EXECUTIVE SUMMARY
AIRCRAFT ACCIDENT INVESTIGATION

F-16C, T/N 87-0314, and F-16C, T/N 86-0357
WARNING AREA 386
1 AUGUST 2013

On 1 August 2013, at 22:23:56 local time (L), an F-16C, tail number (T/N) 87-0314, collided mid-air into an F-16C, T/N 86-0357, while participating in night tactical air intercept training over the Atlantic Ocean, off the coast of Maryland. Both aircraft were assigned to the 121st Fighter Squadron, 113th Wing, District of Columbia Air National Guard, Joint Base Andrews (JBA), Maryland. The right wing of the first mishap aircraft, F-16C, T/N 87-0314 (hereinafter referred to as MA1) struck the left stabilator of the second mishap aircraft, F-16 C, T/N 86-0357 (hereinafter referred to as MA2). The MA1 suffered significant structural damage to its right wing, but the mishap pilot (MP1) was able to recover the aircraft to JBA. The MA2 experienced debilitating structural damage causing the aircraft to be uncontrollable. The mishap pilot two (MP2) successfully ejected, sustained non-life threatening injuries, and was recovered by search and rescue (SAR) forces. The MA1 suffered damage with a repair cost of $1,072,365.00. The MA2 was destroyed upon impact with the water, resulting in a loss valued at $21,868,432.00. Total mishap loss/cost was $22,940,797.00. There was no damage to private property, and there were no civilian casualties.

The MA1 and the MA2 departed JBA as part of a three-ship F-16C formation to complete a Mission Qualification Training (MQT) Aerospace Control Alert (ACA) night intercept upgrade. The MP1 was the Instructor Pilot, and the MP2 was number three in the formation as the non-maneuvering adversary training aid. During the upgrade, the MP1 elected to lead an intercept for a demonstration of intercept geometry and ACA pacing. During the intercept, the MP1 rolled out at 3900 feet behind the MA2 then proceeded to close on the MA2's position to demonstrate an ACA inspect procedure, i.e. fly close enough to allow inspection into a target of interest cockpit. During this phase, the MP1 failed to process the accurate range, airspeed, and closing velocity cues displayed by his aircraft, and attempted to close visually (not monitoring radar cues) under low-illumination/dark night conditions. At 500 feet directly behind the MA2, and at the same altitude, the MP1's airspeed had increased to 412 knots, with 100 knots of closing velocity. His closing velocity should have been less than 5 knots at that range, with an offset, both in horizontal and in vertical altitude, until sufficient visual references were available to close for the inspect procedure. Three seconds later, the MP1 collided into the back of the MA2.

The Board President (BP) found by clear and convincing evidence the cause of this mishap was failure of the MP1 to maintain flight path deconfliction between himself and the MA2 due to three human factors causal to the mishap: Misperception of Operational Conditions, Channelized Attention, and Task Misprioritization. By a preponderance of the evidence, the BP found four human factors substantially contributed to the mishap: Overconfidence, Inadequate Crew Rest, Fatigue – Physiological/Mental, and Violation – Lack of Discipline.

SUMMARY OF FACTS AND STATEMENT OF OPINION
F-16C, T/N 87-0314, AND F-16C, T/N 86-0357
1 AUGUST 2013

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ACRONYMS AND ABBREVIATIONS

1CO	Pilot Air Force Specialty Code
A/C	Air Craft
AAR	Air to Air Refueling
ACA	Aerospace Control Alert
ACC	Air Combat Command
ADI	Attitude Display Indicator
ADUSCAN	Air Defense of the US and Canada
AF	Air Force
AFB	Air Force Base
AFI	Air Force Instruction
AFIP	Armed Forces Institute of Pathology
AFMAN	Air Force Manual
AFPAM	Air Force Pamphlet
AFPD	Air Force Policy Directive
AFSAS	Air Force Safety Automated System
AFTO	Air Force Technical Order
AFTP	Additional Flying Training Period
AGR	Active Guard Reserve
AIB	Accident Investigation Board
ANG	Air National Guard
AQT	ACA Qualification Training
ARC	Air Reserve Component
ARMS	Aviation Resource Management System
ASA	Air Sovereignty Alert
AT	Annual Training
ATP	Advanced Targeting Pod
AUX	Auxiliary
B/E	Bull's-eye
BAC	Blood Alcohol Content
BD	Battle Damage
BD√	Battle Damage Check
BFM	Basic Fighter Maneuvers
BP	Board President
BPO/PR	Basic Post-Flight/Pre-Flight
BVR	Beyond Visual Range
CAP	Combat Air Patrol
Capt	Captain
CAS	Close Air Support
CATA	Collision Antenna Train Angle
CDR	Commander
CIA	Central Intelligence Agency
Col	Colonel
CRU	Connector Regulator Unit
CSFDR	Crash Survivable Flight Data Recorder
CT	Continuation Training
DO	Director of Operations
DoD	Department of Defense
DSG	Drill Status Guardsman
DTC	Data Transfer Cartridge
DVR	Data Video Recorder
E	Extra
EGI	Embedded GPS INS
ELT	Emergency Locator Transmitter
EOT	Engine Operation Time
EP	Emergency Procedure
FAST	Fatigue Avoidance Scheduling Tool
FCIF	Flight Crew Information File
FCR	Fire Control Radar
FDP	Flight Duty Period
FLCS	Flight Control System
FLIR	Forward Looking Infrared
Freq	Frequency
FS	Fighter Squadron
G	Gravity
G-EX	Gravity Awareness Exercises
GK	General Knowledge
GPS	Global Positioning System
GS	General Schedule
Helo	Helicopter
HUD	Head-Up Display
i.e.	*id est* or "in other words"
I/O	Investigating Officer
IAW	In Accordance With
ID	Identification
IFE	In-Flight Emergency
IFG	In-Flight Guide
illum	Illumination
IMDS	Integrated Maintenance Data System
INS	Inertial Navigation System
IP	Instructor Pilot
IPUG	Instructor Pilot Upgrade
ISB	Interim Safety Board
JBA	Joint Base Andrews
JOAP	Joint Oil Analysis Program
K	Thousand
KADW	Joint Base Andrews Airport Code
L	Local Time
Lat	Latitude
LLC	Limited Liability Corporation
Long	Longitude
LOWAT	Low Altitude
LPU	Life Preserver Unit
Lt	Lieutenant
Lt Col	Lieutenant Colonel
MA	Mishap Aircraft
MA1	Mishap Aircraft1
MA2	Mishap Aircraft 2
Maj	Major
MAJCOM	Major Command
Mbr	Member
ME	Mishap Engine
Med	Medical
MED	Medical Member
MF	Mishap Flight

