MSL (Tabs S-22, AA-17).

Intentionally flying 1000’ below the minimum altitude at the IAF reduced the safety margin and the time for the MP to recognize and recover from his descent (Tab AA-23). At the MP’s average descent rate of 1,528 fpm (from 4,000’ MSL to impact) this additional 1000’ would have given the MP an additional 39 seconds to recognize and recover from an unrecognized descent (Tabs S-22, AA-23). However, it is not possible to discern whether the MP would have been able to recognize and recover from his descent with an additional 39 seconds of time (Tab AA-23).

11. HUMAN FACTORS

a. Introduction

As defined by AFI 91-204, *Safety Investigations and Reports*, Attachment 6, 12 February 2014, a human factor is any environmental factor or individual psychological factor a human being experiences that contributes to or influences performance during a task. AFI 91-204, paragraph A6.1, establishes that there are many potential human factors that need to be assessed for relevancy during a mishap investigation.

b. Applicable Factors

The AIB considered all human factors as prescribed in the Department of Defense Human Factors Analysis and Classification System (DoD HFACS), as delineated in AFI 91-204, Attachment 6, figure A6.3, to determine those human factors that directly related to the mishap.

(1) Human Factor 1 - *Vision Restricted by Meteorological Conditions (PE102)*

In accordance with AFI 91-204, Attachment 6, page 139, *Vision Restricted by Meteorological Conditions* is a factor when weather, haze, or darkness restrict the vision of the individual to a point where normal duties were affected.

The mishap occurred at 04:58:10L, after moon set, and prior to sunrise (Tabs F-2, F-8, R-6, R-11, R-12, R-33). The ambient illumination for the mishap location was 1.66 mlx at the time of the mishap (Tab F-2, F-8). Witness testimony indicates that the external visibility was dark with minimal cultural lighting and nearly absent of visual cues at night (Tabs R-6, R-11, R-12, R-15, V-6.9, V-7.5). The lack of cloud cover reduced the impact of what minimal cultural lighting was available northeast of the airfield (Tab R-6, AA-51). Night approach airfield lighting is not visible outside of 5 nm (Tabs R-15 through R-17, R-20, V-6.9). Other than minimal cultural lighting to the distant northwest, no discernible horizon was visible to the unaided eye at approach altitudes (Tabs R-6, R-11 through R-12, R-15 through R-17, R-20, R-21, V-4.15).

While NVGs would normally be stowed during this phase of flight, it is unknown if the MP was using NVGs at the time of impact (Tab R-15 through R-16, V1.13, V1.14, V-3.6, V-3.8, V-4.15, V-6.9, V-7.12, V-8.6). Use of NVGs during the final five minutes of flight may have given the MP a discernible horizon, but no ambient visual cues necessary to reliably detect sink rate or altitude (Tab R-15 through R-17, R-20 through R-21). Regardless of NVG use, only a thorough scan of the cockpit instruments would have given the MP the necessary information to maintain intended altitudes, pitches and descent rates as reflected in Air Force Manual (AFMAN) 11-217, Volume (V) 3, 23 February 2009, *Flying Operations Supplemental Flight Information*, pages 161, 165, 167-168, and 170.

Pursuant to AFMAN 11-217, V3, page 171, a proper visual scan includes a cross-check of the environment outside the aircraft, along with aircraft flight instruments (Tab BB-44). Together, AFMAN 11-217, V1, 22 October 2010, *Flying Operations Instrument Flight Procedures*, page 26, and AFMAN 11-217, V3, page 171, provide the pilot situational awareness with respect to an accurate estimation of the aircraft's attitude and orientation (Tab BB-36, BB-44).

Since visual cues from the environment outside the cockpit were degraded, cockpit instruments were the sole reliable indicator of the MA's orientation with the earth as noted by AFMAN 11-217, V3, page 26 (Tabs R-6, R-11, R-12, R-15, BB-36). As discussed in AFMAN 11-217, V1, page 14, visual cross-referencing of flight instruments, such as the Attitude Director Indicator (ADI), Vertical Velocity Indicator (VVI), Air-speed Indicator (AI) and altimeter, provides essential data about aircraft orientation, required to offset any diminished visual ambient cues. In accordance with AFMAN 11-217, V1, page 14, good instrument cross-check and control of the aircraft by reference to the primary flight instruments is integral to U.S. Air Force pilot training and techniques. This training aims to prevent the effects of spatial disorientation even when visual cues outside the cockpit are absent (Tab AA-50).

