UNITED STATES AIR FORCE
AIRCRAFT ACCIDENT INVESTIGATION BOARD REPORT

F-15C, TAIL NUMBER 86-0157

131ST FIGHTER SQUADRON
104TH FIGHTER WING
BARNES AIR NATIONAL GUARD BASE, MASSACHUSETTS

LOCATION:
GEORGE WASHINGTON NATIONAL FOREST, VIRGINIA

DATE OF ACCIDENT: 27 AUGUST 2014

BOARD PRESIDENT:
BRIGADIER GENERAL MICHAEL A. HUDSON

CONDUCTED IN ACCORDANCE WITH AIR FORCE INSTRUCTION 51-503

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR COMBAT COMMAND
JOINT BASE LANGLEY-EUSTIS VA

OFFICE OF THE VICE COMMANDER
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JUN 04 2015

ACTION OF THE CONVENING AUTHORITY

The Report of the Accident Investigation Board, conducted under the provisions of AFI 51-503, that investigated the 27 August 2014 mishap, near Deerfield, Virginia, involving an F-15C, T/N 86-0157, assigned to the 104th Fighter Wing, Barnes Air National Guard Base, Massachusetts, complies with applicable regulatory and statutory guidance; on that basis it is approved.

HERBERT J. CARLISLE
General, USAF
Commander

EXECUTIVE SUMMARY
AIRCRAFT ACCIDENT INVESTIGATION

F-15C, TAIL NUMBER 86-0157
GEORGE WASHINGTON NATIONAL FOREST, VIRGINIA
27 AUGUST 2014

On 27 August 2014, at approximately 0858 hours local time (L), the mishap aircraft (MA), an F-15C, Tail Number 86-0157, assigned to the 131st Fighter Squadron, 104th Fighter Wing, Barnes Air National Guard Base, Massachusetts, impacted the ground during a cross-country flight to receive a radar upgrade at Naval Air Station Joint Reserve Base New Orleans, Louisiana. The MA impacted the ground in a densely forested area of the George Washington National Forest near Deerfield, Virginia. The mishap pilot (MP), a fully qualified F-15C Standardization Evaluation Flight Examiner with over 2,100 hours of flight time in the F-15C, was fatally injured. There were no other military or civilian casualties. The MA was destroyed upon impact, a loss valued at $45,247,260. There was no damage to civilian property.

The MA departed Barnes Air National Guard Base at 0806L under the call sign HAWK 11. Engine start, taxi, and takeoff were uneventful. MP received directions from several Air Traffic Control Centers during the climb to Flight Level 430 (approximately 43,000 feet above mean sea level). MP reached Flight Level 430 around 0823L and continued at that flight level for approximately 33 minutes.

MP initiated a descent at 0855:58L. Radar data showed the MA initially descending at a rate of approximately 12,000 feet per minute. At 0856:24L, when prompted by the Washington Air Route Traffic Control Center to make a routine radio frequency change, MP responded, "HAWK 11 declaring emergency." The Washington Air Route Traffic Control Center acknowledged the emergency and requested MP's status. At 0856:31L, MP responded, "Affirm. Standby." This was the last communication received from MP.

The MA continued to accelerate in a rapid descent, impacting the ground at approximately 0858L.

The accident investigation board president found by clear and convincing evidence that MP's inability to recover from the descent, due to MP's incapacitation, caused the mishap. With no eyewitness accounts, surviving aircrew members, detailed emergency calls, or flight data recordings, and with minimal information from analysis of components recovered at the mishap site, the specific reason MP became incapacitated could not be determined.