MGECC	Malcolm Grow Emergency Care Center
MOA	Military Operating Area
MP	Mishap Pilot
MP1	Mishap Pilot 1
MP2	Mishap Pilot 2
MQT	Mission Qualification Training
MS	Mishap Sortie
MSL	Mean Sea Level
MTC	Mission Training Center
NCR	National Capital Region
NGB	National Guard Bureau
NM	Nautical Miles
NOTAMS	Notices to Airmen
NVGs	Night Vision Goggles
Ops	Operations
ORM	Operational Risk Management
OSAT	Opposed Surface Attack
OSC	On Scene Commander
PA	Public Affairs
PCP	Phencyclidine
PEX	Patriot Excalibur
PHA	Physical Health Assessment
PLF	Parachute Landing Fall
PRC	Portable Radio Communications
PRD	Pilot Reported Discrepancy
pri	Primary
RAP	Ready Aircrew Program
RESCAP	Rescue Combat Air Patrol
RM	Risk Management
ROE	Rules of Engagement
RTB	Return to Base
RTIT	Radar Tally Identification Terminate
RTU	Replacement Training Unit
RUTA	Rescheduled Unit Training Assembly
S/N	Serial Number
SA	Situational Awareness
SADL	Situation Awareness Data Link
SAR	Search and Rescue
SARCAP	Search and Rescue Combat Air Patrol
schmeez	cloud/dust/fog
SCL	Standard Configuration List
SCU	Software Compatibility Upgrade
SDR	Seat Data Recorder
SIB	Safety Investigation Board
SOF	Supervisor of Flying
SPINs	Special Instructions
SQR	Squadron
SUP	Supervisor
TAR	Task Assignment Record
T.O.	Technical Order
T/N	Tail Number
tac	Tactical
TAD	Tactical Air Display
TCTO	Time Compliance Technical Order
TD	Target Detection
TFR	Temporary Flight Restriction
TI	Tactical Intercept
TOI	Target of Interest
TTP	Tactics, Techniques, and Procedures
UAS	Unmanned Aircraft System
UHF	Ultra High Frequency
UP	Upgrade Pilot
US	United States
U.S.C.	United States Code
UTD	Unit Training Device
V	Volume
v.	Versus
VFR	Visual Flight Rules
VHF	Very High Frequency
vis	Visual
W-386	Warning Area 386
WEZ	Weapon Engagement Zone
WG	Wing
Whiskey	Warning Area
WID	WEZ In-depth
XP	Plans and Programs

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

SUMMARY OF FACTS

1. AUTHORITY AND PURPOSE

a. Authority

On 5 September 2013, Lieutenant General Lori J. Robinson, Vice Commander, Air Combat Command, appointed Colonel Howard P. Purcell to conduct an aircraft accident investigation of a mishap that occurred on 1 August 2013 involving two F-16C aircrafts in Warning Area 386 (W-386) (Tab Y-3). The accident investigation was conducted in accordance with Air Force Instruction (AFI) 51-503, *Aerospace Accident Investigations*, at Joint Base Andrews, Maryland, from 3 October 2013 through 30 October 2013 (Tab Y-3). The Accident Investigation Board (AIB) also included the following members: the legal advisor, pilot member, maintenance member, medical member, and recorder/court reporter (Tab Y-3).

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 August 2013, at 22:23:56 local time (L), an F-16C, tail number (T/N) 87-0314, collided mid-air into an F-16C, T/N 86-0357, while participating in night tactical air intercept training over the Atlantic Ocean, off the coast of Maryland (Tabs Y-3, Z-3). Both aircraft were assigned to the 121st Fighter Squadron, 113th Wing, District of Columbia Air National Guard, Joint Base Andrews (JBA), Maryland (Tabs S-6, N-2 through N-4, R-10, Z-12). The right wing of the first mishap aircraft, F-16C, T/N 87-0314 (hereinafter referred to as MA1), struck the left stabilator (moves and controls the pitch of the aircraft) of the second mishap aircraft, F-16 C, T/N 86-0357 (hereinafter referred to as MA2); the collision embedded the left stabilator of the MA2 into the MA1's right wing (Tabs N-4, R-10, S-2 through S-4). The MA1 suffered significant structural damage to its right wing, but the mishap pilot (MP1) was able to recover the aircraft to JBA (Tabs N-19 through N-21, R-25 through R-26, R-43, S-2). The MA2 experienced debilitating structural damage causing the aircraft to be uncontrollable (Tabs R-10, V-6.6). The mishap pilot two (MP2) successfully ejected, sustained non-life threatening injuries, and was recovered by search and rescue (SAR) forces (Tabs R-10 through R-15, V-6.6 through V-6.11). The MA1 suffered damage with a repair cost of $1,072,365.00 (Tabs P-5, S-2 through S-4). The MA2 was destroyed upon impact with the water, resulting in a loss valued at $21,868,432.00 (Tab P-4 through P-5). Total mishap loss/cost was $22,940,797.00. There was no damage to private property, and there were no civilian casualties (Tab P-2 through P-3).

3. BACKGROUND

The MA1 and the MA2 belong to the 121 Fighter Squadron, 113 Wing, Air National Guard, Air Combat Command stationed at Joint Base Andrews, Maryland (Tab Q-7 through Q-8).

a. Air Combat Command

Air Combat Command (ACC), with headquarters at Langley Air Force Base, Virginia, is a major command created June 1, 1992, by combining its predecessors Strategic Air Command and Tactical Air Command (Tab CC-3). ACC is the primary provider of air combat forces to America's warfighting commanders (Tab CC-3).

To support global implementation of national security strategy, 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, 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). ACC numbered air forces provide the air component to United States (U.S.) Central, Southern and Northern Commands, with Headquarters ACC serving as the air component to Joint Forces Commands. ACC also augments forces to U.S. European, Pacific and Strategic Command (Tab CC-3).

b. Air National Guard

The Air National Guard (ANG) is administered by the National Guard Bureau (NGB), a joint bureau of the departments of the Army and Air Force (AF), located in the Pentagon, Washington, D.C (Tab CC-10). It is one of the seven Reserve components of the United States armed forces that augment the active components in the performance of their missions (Tab CC-10). The ANG has both a federal and state mission (Tab CC-10). The dual mission, a provision of the U.S. Constitution, results in each guardsman holding membership in the National Guard of his or her state and in the National Guard of the United States (Tab CC-10).

The ANG's federal mission is to maintain well-trained, well-equipped units available for prompt mobilization during war and provide assistance during national emergencies (such as natural disasters or civil disturbances) (Tab CC-10). During peacetime, the combat-ready units and support units are assigned to most Air Force major commands to carry out missions compatible with training, mobilization readiness, humanitarian and contingency operations such as Operation Enduring Freedom in Afghanistan (Tab CC-10).

c. District of Columbia Air National Guard

The District of Columbia Air National Guard (DCANG), located at JBA, Maryland, is under the direct jurisdiction of the President of the United States through the office of the Commanding General, District of Columbia National Guard (Tab CC-15). The DCANG provides air expeditionary forces when federalized, and when activated under there "state" auspices, provides disaster relief for earthquakes, floods, search and rescue, and a variety of other support capabilities (Tab CC-15).

d. 113th Wing

The 113th Wing (WG), as an ACC gained unit which also has an Air Mobility Command component, trains and equips air combat and operational airlift crews for national defense (Tab CC-16). Additionally, the 113 WG provides air sovereignty forces to defend the National Capital Region (Tab CC-16).

e. 121st Fighter Squadron

The 121st Fighter Squadron (FS) trains and equips air expeditionary forces to perform air-to-air and air-to-gound combat operations (Tab CC-20). Further, the 121 FS conducts twenty-four hours/day, seven days/week (24/7) Aerospace Control Alert (ACA) operations (Tab CC-20).

e. F-16

The F-16 is a multi-role fighter aircraft (Tab CC-21). It is highly maneuverable and has proven itself in air-to-air combat and air-to-surface attack (Tab CC-21). It provides a relatively low-cost, high performance weapon system for the United States and allied nations (Tab CC-21).

In an air combat role, the F-16's maneuverability and combat radius (distance it can fly to enter air combat, stay, fight and return) exceed that of all potential threat fighter aircraft (Tab CC-21). It can locate targets in all weather conditions and detect low flying aircraft in radar ground clutter (Tab CC-21). In an air-to-surface role, the F-16 can fly more than 500 miles (860 kilometers), deliver its weapons with superior accuracy, defend itself against enemy aircraft, and return to its starting point (Tab CC-21). An all-weather capability allows it to accurately deliver ordnance during non-visual bombing conditions (Tab CC-20).