(2) Human Factor 2 - *Task Misprioritization (AE202)*

In accordance with AFI 91-204, Attachment 6, page 138, *Task Misprioritization* is a factor when the individual does not organize, based on accepted prioritization techniques, the tasks needed to manage the immediate situation.

The MP was qualified and experienced in instrument flying and executing cockpit visual scan patterns (Tab G-25, G-26). The MP demonstrated an adequate instrument scan during the RTB by maintaining level flight at 5,200' MSL for 48 seconds during the initial turn to the west, and at 4,300' MSL for 15 seconds (Tabs L-2, S-22). However, from 3,500' MSL, 90 seconds prior to impact, the MP began a steady descent of 1,740 fpm which increased to over 2,000 fpm passing 3000' MSL, 32 seconds prior to impact (Tabs L-2, S-22). After passing through 3,500' MSL, the MP did not significantly arrest his descent rate prior to impact, indicating a loss of altimeter checks from his visual scan technique (Tabs L-2, S-22, AA-36, AA-37, AA-39, AA-48, AA-50).

Flight path analysis demonstrates the MP was navigating properly on the horizontal plane, but not the vertical plane (Tabs L-2, S-22). During the last 16 seconds of flight, the MP executed a 40 degree turn using up to 42 degrees of bank, and intercepted the localizer course (Tabs L-2, S-22). However, during the same period, the MA maintained an unusually high and steady descent rate of 2,200 fpm through the last second of flight. In addition, 6 seconds prior to impact, the MP made a radio call to the MW asking if he was receiving the glide slope (Tabs L-2, R-6, S-22). The MP misprioritized navigation and supervising his wingman to the exclusion of altitude in his instrument scan (Tabs L-2, S-22, AA-36, AA-37, AA-39, AA-48, AA-50).

(3) Human Factor 3 - *Spatial Disorientation (Type 1) Unrecognized (PC-508)*

In accordance with AFI 91-204, Attachment 6, page 138, *Spatial Disorientation* is a failure to correctly sense a position, motion or attitude of the aircraft or of oneself within the fixed coordinate system provided by the surface of the earth and the gravitational vertical. Spatial Disorientation (Type 1) Unrecognized is a factor when a person's cognitive awareness of one or more of the following varies from reality: attitude, position, velocity, direction of motion, or acceleration. Proper control inputs are not made because the need is unknown.

Visual references provide the most important sensory input to the brain and its ability to maintain spatial orientation during flight (Tab AA-34). They provide information about distance, speed, depth, and orientation (TAB AA-35). Pursuant to Air Force Tactics, Techniques and Procedures (AFTTP) 3-3.F-16, 29 June 2012, Paragraph 9.3.2, as the MP flew on a westerly heading, he may not have been able to identify the true horizon, even with his NVGs on (Tabs F-2, F-8, L-2, R-15 through R-17, R-20 through R-21, S-22). The MP would have had to rely on his instruments and heads-up display (HUD) along with primary performance instruments for orientation (Tabs F-2, F-8, L-2, R-15 through R-17, R-20 through R-21, S-22).

According to AFMAN 11-117, V3, pages 154-155, vision can be divided into two types, focal and ambient vision (Tab AA-36 through AA-38). The distinction between focal and ambient vision is important when considering the role of vision in determining spatial orientation during flight (Tab AA-36 through AA-38). When there is good visibility and a clearly defined horizon, the pilot naturally employs the peripheral ambient visual system for spatial orientation (Tab AA-37). The task requires little conscious processing (Tab AA-35 through AA-36). When flying at night, or under instrument meteorological conditions (IMC), a pilot determines aircraft orientation using flight instruments, which must be learned, and requires the use of focal vision in accordance with AFMAN 11-217, V3, page 161. The focal visual system used in instrument flying is not the natural orientation mechanism and requires more cognitive processing than when external visual cues are used for orientation (Tab AA-36 through AA-37, AA-44). Thus, pursuant to AFMAN 11-217, V3, page 155, spatial disorientation is more likely to occur during flight at night or in IMC.