SUMMARY OF FACTS AND STATEMENT OF OPINION
F-15C, TAIL NUMBER 86-0157
27 AUGUST 2014

TABLE OF CONTENTS

Cover Photo Credit: Technical Sergeant Jason Robertson

ACRONYMS AND ABBREVIATIONS

104 FW	The 104th Fighter Wing
104 MXG	The 104th Maintenance Group
104 OG	The 104th Operations Group
11 MSG	The 11th Mission Support Group
131 FS	The 131st Fighter Squadron
A-3/5	Operations
ACACS	Air Cycle Air Conditioning System
ACC	Air Combat Command
ACM	Air Combat Maneuvering
ACO	Airspace Coordination Order
ADES	Actuated Device Equipment Specialist
AET	Aircraft Electrical Technician
AFB	Air Force Base
AFC	Augmentor Fuel Control
AFDW	Air Force District of Washington
AFE	Aircrew Flight Equipment
AFEM	Aircrew Flight Equipment Member
AFES	Aircrew Flight Equipment Superintendent
AFI	Air Force Instruction
AFIS	Air Force Inspection System
AFP	Augmentor Fuel Pump
AFSAS	Air Force Safety Automated System
AFTO	Air Force Technical Order
AIB	Accident Investigation Board
AIT	Auto-ignition Temperature
AMAD	Aircraft Mounted Accessory Drive
AMXS	Aircraft Maintenance Squadron
ANG	Air National Guard
ANGB	Air National Guard Base
APG	Airframe Powerplant, General
ARM	Aviation Resource Management
ASP	Avionics Status Panel
ATC	Air Traffic Control
ATO	Air Tasking Order
Aug	August
AWS	Air Weather Service
B	Boeing
B/E	Boeing Engineer
BBR	Barnes Air National Guard Base
	Boeing Representative
BPO	Basic Post/Pre-flight
C/SE	Chief of Safety
CAF	Combat Air Forces
CAP	Combat Air Patrol
CAT	Community Action Team
CAT	Crisis Action Team
CC	Commander
CC1	Crew Chief 1
CC2	Crew Chief 2
CC3	Crew Chief 3
CC4	Crew Chief 4
CENC	Convergent Exhaust Nozzle Control
CIVV	Compressor Inlet Variable Vane
CMSgt	Chief Master Sergeant
Col	Colonel
CRU	Crew Regulator Unit
CSAR	Combat Search and Rescue
CT	Continuation Training
CV	Vice Commander
CW	Chief of Weapons
DEEC	Digital Engine Electronic Control
DNIF	Duty Not Involving Flying
DO	Director of Operations
DPH	Director of Public Health
DRS	Digital Recovery Sequencer
E&E	Electrical and Environmental
ECC	Emergency Communications Center
ECS	Environmental Control System
EDU	Engine Diagnostic Unit
EE	Engine Engineer
EES	Electro-environmental Supervisor
EM1	Egress Member 1
EM2	Egress Member 2
EOR	End of Runway
EP	Emergency Procedure
ER	Emergency Room
ESE	Egress System Expert
FAE	Functional Area Expert
FDT	Fan Driven Turbine
FMT	Full Mission Trainers
FOD	Foreign Object Debris
FS	Flight Surgeon
ft	Feet
FTIR	Fourier Transform Infrared Spectroscopy
g	Gravitational Force
GC-MS	Gas Chromatography-Mass Spectrometry
GOX	Gaseous Oxygen
HFM	Human Factors Member
HPC	High Pressure Compressor
HPT	High Pressure Turbine
IAW	In Accordance With
ICMS	Internal Countermeasure System
ICS	Internal Countermeasure Set
IFM	Inlet Fan Module
IFR	Instrument Flight Rules
IG	Inspector General
IGV	Inlet Guide Vane
IMDS	Integrated Maintenance Data System
IO	Investigating Officer
IO1	Investigating Officer 1
IO2	Investigating Officer 2
ISB	Interim Safety Board
IW 1	Identity Witness 1
IW 2	Identity Witness 2