4. SEQUENCE OF EVENTS

a. Mission

On 1 August, 2013, the mishap sortie (MS) was planned, coordinated, and briefed as a "fight-tank-fight" mission qualification training (MQT) sortie with air-to-air refueling (AAR) followed by a 3v2 tactical intercept (TI) continuation training (CT) sortie with another flight (Tabs K-6, R-9, R-20 to R-22, R-49). The mission was to occur in W-386, which is a designated air space over the Atlantic Ocean, off the coast of Maryland (Tab S-6). The mishap flight (MF) had three aircraft/pilots: the MP1 as the instructor pilot (IP), the upgrading pilot (UP), and the MP2 was the adversary training aid (Tabs K-6, R-9). The 121 FS Supervisor of Flying (SOF) authorized the mission on an Aviation Resource Management System fighter authorization form (Tab K-5).

b. Mission Planning

Mission planning for the MS was completed prior to the scheduled pre-flight mass brief time and included intercepts and an MQT ACA upgrade ride (Tabs V-1.6, V-5.16, V-6.4). Mass, coordination, and individual flight briefs started on time and were considered standard (Tab V-1.6). The SOF provided the mass briefing and followed a script; other supervisory personnel were not present (Tabs V-1.8, V-3.5 to V-3.6, V-6.11 to V-6.12, V-7.4). After the mass briefing, the MP1 gave the coordination briefing, which included that the adversaries would turn off external lights during some of the intercept as part of the upgrade training (Tabs V-3.4, V-3.6, V-3.7, V-4.3, V-5.14, V-6.4).

c. Preflight

The MP1, the MP2, and the UP received a standard step briefing from the SOF which included local airfield and airspace weather, diverts, and notices to airmen (NOTAMS) (Tabs R-49, R-55, V-6.4, V-7.11). The MA1 and the MA2 were configured with two external wing fuel tanks, three training air-to-air missiles, one Air Combat Maneuvering Instrumentation pod, and a safe gun (Tabs K-16 through K-19). There is no evidence to suggest preflight procedures were factors in this mishap (Tabs V-5.20 through V-5.21).

d. Summary of Accident

The MF taxi, takeoff, departure, and airspace entry were uneventful (Tabs R-28, V-6.4, V-7.4). Throughout the sortie, both before and after refueling, the UP was unsuccessful in completing his MQT-ACA-2 upgrade (Tabs R-9, R-30, R-46, R-49 through R-50, V-5.24, V-3.4, V-6.5). Due to this failure, the MP1 elected to lead an intercept with the UP in trail behind him, for a demonstration of proper intercept mechanics and ACA pacing (Tabs R-9, R-49 through R-50, V-5.24, V-6.5, V-7.4).

The MP1's demonstration intercept included real-time verbal instruction to the UP and radio inputs, as the MP1 was not only instructing, but also acting as both lead and the ACA controlling agencies (Tabs N-2, V-5.4, V-7.4).

At the beginning of the intercept, the MP1 directed the MP2 to turn off all external lighting (Tabs N-2, V-5.20, V-6.14). During the intercept, the MP2 flew in a straight line back and forth across the airspace at 310 knots, and 11,180 feet mean sea level (MSL) (Tabs V-6.16, Z-3 through Z-12).

The MP1 proceeded to circle around the MA2 and fly within 3900 feet behind the MP1 at 335 knots with 0 knots of closing velocity (Tab Z-3). The MP1, playing both the role of the ACA controlling agencies and the intercepting pilot, directed himself to perform an ACA inspect of the MA2 (Tab N-2). An ACA inspect is a directive to look at and gather data from the cockpit of the target of interest and implies flying within 500 feet to the side of the target (Tabs V-5.25, BB-55).

Ten seconds later, the MP1 was 3,000 feet behind the MA2, at the same altitude, with an airspeed of 386 knots and 60 knots of closing velocity (Tab Z-5). At 500 feet behind the MA2, the MP1's airspeed had increased to 412 knots with 100 knots of closing velocity; a "break-X" appeared in the MP1's head-up display (HUD) (Tab Z-11). A break-X displays in the HUD under these circumstances as a warning indicating that the pilot should maneuver to ensure safe distance from another aircraft (Tab DD-14). The MP1 did not see the break-X that appeared in the HUD of the MA1 (Tab V-5.34). Three seconds later, the MP1 collided into the back of the MA2 (Tabs N-2, S-6, Z-12).

The MA1's right wing suffered significant structural damage, to include having part of the left stabilator from the MA2 embedded in its wing, but the MP1 was able to recover the aircraft to JBA (Tabs R-25 through R-26, R-43, S-2). The MA2 experienced significant structural damage, to include the likely loss of its left stabilator, causing the aircraft to be uncontrollable (Tabs R-10, V-6.6). The MP2 successfully ejected and sustained non-life threatening injuries before recovery by SAR forces (Tabs R-10 through R-15).

e. Impact

On 1 August 2013, at 22:23:56L, the MA1 collided midair into the MA2 over the Atlantic Ocean off the coast of Maryland (Tabs Y-3, Z-3). At the time of the impact, the MA1 was flying 412 knots at 11,180 feet MSL behind the MA2, which was flying in mid-range position at 310 knots and 11,180 feet MSL (Tab Z-3 through Z-12).

After the midair collision, the MA2 impacted the Atlantic Ocean at approximately 22:25L and was completely destroyed (Tab P-4 through P-5). The MA2's flight data recorder was recovered from the ocean, but it suffered damage such that data retrieval was impossible, rendering exact flight parameters to be unknown (Tabs Z-13, DD-3).

f. Egress and Aircrew Flight Equipment

The MP2 was wearing all appropriate aircrew and flight equipment for a nighttime mission (Tab Tabs Q-17, Q-18, V-6.4). The MP2's Aircrew Flight Equipment inspections were current (Tab EE-3 through EE 13). The MP2 initiated a successful ejection within the performance envelope of the ejection system (Tab V-6.6). The MP2 initiated ejection at approximately 11,180 feet MSL (Tab Z-3 through Z-12). The Aircrew Flight Equipment recovered from the MP2 was in

serviceable condition and functioned as designed during the mishap and ejection (Tab Q-17, Q-18, V-6.6).

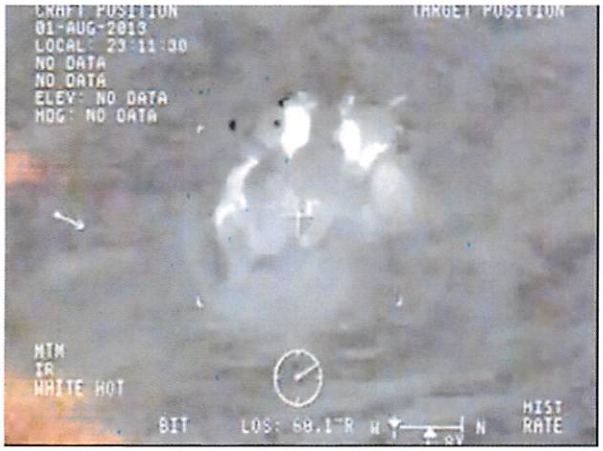
Just after the midair collision, the MA2 began a slow barrel roll to the left, did not respond to the MP2's control inputs, and continued rolling (Tabs R-10, V-6.6). The MP2 made a prudent decision to eject and did so once he ensured the MA2 cockpit was pointed upright (Tabs R-10, V-6.6). The MP2 pulled the ejection handle and the force of the ejection caused the MP2 to be "thrown around like a ragdoll" for five to seven seconds (Tabs R-10, R-11, V-6.6). The parachute successfully opened, and the MP2 descended to the ocean (Tab R-11, V-6.6). The MP2 hit the water, popped back up from the water as his life preserver unit inflated, disconnected the parachute, and located his life raft, which had fully inflated (Tabs R-11, V-6.6).