The use of visual cues not only maintains spatial orientation, it also controls inappropriate input from the vestibular system (Tab AA-39 through AA-40, AA-48). With time and practice, an aviator develops the ability to suppress vestibular miscues (Tab AA-39 through AA-40, AA-48). This vestibular suppression occurs primarily through visual dominance (Tab AA-48). Vestibular suppression occurs more easily in high visibility situations using primarily ambient visual cues derived outside the cockpit (Tab AA-48). Aviators learn to suppress vestibular input even in low visibility conditions by using focal vision cues derived from the aircraft instruments using an intact visual scan (Tab AA-48).

Analysis of the MA's flight path demonstrates a steadily increasing descent from 4,300' MSL to the surface of the earth with only a momentary level off (Tabs L-2, S-22). Based upon control inputs, as the MA approached 3,500' MSL, the MP leveled off momentarily, but immediately reinitiated the descent as the MA airspeed climbed above 250 kts (Tabs L-2, S-22). The MP appropriately reduced power to idle, but maintained his pitch setting (Tabs L-2, S-22). This resulted in the intended lower airspeed, but also the reestablishment of a descent rate (Tabs L-2, S-22). These control inputs indicate a loss of focus by the MP on his instrument cross-check and a reflexive response to a vestibular illusion caused by a prolonged steady descent (Tab AA-40, AA-43 through AA-44, AA-48).

Since the vestibular system registers accelerations, it would stop providing inputs once a relatively steady descent was reached (Tab AA-40, AA-43 through AA-44). Any attempt to decrease or arrest the steady descent would cause the body to sense a pitch up/climb (Tab AA-43 through AA-44). If the pilot does not monitor attitude, altitude, and VVI during this critical time, the vestibular illusion can cause him to put the aircraft back into a descent (Tab AA-44). This vestibular illusion is also known as the "elevator illusion" referencing the common circumstance of a long elevator descent with no visual references (Tab AA-38, AA-43).

Figure 2 displays a variety of MA flight parameters over time. Figure 2-1 charts altitude and vertical velocity. Figure 2-2 charts airspeed and throttle position (from the lowest power setting of "idle" to the highest power setting without afterburner of "military," or "MIL"). According to the flight path data, the MA passed through 3,100' MSL in a steady 1,500 fpm descent (Tabs L-2, S-22). The MP then pushed the stick forward and increased his descent angle (Tabs L-2, S-22). Pursuant to AFMAN 11-217, V1, page 160, had the MA been at 3500' MSL, then the MP's flight control inputs would have been the correct actions to descend to 3,000' MSL, however, the MA was already in an unrecognized descent (Tab BB-31). Given the MP's unperceived 1,500 fpm descent rate from the ongoing elevator illusion, his flight control inputs further increased the actual descent rate to between 2000-3000 fpm (Tabs L-2, S-22). At 2,300' MSL (160' above ground level (AGL)) and sinking at 3,000 fpm, the MP turned to the right, and increased power in a 1.3G turn to the final approach course (Tabs L-2, S-22). Without a thorough instrument visual scan, this additional G Force would stimulate the MP's vestibular system to register another false pitch up sensation exacerbating the elevator illusion and reinforcing the decision to continue the descent (Tab AA-42 through AA-44).

Figure 2. Visual Representation of Altitude and Vertical Velocity in Comparison to Air Speed and Throttle Position (Tab Z-4)