IW 3	Identity Witness 3
IW 4	Identity Witness 4
IW 5	Identity Witness 5
JFS	Jet Fuel Starter
JHMCS	Joint Helmet Mounted Cueing System
KEAS	Knots Equivalent Airspeed
L	Local Time
L/H	Left Hand
LA	Legal Advisor
LAU	Launcher Assembly Unit
LCC	Lead Crew Chief
LED	Light-emitting Diode
LOX	Liquid Oxygen
Lt Col	Lieutenant Colonel
MA	Mishap Aircraft
Maj	Major
MAJCOM	Major Command
MDM	Medical Member
Med	Medical
MFC	Main Fuel Control
MFP	Main Fuel Pump
MICAP	Mission Impaired Capability Awaiting Parts
MOCC	Mission Operations Control Center
MP	Mishap Pilot
MSgt	Master Sergeant
MSL	Mean Sea Level
MXET	Maintenance Egress Technician
MXM	Maintenance Member
MXPS	Maintenance Production Superintendent
MXS	Maintenance Squadron
NGAUS	National Guard Association of the United States
NIST	National Institute of Standards and Technology
NOTAMs	Notices to Airmen
O2	Oxygen
OG	Operations Group
OGV	Operations Group Standardization and Evaluation
Ops	Operations
ORM	Operational Risk Management
P	President
P&S	Plans & Scheduling
P/N	Part Number
P1	Pilot 1
P2	Pilot 2
P3	Pilot 3
P4	Pilot 4
PAC	Personnel Acceptance Certification
PAH	Polynuclear Aromatic Hydrocarbons
PBG	Pressure Breathing Gaseous
PCS	Permanent Change of Station
PE	Pilot Expert
PEX	Patriot Excalibur
PHX	Primary Heat Exchanger
PIG	Liquid Oxygen Converter Cart
PLI	Pilot Location Indicator
PM	Pilot Member
PMEL	Precision Measurement Equipment Laboratory
PMMA	Polymethyl Methacrylate
POC	Point of Contact
PPR	Prior Permission Required
PRSOV	Pressure Regulating Shutoff Valve
PSI	Pounds Per Square Inch
PSIG	Pounds Per Square Inch Gauge
PTO	Power Take Off
QA	Quality Assurance
R	Recorder
R/H	Right Hand
R1	Representative 1
R2	Representative 2
RCC	Rescue Coordination Center
RCVV	Rear Compressor Variable Vane
ROBD	Reduced Oxygen Breathing Device
RTB	Return-to-base
RVSM	Reduced Vertical Separation Minimums
SELO	Standards and Evaluation Liaison Officer
Sep	September
SEPT	Situational Emergency Procedures Training
SIB	Safety Investigation Board
SMDC	Shielded Mild Detonation Cord
SME	Subject Matter Expert
SOF	Supervisor of Flying
SOI	Sherriff's Office Investigator
SPO	System Program Office
SrA	Senior Airman
TAFMS	Total Active Federal Military Service
TAG	The Adjutant General
TCTO	Time Compliance Technical Order
TDY	Temporary Duty Yonder
TO	Technical Order
TR	Technical Representative
TSgt	Technical Sergeant
US	United States
UTA	Unit Training Assembly
UV	Ultraviolet
V3	Version 3
WCD	Work Control Document
Z	Zulu

The above list was compiled from the Executive Summary, Summary of Facts, Statement of Opinion, Witness Testimony (Tab V), and referenced portions of the tabs.

SUMMARY OF FACTS

1. AUTHORITY AND PURPOSE

a. Authority

On 28 August 2014, the Vice Commander of Air Combat Command (ACC) appointed Brigadier General Michael A. Hudson to conduct an aircraft accident investigation of a mishap that occurred on 27 August 2014 involving an F-15C aircraft that impacted the ground in the George Washington National Forest near Deerfield, Virginia (Tabs Q-7 and Y-3 to Y-8). The aircraft accident investigation was conducted in accordance with Air Force Instruction (AFI) 51-503, *Aerospace Accident Investigations*, at Barnes Air National Guard Base (ANGB), Massachusetts, from 7 October 2014 through 30 October 2014 (Tab Y-7 to Y-8). The board membership included a medical member, pilot member, maintenance member, legal advisor, and recorder (Tab Y-5 to Y-8). In addition, an Electrical and Environmental functional area expert was appointed (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 (Tab BB-42 to BB-43).

2. ACCIDENT SUMMARY

On 27 August 2014, at approximately 0858 hours local time (L), the mishap aircraft (MA), an F-15C, Tail Number 86-0157, assigned to the 131st Fighter Squadron (131 FS), 104th Fighter Wing (104 FW), Barnes ANGB, impacted the ground during a cross-country flight to receive a radar upgrade at Naval Air Station Joint Reserve Base New Orleans, Louisiana (Tabs M-2.13, Q-7 to Q-8, V-2.5, and DD-11). The mishap pilot (MP) had declared an in-flight emergency approximately 1 minute 30 seconds prior to impact (Tab N-3.12 and N-3.17). The MA impacted the ground in a densely forested area of the George Washington National Forest (Tabs Q-7, V-5.4, V-7.6, and Z-3). MP was fatally injured (Tabs V-5.4, V-16.5, and X-4). There were no other military or civilian casualties (Tab V-5.4 and V-18.4). The MA was destroyed upon impact, a loss valued at $45,247,260 (Tabs P-4 and Q-8). There was no damage to civilian property (Tab V-5.4, V-7.6, V-16.6, and V-18.4). Media interest following the mishap was high (Tab V-7.6 and V-16.6).