The MP2 sustained injuries to both legs during the ejection and had difficulty getting into the life raft (Tabs R-10 through R-13, V-6.8). Approximately 40 minutes after ejecting, the MP2 had boarded the life raft, located the survival kit radio, and contacted the on-scene commander (OSC) on the military Guard frequency (Tabs N-20, R-10 through R-13, R-51). The OSC advised the MP2 that the Coast Guard was on the way (Tabs R-14, R-51, V-6.9).

g. Search and Rescue (SAR)

Approximately 10 seconds after the midair collision, which occurred at 22:23:56L, the MA2's emergency locator transmitter (ELT) sounded through the MP1's and the UP's communications systems (Tab N-2, R-22, R-25, V-7.4). Within a minute of the midair collision, the MP1 communicated the collision to the W-386 controlling agency and passed approximate GPS coordinates of the mid-air collision (Tab N-3). The controlling agency responded that SAR forces would be launched (Tab N-3). One of the mission sortie pilots assumed OSC duties and attempted for 40 minutes to contact the MP2 via military guard frequency (Tabs N-5, R-50, R-56).

Approximately 40 minutes after ejecting, the MP2 boarded his survival life raft and contacted the OSC via radio (Tabs N-20, R-10 through R-13, R-51). The MP2 communicated his location to the OSC who relayed the information to the Coast Guard (Tabs R-14, R-51, V-6.9). A HH-60G helicopter and a Navy Ship (Navy Ship 103) with a helipad were sent to recover the MP2 (Tab R-51). The MP2 utilized flares and verbal directions to guide the helicopter to his location (Tabs R-14, V-6.10). Within two hours of impact, and without any difficulties, a Coast Guard rescue diver deployed into the water, successfully strapped the MP2 to a floating litter, and lifted the MP2 out of the water and into the helicopter (Tabs R-15, V-6.9 through V-6.11). The helicopter transported the MP2 to JBA uneventfully (Tabs R-15, V-6.11).



Infrared photo from HH-60 during recovery.

g. Recovery of Remains

Not Applicable.

5. MAINTENANCE

a. Forms Documentation

The Air Force Technical Order (AFTO) form series 781 is used to document aircraft maintenance, inspections, servicing, and airworthiness of the aircraft (Tab DD-12 through DD-13). In addition to scheduling and documenting routine maintenance actions, these tools allow aircrews to report aircraft discrepancies and maintenance personnel to document the actions taken to resolve the reported issues (Tab DD-12 through DD-13). Furthermore, the forms and the Integrated Maintenance Data Systems (IMDS) provide a tool to research past aircraft problems to more effectively troubleshoot and solve new maintenance discrepancies (Tab DD-12 through DD-13).

AFTO Form 781Ks are used to track and document all scheduled inspections (Tab DD-12 through DD-13). An in-depth review was completed and revealed no overdue scheduled inspections or open time compliance technical orders (TCTO's) in the active forms to restrict the MA from flying (Tabs D-9 through D-17, D-83 through D-90).

The AIB conducted a detailed review of active historical AFTO 781A forms for the MA1 and the MA2 covering a 30-day period prior to the mishap. Maintenance documentation was accomplished IAW applicable maintenance directives (Tab U-3 through U-126).

b. Inspections

The total airframe operating time of the MA1 at the time of the mishap was 5764.3 hours (Tab D-7). The MA1 completed its last aircraft maintenance phase on 30 August 2011 at 5698.0 hours (Tab D-2). Following the phase, the MA1 had extensive depot work conducted at Hill Air Force Base (Tab D-2). After the depot work was completed, a Functional Check Flight was performed on 1 November 2012, and the MA1 was released back to the 113th Wing (Tab U-127).

The total airframe operating time of the MA2 at the time of the mishap was 5864.6 hours (Tab D-73). The last aircraft maintenance phase on the MA2 was completed on 3 July 2013 at 5850.0 flight hours (Tab U-141).

A Basic Post-flight/Pre-flight (BPO/PR) is a flight preparedness inspection performed by maintenance personnel prior to flight and is valid for 72 hours once completed (Tab DD-12 through DD-13). The BPO/PR inspection is performed IAW T.O. 00-20-1, *Aerospace Equipment Maintenance Inspection, Documentation, Policies, and Procedures* (Tab DD-12 through DD-13). The purpose of the BPO/PR is to visually inspect and operationally check various systems of the aircraft in preparation for a flying period (Tab DD-12 through DD-13). The last MA1 BPO/PR inspection occurred on 31 July 2013; there were no discrepancies noted

(Tab D-3). The last MA2 BPO/PR inspection occurred on 1 August 2013; there were no discrepancies noted (Tab D-73).

All work packages and inspections for engines were reviewed in detail to include information from IMDS, Joint Oil Analysis Program (JOAP) and Comprehensive Engine Management System to determine serviceability of the mishap engines, and no discrepancies were found (Tab U-128 through U-131).

All scheduled inspections were satisfactorily completed with no discrepancies (Tabs D-3, D-73, Tab U-128 through U-131).

c. Maintenance Procedures

Maintenance procedures are described in applicable AFTO, Major Command, Air National Guard, and local procedures. Supervision and personnel are currently operating within guidelines of applicable AFTO's, Air Force and Air National Guard Instructions, and local procedures (Tab DD-12 through DD-13). There is no evidence that maintenance procedures were a factor in this mishap.

d. Maintenance Personnel and Supervision

113th Aircraft Maintenance Squadron personnel performed all required inspections, documentation, and service for the MA1 and the MA2 prior to flight (Tab U-3 through U-126). Upon a detailed review of maintenance documentation, all maintenance activities were normal, and all personnel involved with the MA1 and the MA2 had adequate training, experience, expertise, and supervision to perform their assigned tasks (Tab U-3 through U-126).

e. Fuel, Hydraulic and Oil Inspection Analyses

Pre-Mishap fuel samples were taken from the fuel trucks and the samples were tested IAW T.O. 42B-1-1, *Quality Control of Fuel and Lubricants*, with normal results and no unusual volatiles in the spectrum (Tab U-132 through U-136). A JOAP sample was taken from the MA1 on 27 July 2013, and no unusual readings were found (Tab U-128). A JOAP sample was taken from the MA2 on 2 July 2013, and no unusual volatiles were found (Tab U-130). Samples were also taken from the hydraulic cart and oil carts, and no abnormalities were observed (Tab U-138 through U-140). A post-mishap fuel sample was taken from the MA1, and the readings were normal (Tab U-137).

f. Unscheduled Maintenance

Having analyzed the unscheduled maintenance events for the MA1 and the MA2 since the last aircraft phase inspection, there is no evidence to suggest that unscheduled maintenance events were a factor in the mishap (Tab U-3 through U-126).

6. AIRFRAME

The MA1 was flown back to JBA (Tab Q-6). All data from the flight data recorder was analyzed by the Air Force Mishap Analysis and Animation Facility, and the engine data was analyzed by the 113 Engine Management Section; there was no evidence of any un-commanded flight control, electrical, or hydraulic malfunctions that would have contributed to the mishap (Tab L-2 through L-9). Based on documented aircraft maintenance actions there is no indication that airframe maintenance contributed to this mishap (Tabs U-55 through U-127, D-2 through D-71).

The MA2 was destroyed upon impact with the Atlantic Ocean. The Flight Data Recorder was recovered and sent to the United States Air Force Mishap Analysis and Animation Facility (Tab DD-3). However, due to the damage it sustained, no data was retrievable (Tab DD-3).