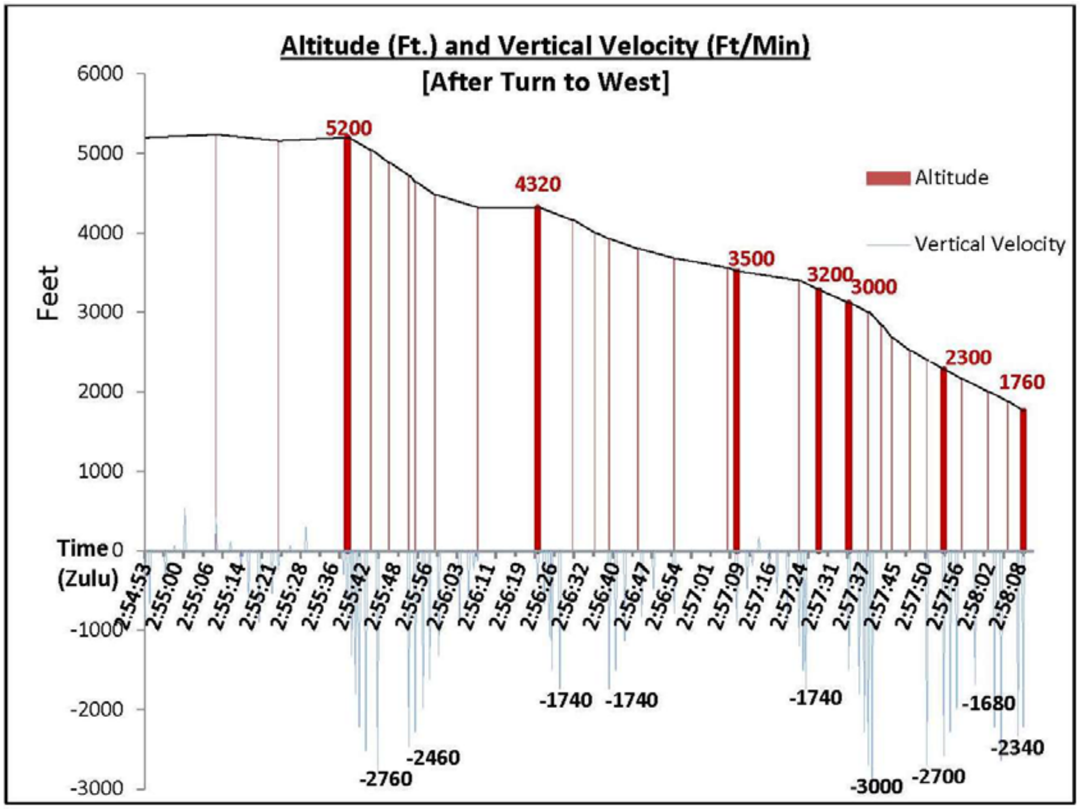


Figure 2-1

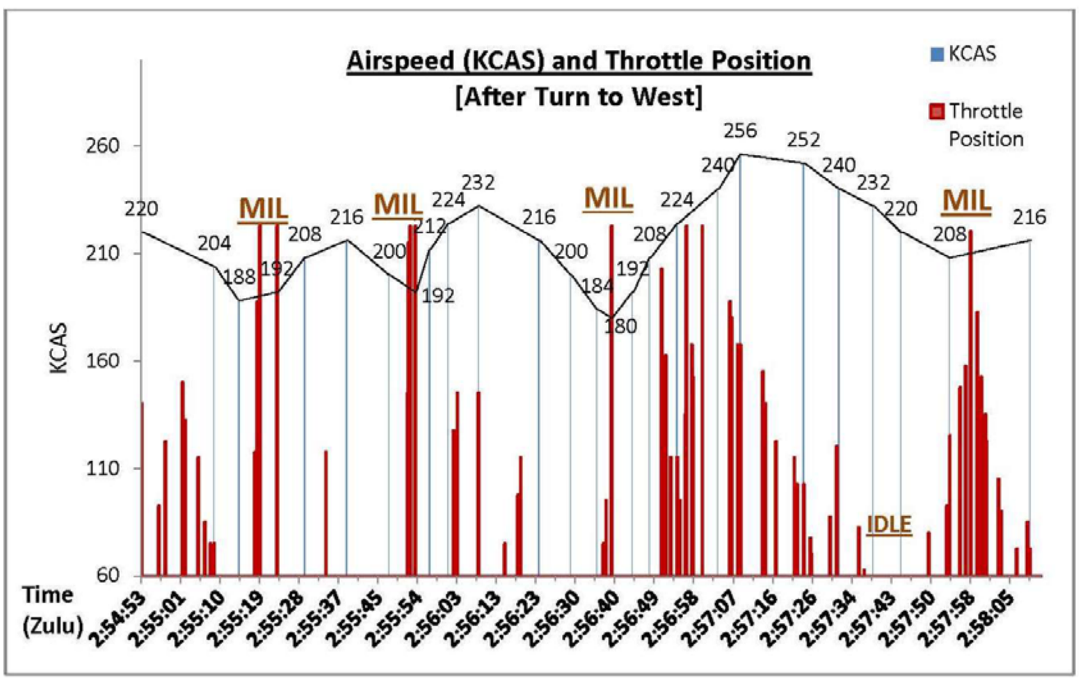


Figure 2-2

(4) Human Factor 4 - *Risk Assessment – During Operation (AE201)*

In accordance with AFI 91-204, Attachment 6, page 138, *Risk Assessment – During Operation* is a factor when the individual fails to adequately evaluate the risks associated with a particular course of action. This faulty evaluation leads to inappropriate decision and subsequent unsafe situation. This failure occurs in real-time when formal risk-assessment procedures are not possible.

After the MW's aircraft had a landing gear door malfunction, the MP directed the mishap flight to reduce weight by burning down fuel over the BO (Tab R-5 through R-6). After sufficient weight reduction, the MP directed the MF to join the instrument approach inside the IAF below the MSA (Tab V-7.5, V-8.2, V-8.3, V-8.4). This was common practice in the 77 EFS utilized to compensate for the lack of radar approach control at the BO airfield (Tab V-7.5, V-8.3 through V-8.4).

The MP's decision to descend below MSA removed a safety buffer that would have given the MP extra time to re-establish altitude awareness in his instrument visual scan (Tab L-2, S-22, AA-3, AA-23).

12. GOVERNING DIRECTIVES AND PUBLICATIONS

a. Publically Available Directives and Publications Relevant to the Mishap

(1) Air Force Instruction 11-202, Volume 3, *General Flight Rules*, 7 November 2014
(2) Air Force Instruction 11-202, Volume 1, *Flying Operations*, 22 November 2010