3. BACKGROUND

MP was assigned to 131 FS (Tab G-3). The MA belonged to 131 FS (Tab Q-8). Barnes ANGB is part of the Massachusetts Air National Guard (Tab CC-9). The 104th Fighter Wing is an operational component of ACC (Tabs Q-8 and CC-9).

a. Air Combat Command

ACC is the primary force provider of combat airpower to America's warfighting commands (Tab CC-3). To support national security strategy, ACC operates fighter, bomber, reconnaissance, battle management, and electronic-combat aircraft (Tab CC-3). It prepares forces for rapid deployment and ensures strategic air defense forces are ready to meet emerging challenges (Tab CC-3).

b. Massachusetts Air National Guard

Dating back to 1921, the Massachusetts Air National Guard formed with the creation of the 101st Observation Squadron (Tab CC-7). Following World War II, it expanded to include the 102nd Fighter Wing and 104 FW (Tab CC-7). The Massachusetts Air National Guard is equipped to support global operations and respond to local needs (Tab CC-8).

c. The 104th Fighter Wing

Located at Barnes ANGB in Westfield, 104 FW is one of the oldest flying units in the Commonwealth of Massachusetts (Tab CC-9). It employs over 700 traditional guardsmen and over 300 Active Guard Reserve and military technicians (Tab CC-9). The 104th Fighter Wing supports wartime contingency requirements and performs peacetime missions to ensure readiness (Tab CC-9).

d. The 131st Fighter Squadron

The 131st Fighter Squadron serves as the operational combat arm of 104 FW (Tab CC-9). Its fighter pilots perform air sovereignty and alert missions for air defense of the northeastern sector of the United States (Tabs G-2 and CC-9). The 131st Fighter Squadron provides the aircraft, manpower, and tactics to win and sustain air superiority using conventional air-to-air weapons (Tab CC-9).

e. F-15C Eagle

Figure 1: Image of Inspection of F-15C at Kadena Air Base, Japan (Tab Z-3)
Photo Credit: Technical Sergeant Rey Ramon

The F-15C Eagle is a single-seat, all-weather, tactical fighter designed to maintain air superiority during combat (Tab CC-11). Its thrust-to-weight ratio and weight-to-wing area ratio allow for superior maneuverability and acceleration (Tab CC-11). The F-15C features a multi-mission avionic system, which includes a head-up display, advanced radar, ultrahigh frequency communications, and a tactical navigation system (Tab CC-11). It has deployed to support various combat operations, including Desert Storm in the Persian Gulf, Provide Comfort in Turkey, Enduring Freedom in Afghanistan, and Iraqi Freedom in Iraq (Tab CC-12).

4. SEQUENCE OF EVENTS

a. Mission

The mission on 27 August 2014 was a cross-country flight for delivery of the MA to Naval Air Station Joint Reserve Base New Orleans for a radar upgrade (Tabs K-4 and V-2.5). The Director of Operations (responsible for short and long-term operations planning) for 131 FS properly authorized the mission (Tabs K-4, V-2.5, and V-22.6).

b. Planning

The mission planning and briefing were accomplished using standard procedures for a cross-country aircraft delivery and in accordance with the *104FW Inflight Guide* (dated February 2013) and Air Force regulations (Tabs V-2.5, V-6.5, V-6.8 to V-6.9, AA-3 to AA-5, and BB-10 to BB-27). MP began mission planning on 26 August 2014 after informally removing himself from the day's flying schedule due to a self-reported illness, which MP described as a head cold or sinus infection (Tab V-1.11, V-1.14, V-6.3 to V-6.4, V-6.8 to V-6.10, and V-21.2). The morning of 27 August 2014, MP finalized mission planning and reviewed the mission details with the Supervisor of Flying (responsible for ongoing flying operations) in accordance with the *104FW Inflight Guide* (Tab V-2.5 to V-2.6, V-6.8 to V-6.9, V-22.5 to V-22.6, and AA-3 to AA-4). Planning for the flight was completed in accordance with the applicable regulations and met the requirements for a cross-country aircraft delivery (Tabs V-2.5, AA-3 to AA-4, BB-6 to BB-8, and BB-10 to BB-27).