7. WEATHER

a. Forecast Weather

The forecasted weather for JBA during the MF takeoff time was a temporary condition of broken clouds at 1,500 feet with light thundershowers, visibility of 2 nautical miles (NM), and westerly winds of 15 knots gusting to 25 knots. The forecasted weather at the estimated land time was scattered clouds at 3,000 feet, unrestricted visibility, and northwesterly winds of 6 knots (Tab F-2). The forecasted weather in W-386 was scattered clouds from 5,000 to 8,000 feet, and broken, layered clouds from 15,000 to 30,000 feet with 7 miles or more of visibility (Tabs F-3 through F-4). There was no moon, and forecasted/actual illumination for the evening was low (1.6 millilux) (Tabs W-3, V-3.7, V-6.5, V-7.9).

b. Observed Weather

Takeoff weather at JBA was better than forecasted; conditions improved more quickly than expected, and the field was relatively clear at the takeoff time (Tab V-1.8). Sunset occurred at 20:19L (6 minutes after the MF actual takeoff time) (Tabs F-2, K-5). There were clouds and thunderstorms in the W-386 area, but they did not adversely affect the mission execution (Tabs R-9, R-23, V-5.34, V-6.15). Low illumination was present throughout the mission area (Tabs R-21, R-23, R-29, V-1.8, V-3.4, V-4.7, V-6.13, V-7.4).

c. Space Environment

Not applicable.

d. Operations

The MF was able to find clear, workable airspace during the MS and conducted operations within the weather guidelines of Air Force Instruction 11-214 *Air Operations Rules and Procedures* (Tabs R-9, R-29, V-5.34, V-6.15, BB-27).

8. CREW QUALIFICATIONS

a. Mishap Pilot 1

The MP1 was a current and qualified instructor pilot in the F-16C and met required flying continuation training (Table 8.1) (Tabs G-4, G-11, G-12, G-89). The MP1 had a total of 2754.6 flight hours, 2390.4 hours in the F-16, and 973.6 F-16 instructor hours (Tabs G-3, G-4).

Table 8.1 The MP1's Supplemental 30/60/90 Day History

	Sorties	RAP Counters*	Hours
Last 30 Days	7	12	15.1
Last 60 Days	8	20	17.2
Last 90 Days	10	22	20.5

* Ready Aircrew Program (RAP) counters include F-16 (continuation training and upgrade) sorties and F-16 Mission Training Center (MTC) simulator sorties.

b. Mishap Pilot 2

The MP2 was a current and qualified wingman in the F-16C and met required flying continuation training (Table 8.2) (Tabs G-15, G-23, G-24, G-89). The MP2 had a total of 648.4 flight hours and 396.1 hours in the F-16 (Tabs G-14, G-15).

Table 8.2 The MP2's Supplemental 30/60/90 Day History

	Sorties	RAP Counters*	Hours
Last 30 Days	4	8	9.6
Last 60 Days	10	16	18.6
Last 90 Days	13	27	24.3

* Ready Aircrew Program (RAP) counters include F-16 (continuation training and upgrade) sorties and F-16 Mission Training Center (MTC) simulator sorties.

9. MEDICAL

a. Qualifications

The MP1 was medically qualified to perform flying duties without restrictions at the time of the mishap (Tab DD-5 through DD-6). The MP1's annual Preventative Health Assessment (PHA) was current (Tab DD-5 through DD-6). The associated Medical Recommendation for Flying or Special Operational Duty Form 1042 was current and dated 4 November 2012 (Tab DD-5

through DD-6). Except for fatigue, the MP1 did not display any physical or medical limitations prior to the mishap (Tab DD-5 through DD-6, DD-7 through DD-9).

The MP2 was medically qualified to perform flying duties without restrictions at the time of the mishap (Tab DD-5 through DD-6). The MP2's annual PHA was current (Tab DD-5 through DD-6). The associated Medical Recommendation for Flying or Special Operational Duty Form 1042 was current and dated 19 February 2013 (Tab DD-5 through DD-6). The MP2 had a current waiver for cornea refractive surgery; he has had no visual complications since his January 2005 surgery (Tab DD-5 through DD-6). The MP2 did not display any physical or medical limitations prior to the mishap (Tab DD-5 through DD-6).

b. Health

A medical and dental record review indicated the MP1 was in good health and had no performance-limiting condition or illness prior to the mishap (Tab DD-5 through DD-6). Furthermore, the MP1's health was self-described as "Excellent" on the day of the mishap (Tab V-5.30). There was no evidence of an MP1 medical or dental condition that might have contributed to the mishap (Tab DD-5 through DD-6). A review of the MP1's post-mishap history and physical examination revealed no physical injuries (Tab DD-5 through DD-6).

A medical and dental record review indicated the MP2 was in good health and had no performance-limiting condition or illness prior to the mishap (Tab DD-5 through DD-6). The MP2 had no health related concerns on the day of mishap (Tab R-17). The MP2 successfully ejected and suffered moderate non-life threatening "flail" injuries to his bilateral lower extremities upon ejection from the aircraft; the violence of the ejection caused the MP's legs to whip around or flail, thus causing injuries (Tabs V-6.6, X-3). The MP2 received multiple surgeries for the associated ligament tears (Tab X-3). The MP2 is expected to return to full flying duties after recovery (Tab X-3).

c. Toxicology

Immediately following the mishap, in accordance with AFI 91-204, *Safety Investigations and Reports*, the commander directed toxicology testing for all persons involved in the flight and launch of the MA1 and the MA2 (Tab DD-5 through DD-6). Blood and urine samples were submitted to the Armed Forces Institute of Pathology (AFIP) for toxicology analysis (Tab DD-5 through DD-6). These tests are used to identify carbon monoxide and ethanol levels in blood and to detect traces of drugs in urine (Tab DD-5 through DD-6). Analysis of the MP1's and the MP2's blood concluded the carboxyhemoglobin concentration was within normal limits and ethanol was not detected (Tab DD-5 through DD-6). The AFIP report further confirmed there were no amphetamines, barbiturates, benzodiazepines, cocaine, cannaboids, opiates, or phencyclidine (PCP) present in their urine samples (Tab DD-5 through DD-6).

All associated aircrew and maintainers also provided samples that were tested for amphetamines, barbiturates, benzodiazepines, cocaine, cannaboids, opiates, and PCP, and none of these substances were detected (Tab DD-11).

d. Lifestyle

According to the MP1's 72-hour and 14-day history, the only life stressor relevant to the mishap was abbreviated sleep intervals, which will be discussed further in section 9e (Tabs V8.1 through V8.5, DD-6 through DD-9).

According to the MP2's 72-hour and 14-day history, the MP2 did not engage in any unusual habits, behaviors or stressors that contributed to the accident (Tab DD-5 through DD-6). The MP2 had no lifestyle factors relevant to the mishap (Tabs R-2 through R-6, R-17, DD-5).

e. Crew Rest and Crew Duty Time

Air Force Instructions require pilots have proper "crew rest," prior to performing in-flight duties (Tabs BB-5 through BB-6, BB-11, BB-17). AFI 11-202, Volume 3, *General Flight Rules*, as well as the ACC Supplement, define normal crew rest as a minimum of a 12-hour non-duty period before the designated flight duty period (Tabs BB-5 through BB-6, BB-11, BB-17). Its purpose is to ensure the aircrew member is adequately rested before performing flight or flight-related duties (Tabs BB-5 through BB-6, BB-11, BB-17). During crew rest, 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 including "an opportunity for at least 8 hours of uninterrupted sleep" (Tabs BB-5 through BB-6, BB-11, BB-17).

The MP1's 72-hour and 14-day history showed he failed to comply with established crew rest standards for the two nights immediately preceding the mishap (Tabs V-8.4, V-8.5). The MP1 flew a night sortie on 30 July 2013, and he did not get to bed until 0230L on 31 July 2013 (Tab V-8.3). Having gone to bed at 0230L and waking at 0630L, the MP1 recorded a period of sleep lasting 4 hours (V.8.4). On that same day, the MP1 left for his civilian employment at 0700L (V-8.4). The MP1 did not allow for "at least 8 hours of uninterrupted sleep" prior to his flight duties on the evening of 31 July 2013, the day prior to the mishap (Tab V-8.4).