(3) Air Force Manual 11-217, Volume 1, *Instrument Flight Procedures*, 22 October 2010
(4) Air Force Manual 11-217, Volume 2, *Visual Flight Procedures*, 22 October 2010
(5) Air Force Manual 1-217, Volume 3, *Supplemental Flight Information*, 23 February 2009, Certified Current 9 April 2012
(6) Air Force Instruction 21-101, *Aircraft and Equipment Maintenance Management*, dated 26 July 2010
(7) Air Force Guide Memorandum to Air Force Instruction 21-101, 22 April 2014
(8) Air Force Instruction 91-204, *Safety Investigations and Reports*, 12 February 2014
(9) Air Force Policy Directive 11-2, *Flying Operations*, 9 January 2012
(10) Air Force Instruction 11-2F-16, Volume 1, *F-16 Pilot Training*, 11 August 2011
(11) Air Force Instruction 11-2F-16, Volume 2, *F-16 Aircrew Evaluation Criteria*, 10 December 2009 Incorporating Change 1, 27 August 2010
(12) Air Force Instruction 11-2F-16, Volume 3, *F-16 Operations Procedures*, 18 December 2013
(13) Air Force Instruction 11-2F-16, Volume 3, *F-16 Operations Procedures*, 18 February 2010, Shaw Air Force Base Supplement, 10 October 2012
(14) Air Force Instruction 11-202, Volume 2, *Aircrew Standardization/Evaluation Program*, 13 September 2010, Air Combat Command Supplement 30 June 2011
(15) Air Force Instruction 11-202, Volume 3, *General Flight Rules*, 22 October 2010, Air Combat Command Supplement 28 November 2012

(16) Air Force Instruction 48-123, *Aerospace Medicine Medical Examinations and Standards,* 5 November 2013