c. Preflight

Prior to departing 131 FS for the MA on 27 August 2014, MP gathered and inspected his Aircrew Flight Equipment (AFE) and received a final briefing from the Supervisor of Flying concerning parking location, maintenance issues, aircraft configuration, Notices to Airmen, bird watch condition, weather, and overall mission timeline (Tab V-2.5 to V-2.6, V-2.11, V-2.13 to V-2.16, V-6.5 and V-6.8 to V-6.9). According to the Supervisor of Flying and the Aviation Resource Manager, who both saw MP prior to departure for the MA, MP did not appear congested or otherwise unfit to fly (Tab V-2.11, V-2.13, V-2.17, V-6.3 to V-6.4, and V-6.9 to V-6.10). MP proceeded to the MA at approximately 0730L (Tab V-2.13). The flight plan was electronically filed with the Federal Aviation Administration on the Department of Defense Form 175 (Tabs K-2 and V-6.8). After arrival to the MA, MP conducted a review of the aircraft forms, completed a walk-around inspection, and initiated the engine start sequence and preflight checks (Tab V-11.10 to V-11.12, V-13.6, and V-13.11). Nothing abnormal was reported during the preflight inspection or ground operations prior to takeoff (Tab V-2.6, V-8.10 to V-8.11, V-11.5, V-11.10 to V-11.11, V-11.14, and V-13.6 to V-13.9).

d. Summary of Accident

The MA departed Barnes ANGB at 0806L under the call sign HAWK 11 (Tabs K-2, V-2.11, V-6.8, and Z-3). Engine start, taxi, and takeoff were uneventful (Tab V-2.6, V-2.11, and V-11.5). MP received direction from several Air Traffic Control Centers during the climb to cruising altitude (Tab EE-4). MP sounded normal, showing no signs of illness, hypoxia, or stress

(Tab EE-4). The MA proceeded along the planned route, reaching Flight Level 430 (approximately 43,000 feet mean sea level (MSL)) around 0823L (Tabs N-3.1, N-3.4, and EE-3). MP continued at Flight Level 430 for approximately 33 minutes without reporting any significant issues (Tabs N-3.2 to N-3.12 and V-22.4 to V-22.5).

At 0855:58, MP began a descent (Tab M-2.12). Radar data showed the MA initially descending at a rate of approximately 12,000 feet per minute (Tabs M-2.12 to M-2.13 and EE-3). At 0856:11L, Washington Air Route Traffic Control Center (Washington Center) requested MP to make a routine radio frequency change (Tab N-3.12). At 0856:24L, while passing Flight Level 380 (approximately 38,000 feet MSL), MP responded, "HAWK 11 declaring emergency" (Tabs M-2.12 and N-3.12). Washington Center acknowledged the emergency and requested MP's status (Tab N-3.12). At 0856:31L, MP responded, "Affirm. Standby." while passing Flight Level 360 (approximately 36,000 feet MSL) (Tabs M-2.12 and N-3.12). This was the last communication received from MP despite numerous attempts by Washington Center to make contact for additional information (Tab N-3.12 to N-3.13).

After the initial descent at 12,000 feet per minute, the MA continued to accelerate and descend (Tab M-2.12 to M-2.13). Prior to impact, the MA reached supersonic speed, indicating that no catastrophic structural failure occurred before impact (Tab J-6). Radar data showed no evidence that MP maneuvered to recover the MA between the final call to Washington Center and impact (Tabs M-2.12 to M-2.13 and GG-50). At Flight Level 360, MP was at a sufficient altitude to recover or eject from the aircraft (Tabs H-2 to H-3, V-20.4 to V-20.5, and EE-4).

See Figure 2 for a chart showing the altitude of the MA over time after leaving Flight Level 430.