Having flown the night of 31 July 2013, the MP1 did not get to bed until the early morning hours of 1 August 2013 (Tabs V-8.4, V-8.5). For the early morning hours of 1 August 2013, the MP1 recorded a period of sleep lasting 4.5 hours, with a bedtime of 0200L and wake time of 0630L (Tab V-8.5). The MP1 left for his civilian employment at 0700L (Tab V-8.5). The MP1 again did not allow for "at least 8 hours of uninterrupted sleep" prior to his flight duties on the evening of the mishap (Tab V-8.5). The MP1 did not report fatigue as a concern on his 72-hour or 14-day history (Tab V-8.1 through V-8.5). During an interview with the MP1 on 16 October 2013, the MP1 stated he felt "a little tired" before the mishap flight (Tab V-5.10).

AFI 11-202, Volume 3, *General Flight Rules*, ACC Supplement, paragraph 9.4.6, defines the Flight Duty Period (FDP) for Air Reserve Component (ARC) personnel to include both military duty and civilian work (Tab BB-11). FDP begins when the individual reports for his or her first duty period (military or civilian) and ends at engine shutdown (Tab BB-11). Paragraph 9.8.3 defines the maximum FDP as 10 hours for single pilot aircraft when night operations are conducted (Tab BB-17).

The MP1's 72-hour and 14-day history showed he did not meet crew rest and FDP requirements on 31 July 2013 and 1 August 2013 (Tabs V-8.1 through V-8.5). On 31 July 2013, the MP1 began his FDP with civilian employment at 0720L, and engine shutdown at approximately 2300L, for an approximate FDP of 15 hours and 40 minutes (Tabs V-8.1 through V-8.5). On 1 August 2013, the MP1 began his FDP with civilian employment at 0730L and was on FDP for 14 hours and 54 minutes hours, at the time of mishap at 2224L (Tab V-8.1 through V-8.5).

According to the MP2's 72-hour and 14-day history, he complied with crew rest and FDP requirements on 1 August 2013 and the days preceding the mishap (Tab V-8.1 through V-8.5 and BB-11, BB17). There was no observed evidence of acute or cumulative fatigue in the MP2. The MP2 testified that he did not feel physical nor mental fatigue (Tabs R-2 through R-6, R-17).

10. OPERATIONS AND SUPERVISION

a. Operations

The 121 FS is a unit of the District of Columbia Air National Guard tasked with an ACA mission to provide homeland defense (Tab CC-15). The 121 FS is equipped with F-16C aircraft (Tab CC-14). In addition to the ACA mission, the 121 FS personnel conduct Air Expeditionary Force operations and training (Tab CC-15). Of the unit's 33 assigned pilots, 29 are experienced fighter pilots (Tab G-89). During the week of the mishap, the unit was flying night missions, beginning on 30 July 2013 (V-1.5 through V-1.6).

b. Supervision

The 121 FS SOF authorized the mission on an Aviation Resource Management System (ARMS) Flight Authorization Form (Tab K-5). The flight received a step brief from the SOF prior to stepping to the aircraft (Tabs R-26, R-49, V-5.20, V-6.4). The step brief and supervision of flight activities were considered normal (Tabs R-49, V-6.4).

11. HUMAN FACTORS

a. Introduction

The AIB evaluated human factors relevant to the mishap using the analysis and classification system model established by the Department of Defense Human Factors Analysis and Classification System (DoD HFACS) guide, implemented by AFI 91-204, *USAF Safety Investigations and Reports*, dated 24 September 2008, and the relevant factors are defined below (Tab BB-61 through BB-90).

b. Applicable Human Factors

(1) Misperception of Operational Conditions

Misperception of Operational Conditions is a factor when an individual misperceives or misjudges altitude, separation, speed, closure rate, road/sea conditions, aircraft/vehicle location

within the performance envelope or other operational conditions and this leads to an unsafe situation (Tab BB-80).

Misperception of Operational Conditions occurred in the final phase of the mishap intercept. To begin the intercept, the MP1 proceeded to roll out and fly within 3900 feet directly behind the MA2 at 335 knots and 0 knots of closing velocity (Tab Z-3). Night illumination was low (1.6 millilux) over the water, and the MA2 had all of its lights out, as directed by the MP1 (Tabs N-2, R-21, R-23, W-3). The MP1 flew closer to the MA2 in order to inspect the target as a part of the ACA demonstration intercept for the UP (Tabs N-2, V-5.19 through V-5.20). Despite being at 1000 feet, 80 knots of closure, and 0 degrees aspect, the MP1 called over the radio that he was at 3000 feet behind the MA2 (Tabs N-2, Z-7, V-5.26 through V-5.27). Within seconds, at 100 knots of closure on the MA2 and flying at the same altitude, the MA1 collided into the MA2 (Tabs V-6.5, Z-12). Accurate range, speed, and closure were available from the radar target track and displayed in the HUD, yet the MP1 failed to look at and/or process this data as he attempted to complete the inspect of the MA2 (Tabs V-5.5, V-5.27 through V-5.34, Z-3 through Z-12).

In addition, during the low-illumination mishap intercept, the MP1 directed the MP2 to turn off all external lighting, which is an acceptable objective for an MQT ACA qualified pilot (Tabs N-2, V-5.19, V-5.20, V-6.14, W-3). However, by turning off all external lighting, the MP1's primary visual reference was the MA2's exhaust plume, until just prior to impact, when he picked up visual line of sight and closure details in his NVGs, thus adding to the misperception of operational conditions (Tab V-5.27 through V5.28).

(2) Channelized Attention

Channelized Attention is a factor when the individual is focusing all conscious attention on a limited number of environmental cues to the exclusion of others of a subjectively equal or higher or more immediate priority, leading to an unsafe situation (Tab BB-73). It may be described as a tight focus of attention that leads to the exclusion of comprehensive situational information (Tab BB-73).

The MP1 was not monitoring available range, airspeed, and closure rates available from the radar target track and displayed in the HUD during the critical final phase of the intercept leading up to the mishap, and he failed to maintain flight path deconfliction, i.e. flying with enough distance between him and another aircraft (Tabs V-5.4, V-5.29 through V-5.30). His attention was channelized elsewhere (Tabs V-5.29 through V-5.30). The MP1's testimony was that he: (1) either focused his attention completely on maintaining his visual of the MA2's exhaust plume; or (2) he was focused inside his cockpit; either one to his exclusion of available and accurate target conditions provided by the radar (Tabs V-5.29 through V-5.30).

(3) Task Misprioritization

Task Misprioritization is a factor when the individual does not organize, based on accepted prioritization techniques, the tasks needed to manage the immediate situation (Tab BB-68).

The MP1 failed to prioritize the tasks of "aviate, navigate, and communicate" in the final portion of the mishap intercept. As indicated in AFTTP 3-3.F-16, paragraph 9.3.4.1, when one aircraft approaches another from behind, the pilot must first ensure flight path deconfliction, i.e. he must aviate (Tab BB-57). Conversely, the MP1 attempted to lead the intercept/inspect while making anticipated radio calls as both the intercepting pilot and the simulated controlling agencies, while also providing real-time verbal feedback to the UP (Tabs N-2, V-5.4 through V-5.5). The MP1 stated, "I felt that I was failing my student at the time, and I began to obsessively focus on instruction" (Tab V-5.4). Rather than prioritizing the monitoring of available and accurate target range, closure, aspect, and altitude readily displayed to him by his radar or following accepted TTPs to maintain flight path deconfliction, the MP1 prioritized instruction and communications (Tabs V-5.26, V-5.29 through V-5.30, BB-57).

(4) Overconfidence

Overconfidence is a factor when the individual overvalues or overestimates personal capability, the capability of others or the capability of aircraft/vehicles or equipment and this creates an unsafe situation (Tabs BB-74, BB-75).