NOTICE:

a. 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. T.O. 00-20-1, *Aerospace Equipment Maintenance Inspection, Documentation, Policies, and Procedures*, dated 15 June 2013 can be located at: http://www.tinker.af.mil/shared/media/document/AFD-130619-015.pdf

b. Other Directives and Publications Relevant to the Mishap

(1) T.O. 1F-16CJ-2-29FI-00-1, *Organizational Maintenance Fault Isolation – Hydraulic System, Fault Tree* (29-00-XD), 1 September 2013
(2) T.O. 1F-16CJ-2-29JG-10-1, *Organizational Maintenance Job Guide – Hydraulic Systems, Function* (29-11-06), 1 November 2014
(3) T.O. 42B-1-1, *Quality Control of Fuels and Lubricants*, 1 August 2014
(4) T.O. 00-20-1, *Aerospace Equipment Maintenance Inspection, Documentation, Policies, and Procedures*, dated 15 June 2013
(5) T.O. 1F-16CJ-6, *Scheduled Inspection and Maintenance Requirements*, 1 November 2013, w/ interim supplements 4 November 2014 and 8 November 2014
(6) T.O. 1F-16CJ-6WC-1-11, *Preflight, End of Runway, Thru-flight, Launch and Recovery, Quick Turnaround, and Basic Post-flight Inspection Work Cards*, 1 November 2013
(7) T.O. 1F-16CM-1, *Aircrew Flight Manual*, 1 May 2014
(8) T.O. 1F-16CM-1CL-1, *Flight Crew Checklist*, 15 April 2007, IC 9, 1 May 2014
(9) T.O. 1F-16CM-34-1-1 , *Avionics and Nonnuclear Weapons Delivery Flight Manual*, 1 June 2014
(10) Air Force Tactics, Techniques and Procedures (AFTTP) 3-3.F-16, *Combat Aircraft Fundamentals*, 29 June 2012
(11) *Fundamentals of Aerospace Medicine,* 4th Edition, Jeffrey R. Davis, Lippincott Williams & Wilkins, Philadelphia, 2008
(12) Fatigue Avoidance Scheduling Tool (FAST) developed by Dr. Steven Hursh of Science Applications International Corporation under license to the Department of Defense
(13) *Ernsting's Aviation Medicine*, 4th Edition, Edited by David J. Rainford and David P. Gradwell, Oxford University Press Inc, New York, 2006
(14) *Spatial Disorientation in Aviation*, Edited by Fred H. Previc and William R. Ercoline, published by the American Institute of Aeronautics and Astronautics, Inc., Reston, Virginia, 2004
(15) Federal Aviation Administration, *Aeronautical Information Manual Official Guide to Basic Flight Information and ATC Procedures,* 3 April 2014
(16) Federal Aviation Administration Volume 82, *Space and Environmental Medicine* 2011, pages 717-724

c. Known or Suspected Deviations from Directives or Publications

The MF deviated from 77 EFS guidance in PRF 14-01, by not starting the instrument approach at the IAF (Tab L-2, S-22, AA-27).

The MF deviated from AFI 11-202, V3, paragraph 6.2.2.2.3, by flying below the minimum IFR altitude (Tab L-2, S-22). When off an airway, without a published Off Route Obstacle Clearance Altitude (OROCA), or Off Route Terrain Clearance Altitude (ORTCA), AFI 11-202, V3, 6.2.2.2.3, requires aircraft to remain above the lowest published MSA. In this case, the minimum sector altitude of 3,700' MSL within 25 nm was the lowest published MSA (Tab L-2, S-22, AA-3).

The MF violated AFI 11-217, V1, paragraph 9.5.5, by deviating from their Air Traffic Control (ATC) clearance, by descending below their cleared altitude of 4,200' MSL prior to being established on a segment of the approach (Tab L-2, S-22).

13. ADDITIONAL AREAS OF CONCERN

Not applicable.

16 MARCH 2015

JEFFREY B. TALIAFERRO
Brigadier General, USAF
President, Accident Investigation Board

STATEMENT OF OPINION

F-16CM, T/N 91-0375
CENTCOM AOR
1 DECEMBER 2014

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 unrecognized descent into the ground resulting in controlled flight into terrain.

Further, I find by a preponderance of the evidence that the mishap pilot's initial intentional descent below minimum safe altitude, significantly reducing the time available to recognize and respond to the unrecognized descent, was a factor that significantly contributed to the mishap.