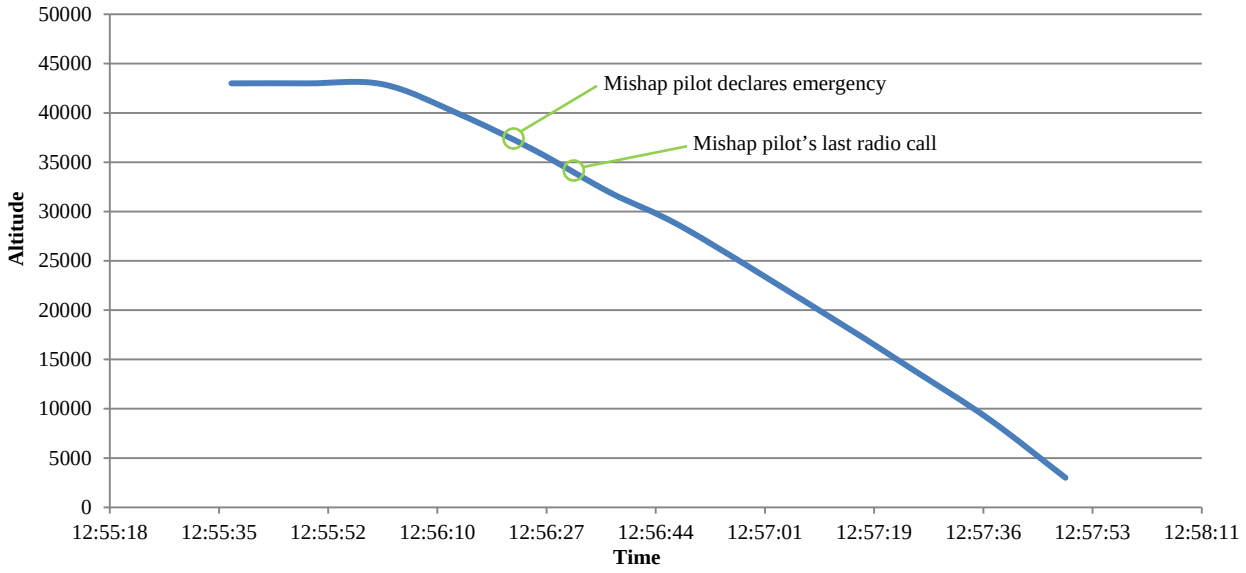

Figure 2: Altitude of Mishap Aircraft Over Time after Leaving Flight Level 430 (Tabs M-2.12 to M-2.13, N-3.12 to N-3.13, and GG-62)

At some point during the mishap flight, MP received an Environmental Control System (ECS) warning light indicating higher than normal temperature in the avionics bay (Tab J-58 and J-73). This type of warning does not indicate an immediate threat to the aircraft and may result in a rise in cockpit temperature to the point where the pilot may become uncomfortable (Tab V-21.5 to V-

21.6). The time that the ECS warning light came on in the MA is unknown because the F-15C does not have a flight data recorder (Tab EE-4).

ECS warning lights are relatively common in the F-15C (Tabs V-5.10 to V-5.11, V-21.4, V-22.3 to V-22.4, and EE-4). An experienced pilot would declare an in-flight emergency and take immediate steps to respond to an ECS warning light (Tab V-22.4). Personnel in 131 FS regularly train on how to respond to an ECS warning light (Tab V-5.7 to V-5.8). Standard procedure after receiving an ECS warning light includes initiating a descent (Tabs V-21.8, V-22.4, and BB-64 to BB-65). The standard response to an ECS warning light at a high altitude might include an aggressive descent (e.g., rolling the aircraft to an inverted position and pointing the nose of the aircraft toward the ground) (Tab V-22.8). The standard response to any in-flight emergency at a high altitude normally includes descending the aircraft to a lower altitude (Tab V-22.8).

e. Impact

The MA impacted the ground at approximately 0858L in a densely forested area of the George Washington National Forest (Tabs M-2.13, N-3.15, and Z-3). Pieces from all the main sections of the MA were found at the crash site, indicating that there was no catastrophic structural failure prior to impact (Tab J-6). The MA created a large crater (approximately 15 to 20 feet deep) at the point of impact (Tab J-2). At the time of the impact, the MA was inverted between 60 to 70 degrees nose low (i.e., upside down and pointed sharply toward the ground) and traveling at an airspeed greater than 0.83 Mach (Tab J-2 and J-25). The MA's engines were operating normally in a mid-range power setting—the standard power setting at cruising altitude for a cross-country flight—at the time of impact (Tabs J-78.10 and V-22.5).

At 0858L, a pilot flying an aircraft near the George Washington National Forest radioed Washington Center to report a "big black plume of smoke on the ground" (Tab N-3.15). The pilot did not see a parachute or anything else in the air near the plume of smoke (Tab N-3.15). Eventually the pilot flew close enough to observe fire on the ground (Tab N-3.17).

See Figure 3 for aerial images of the crash site taken at 1851L on the day of the mishap.