During the week of the mishap sortie, the MP1 overestimated his personal capabilities and underestimated the effects fatigue would have on him (Tab V-5.6). The MP1 stated, "Through learned behaviors and prior success managing long work schedules, I had been accustomed to working long and demanding days. Even so, had I exhibited better judgment I would have managed my workday more prudently to ensure I was sufficiently rested for this lengthy and somewhat demanding mission" (Tab V-5.5).

Furthermore, overconfidence led to an inaccurate self-assessment prior to the mishap sortie. The MP1 stated, "One of my obligations as a pilot is to assess whether I'm fit to fly prior to each sortie. At the time that day, I believed that I was fit to fly. I was obviously wrong in the self-assessment as evidence by my monumental mistake the night of the mishap sortie" (Tab V-5.6).

The MP1 overestimated his ability to manage both civilian employment and ANG duties during the week of the mishap. The MP1 stated, "I also believed that I could handle the combination of civilian employment and Air National Guard duties for the week as long as I reduced my social commitments. I admit that I was grossly mistaken in this assessment and did not demonstrate sound judgment" (Tab V-5.6).

The MP1 summarized, "Overconfidence in my own abilities was firmly rooted in my previous work habits which had time and again proven successful for me. This misplaced confidence in my ability to overcome the need for reasonable rest in my opinion was a root cause of the accident" (Tab V-5.6).

(5) Inadequate Rest

Inadequate rest is a factor when the opportunity for rest was provided but the individual failed to take the opportunity to rest (Tab BB-83).

The MP1 slept 4.5 hours the night preceding the mishap (Tabs V-5.10 through 5.11, V-8.1 through V-8.5). In addition, the MP1 had been awake for a continuous period of 15.92 hours before the mishap (Tab V-8.5). Given his inadequate sleep the evening before the mishap, and his overly long military and civilian duty day, the MP1 had 10.03 less hours of sleep than he should have had to be properly rested (Tabs V-5.10 through 5.11, V-8.1 through V-8.5, BB-11). His inadequate rest history is a direct result of the MP1's attendance during the day at his civilian job while flying nights with his unit (Tabs V-8.1 through V-8.5, DD-7).

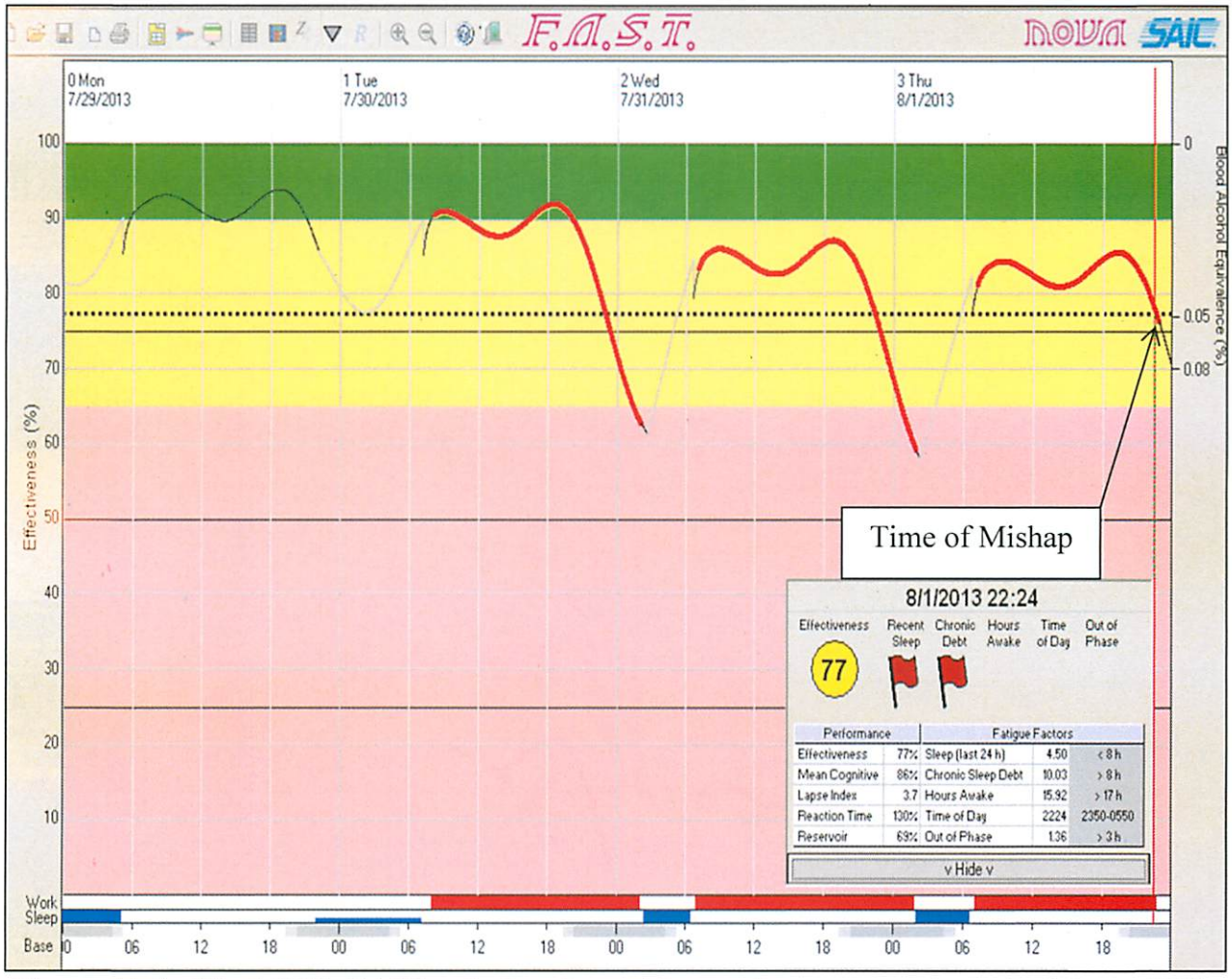


Figure 11-1: The MP1's FAST calculated cognitive performance at time of mishap= 77%

(6) Fatigue - Physiological/Mental

Fatigue - Physiological/Mental is a factor when the individual's diminished physical or mental capability is due to an inadequate recovery, as a result of restricted or shortened sleep or physical or mental activity during prolonged wakefulness (Tab BB-77). Fatigue may additionally be described as acute, cumulative or chronic (Tab BB-77).

The MP1's fatigue effects were calculated using the Fatigue Avoidance Scheduling Tool (FAST) (Figure 11-1) (Tab DD-7 through DD-10). The analysis utilized data collected from the MP1's

72-hour and 14-day history reports (Tab DD-7 through DD-10). At the time of the mishap, the MP1 was calculated to have a cognitive performance level of 77%, which is less than optimal and considered to be "cautionary" (Tab DD-7 through DD-10). According to the FAST analysis, his blood alcohol content (BAC) equivalence was 0.05 at the time of the mishap (Figure 11-1) (Tab DD-7 through DD-10). A BAC of 0.05 has predictable effects to include: impaired judgment, lowered alertness, reduced coordination, reduced ability to track moving objects, difficulty steering, and reduced response to emergency driving situations (Tab DD-7 through DD-10). The FAST also predicted the MP1 was 3.7 times more likely to experience both a lapse in attention and expanded reactions times 130% of normal (Tab DD-7 through DD-10). During testimony, the MP1 stated on the night of the mishap he did feel "a little tired" (Tab V-5.10).

(7) Violation – Lack of Discipline

Violation - Lack of Discipline is a factor when an individual, crew or team intentionally violates procedures or policies without cause or need (Tab BB-69). These violations are unusual or isolated to specific individuals rather than larger groups (Tab BB-69). There is no evidence of these violations being condoned by leadership (Tab BB-69).

As described in the Crew Rest and Crew Duty Time section of this report, the MP1 began the mishap sortie without adequate crew rest, thus violating AFI 11-202, Volume 3, ACC Supplement, paragraph 9.4.5, crew rest minimum requirements (Tabs V-5.10 through 5.11, V-8.1 through V-8.5, BB-11).