2. Discussion of Opinion

On 1 December 2014 at 04:58:10 hours local time (L) (02:58:10 hours Zulu time (Z)) the Mishap Aircraft (MA), an F-16CM, Tail Number (T/N) 91-0375, deployed with the 77th Expeditionary Fighter Squadron, to a classified base of operation (BO) in the U.S. Central Command (CENTCOM) Area of Responsibility (AOR), impacted the ground 9.5 nautical miles (nm) southeast of the BO. The Mishap Flight (MF) was a two-ship combat mission in support of Operation Inherent Resolve in the CENTCOM AOR. The mishap occurred in an unpopulated area. The Mishap Pilot (MP) did not attempt to eject from his aircraft and was fatally injured on impact. The MA was destroyed with a loss valued at $30,796,852. Host nation forces recovered the remains of the MP and transported them to U.S. forces at the BO. The mishap caused neither civilian injuries nor damage to civilian property. Many U.S. and international media sources reported on the mishap.

The MA took off from the BO on 1 December 2014 at 0421L (0221Z) and flew the entire sortie at night. The MP was flight lead of a two-ship of F-16CMs tasked to support Operation Inherent Resolve in the CENTCOM AOR. Upon takeoff, the Mishap Wingman (MW) experienced a landing gear door malfunction causing the MP to direct the flight to remain near the BO, burn down fuel to reduce weight, and land. The MP coordinated with operations supervision at the BO who directed the MF, once able to land, to move to new aircraft and re-launch to accomplish their combat mission. Due to the MW's gear malfunction, the MP put the MW in the lead of the formation for the majority of the flight. While maneuvering to land, the MP descended into the ground due to unrecognized spatial disorientation and misprioritization of tasks. The MP had already descended below the published minimum safe altitude (MSA) into an environment lacking sufficient visual cues (night), against instrument procedures and guidance, thereby reducing his margin of safety and time to recognize and respond to the unrecognized descent.

The MP did not recognize a continued descent from 3000' mean sea level (MSL) to impact with the ground (1,680' MSL) as a result of unrecognized Spatial Disorientation and misprioritization of tasks. During this 32-second period, the MA maintained a continuous descent. During the final 16 seconds of flight, the MP turned approximately 40 degrees to intercept final approach course using up to 42 degrees of bank. Near the end of this turn, six seconds prior to impact, the MP called the MW on the radio to ask if he was receiving the glide slope. During the last second of flight, the MP recognized the MA's relation to the ground and initiated a 4G level pull away from the ground. At that point, insufficient time and altitude remained for the MP to avoid impact with the ground. The MP did not attempt to eject and died upon impact. While working to intercept the final approach course and supervising his wingman, the MP failed to keep his own altitude in his cross-check in an environment lacking sufficient visual cues to compensate.

The MF intentionally flew below the MSA prior to starting the approach, against instrument procedures. To compensate for the lack of radar approach control, the MF executed a common practice used among 77 EFS pilots of joining the instrument approach inside the initial approach fix (IAF), which is later than allowed by published procedures and guidance. As a result, both aircraft in the MF continued to approximately 3,000' MSL (1,000' below IAF) before being established on a segment of the instrument approach, thereby reducing time to recognize and respond to the subsequent descent by approximately 39 seconds. Squadron supervision was aware of this common practice and had taken some steps to stop it, but those steps proved insufficient. In fact, at a minimum, some pilots perceived the leadership's informal focus, in regards to night approaches, was to meet approach requirements by the final approach fix (3,000' MSL). While not the direct cause of the mishap, the MP's intentional descent below minimum safe altitude was a significant contributing factor as it is impossible to discern whether the MP would have been able to recognize and recover from his subsequent unrecognized descent if provided that additional time.

3. CONCLUSION

I find by clear and convincing evidence the cause of this mishap was the mishap pilot's unrecognized descent into the ground resulting in controlled flight into terrain.

Further, I find by a preponderance of the evidence that the mishap pilot's initial intentional descent below minimum safe altitude, significantly reducing the time available to recognize and respond to the unrecognized descent, was a factor that substantially contributed to the mishap.

16 MARCH 2015

JEFFREY B. TALIAFERRO
Brigadier General, USAF
President, Accident Investigation Board

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