12. GOVERNING DIRECTIVES AND PUBLICATIONS

a. Publically Available Directives and Publications Relevant to the Mishap

(1) AFI 11-202, Volume 3, *General Flight Rules*, dated 22 October 2010;

(2) AFI 11-202, Volume 3, *General Flight Rules*, Air Combat Command Supplement, dated 28 November 2012;

(3) AFI 11-214, *Air Operations Rules and Procedures*, dated 14 August 2012;

(4) Department of Defense Human Factors Analysis and Classification System (DoD HFACS) guided, implemented by AFI 91-204, *USAF Safety Investigations and Reports*, dated 24 September 2008.

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) AFTTP 3-1.ADUSCAN, *Tactical Employment*, dated 11 September 2013;

(2) 121 FS Alert Standards, dated December 2010;

(3) 121 FS ACA Syllabus, dated 2 March 2013;

(4) Air Force Tactics, Techniques, and Procedures, 3-3 F-16, dated 29 June 2012.

c. Known or Suspected Deviations from Directives or Publications

(1) AFI 11-202, Volume 3, *General Flight Rules*, Air Combat Command Supplement, dated 28 November 2012, paragraphs 9.4.5 and 9.4.6;

(2) Air Force Tactics, Techniques, and Procedures, 3-3 F-16, dated 29 June 2012, paragraph 9.3.4.1.

13. ADDITIONAL AREAS OF CONCERN

Not applicable.

13 NOVEMBER 2013

HOWARD P. PURCELL, Colonel, ANG
President, Accident Investigation Board

STATEMENT OF OPINION

F-16C, T/N 87-0314, and F-16C, T/N 86-0357
WARNING AREA 386
1 AUGUST 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

On 1 August 2013, at 22:23:56 local time (L), an F-16C, tail number (T/N) 87-0314, collided midair into an F-16C, T/N 86-0357, while participating in night tactical air intercept training over the Atlantic Ocean in Warning Area-386, off the coast of Maryland. Both aircraft were assigned to the 121st Fighter Squadron, 113th Wing, District of Columbia Air National Guard, Joint Base Andrews (JBA), Maryland. The first mishap aircraft, F-16C, T/N 87-0314 (hereinafter referred to as MA1), suffered significant structural damage to the right wing, but the mishap pilot (MP1) was able to recover the aircraft to JBA. The second mishap aircraft, F-16C, T/N 86-0357 (hereinafter referred to as MA2), experienced debilitating structural damage causing the aircraft to be uncontrollable. The second mishap pilot (MP2) successfully ejected, sustained non-life threatening injuries, and was recovered by search and rescue (SAR) forces. The MA2 was destroyed upon impact with the Atlantic Ocean.

I find by clear and convincing evidence that the cause of the mishap was failure of the MP1 to maintain flight path deconfliction and safe operations between himself and the MA2 due to three human factors: Misperception of Operational Conditions, Channelized Attention, and Task Misprioritization.

I find by a preponderance of evidence that four human factors substantially contributed to the mishap: Overconfidence, Inadequate Crew Rest, Fatigue - Physiological/Mental, and Violation – Lack of Discipline.

I developed my opinion by analyzing factual data from Air Force directives and guidance, engineering analysis, medical analysis, witness testimony, and flight data.

2. DISCUSSION

a. Cause

There is clear and convincing evidence that the MP1 failed to maintain flight path deconfliction between the MA1 and the MA2 by colliding midair into the MA2, and three human factors caused the failure. During the mishap intercept, the MP1 misperceived his operational conditions believing he was further away from the non-maneuvering MA2 than his actual

distance. The MP1 also channelized his attention on a night vision goggle (NVG) visual rejoin with the MA2 under difficult environmental conditions, and away from the accurate target information displayed by his aircraft on the radar and in the head-up display (HUD) in his cockpit. Finally, the MP1 task misprioritized as he fixated on his instruction rather than flying his aircraft and following acceptable tactics, techniques, and procedures (TTPs) for intercepts, rejoins, and maintaining flight path deconfliction.

(1) Misperception of Operational Conditions

The MP1 misperceived his distance, speed, and closure rate with the MA2 as he attempted to accomplish an Aerospace Control Alert (ACA) inspect procedure that required him to get close enough to allow inspection into the MA2 cockpit, which resulted in the MP1 colliding into the MA2. At 1000 feet radar range with 80 knots of closure, the MP1 called over the radio that he was at 3000 feet in a stern conversion, i.e. directly behind the MA2. Five seconds later, the MP1 collided midair into the back of the MA2 with 100 knots of closure. The MP1 failed to utilize the accurate target distance, speed, and closure information displayed in his HUD and attempted to close with the MA2 utilizing only limited night visual target references and a misperceived intercept timeline.

In addition, the MP1 had directed the MP2 to turn off all external lighting during the mishap intercept. When combined with the low illumination night environment and no horizontal or vertical altitude offset, the MP1 would have had limited depth perception and line-of-sight clues to aid him in visually recognizing his misperceived conditions.

(2) Channelized Attention

The MP1 was not effectively monitoring range, airspeed, and closure rates displayed in the HUD during the mishap intercept. The MP1 testified that prior to impact either he focused his attention on maintaining a visual on the MA2, or he was focused inside his own cockpit. The MP1 also testified that his only visual reference of MA2 until just prior to impact was the hot exhaust seen through his NVGs. I find by clear and convincing evidence that the MP1 channelized on the limited visual references available from the MA2 to discern sufficient cues to complete his attempt at a night visual rejoin to an inspect position. The MP1's channelized attention led to his exclusion of accurate target information provided by his aircraft, and resulted in the MA1 colliding into the MA2.

(3) Task Misprioritization

Additionally, the MP1 failed to effectively prioritize the acceptable tasks required to complete a safe intercept and rejoin, and instead focused on ACA-simulated radio calls and verbal instruction to the upgrade pilot. The MP1's stated priority was on instruction immediately prior to his collision into the MA2. This misprioritization led to the MP1's failure to monitor and react to the available and accurate target information readily displayed to him, and his failure to follow established TTPs for controlling closure and maintaining flight path deconfliction.

b. Substantially Contributing Factors

(1) Overconfidence

I find by a preponderance of the evidence that the MP1's overconfidence, inadequate rest, and fatigue substantially contributed to the mishap. The MP1 overestimated his personal capabilities and underestimated the effects fatigue would have on him the night of the mishap. The MP1 felt he had success managing long work schedules and the ability to satisfy both his civilian and military commitments. The MP1's overconfidence clouded his judgment when self-assessing personal risk management prior to the mishap flight. Furthermore, the MP1 overestimated his personal capability during the mishap intercept by juggling multiple roles and providing verbal instruction immediately prior to impact, which contributed to the collision.

(2) Inadequate Rest

The MP1 had 4.5 hours of sleep the day of the mishap and 4 hours the previous day. Further, the MP1 had been awake for a continuous period of 15.92 hours before the mishap. The MP1's attendance each morning at his civilian job while flying nights with his unit resulted in his inadequate rest and subsequent fatigue.

(3) Fatigue – Physiological/Mental

By his own admission, the MP1 felt tired prior to the mishap flight. By a preponderance of the evidence, the MP1's fatigue directly contributed to his loss of situational awareness during the mishap intercept and exacerbated his Misperception of Operational Conditions, Channelized Attention, and Task Misprioritization, which caused the mishap.

(4) Violation – Lack of Discipline

I find by a preponderance of the evidence that the MP1's lack of discipline violation substantially contributed to the mishap. The MP1 knowingly and intentionally began the flight after violating Air Force crew rest minimum requirements, both the night of the mishap and the night prior.

13 November 2013

HOWARD P. PURCELL, COL, ANG
President, Accident Investigation Board

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