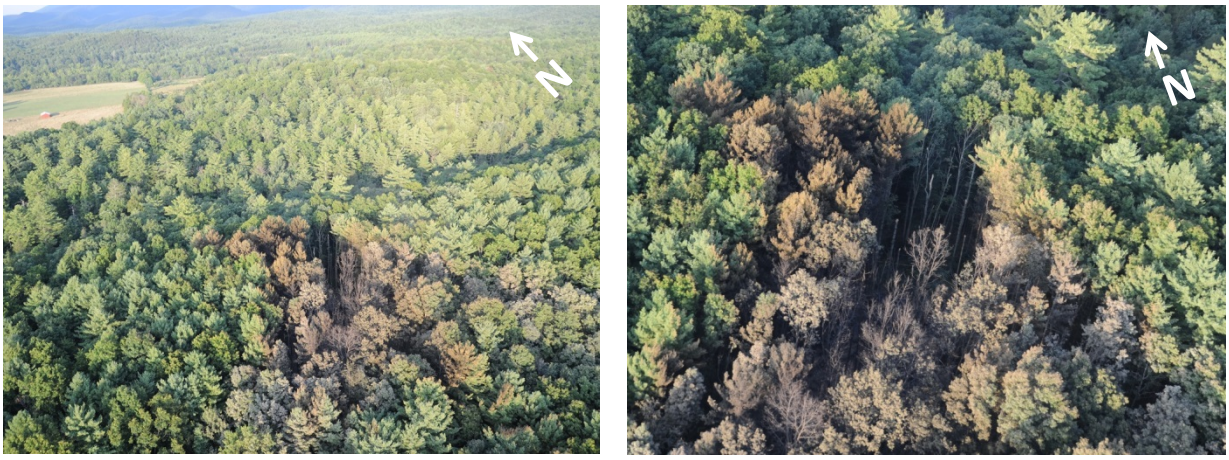

Figure 3: Aerial Images of Crash Site Taken at 1851L on 27 August 2014 (Tab Z-3)

f. Egress and Aircrew Flight Equipment

The MA's egress system, to include the canopy and ejection seat, was intact at the time of impact (Tabs J-20 to J-21 and H-8). Analysis of a JAU-8/25 (an ejection sequence initiator component) and left ejection control handle, which were both recovered from the crash site, indicated that MP did not attempt to eject from the MA (Tabs H-4, H-8, and V-20.4). All AFE was destroyed (Tab H-9). The inspections for the egress system and AFE were current at the time of the mishap (Tabs EE-3 and FF-4).

g. Search and Rescue

The MA impacted the ground at approximately 0858L (Tabs M-2.13 and N-3.15). The Augusta County Sheriff's Department from Deerfield made the initial response to the crash site immediately after being relayed information at 0900L concerning the mishap from the Potomac Approach Control and several emergency phone calls from civilians (Tabs V-7.3 and DD-3). Due to rugged terrain and difficulty in pinpointing the exact location of the crash site, it took initial responders approximately 1 hour and 40 minutes to reach the crash site (Tab V-7.4 and V-16.6). Initial responders arrived at the crash site at 1041L and observed pieces of debris within a 300 to 450 foot radius from the point of impact (Tab V-7.4 and V-16.6). Although several pieces of debris appeared to be smoldering, the fire was contained to the impact crater (Tab V-7.5).

Members of the volunteer fire department from Deerfield used hand tools and fire extinguishers to put out the fire (Tab V-16.4 to V-16.5). Response and recovery personnel from the Air Force arrived throughout the afternoon of 27 August 2014 and established an incident response camp near the crash site (Tabs V-16.5 and Z-3).

h. Recovery of Remains

The initial responders from the Augusta County Sheriff's Department and volunteer fire firefighters from Deerfield were unable to determine whether MP ejected from the MA prior to impact (Tabs V-7.5 to V-7.6, V-18.5, and DD-7). On 28 August 2014, Air Force response personnel discovered evidence that MP had not ejected from the MA prior to impact (Tabs V-16.5 to V-16.6 and DD-11). Personnel from the Armed Forces Medical Examiner System handled the recovery of remains (Tab V-16.5 to V-16.6).

See Figure 4 for a timeline summary of events.

Local Time	Event
Prior to 0615	Mishap pilot's duty day begins
~0730	Mishap pilot proceeds to mishap aircraft
0806	Takeoff
~0823	Mishap aircraft levels off at final cruising altitude (Flight Level 430)
0855:58	Mishap pilot initiates a descent from Flight Level 430
0856:24	Mishap pilot declares emergency while passing Flight Level 380
0856:31	Mishap pilot's last radio call while passing Flight Level 360

Figure 4: Timeline Summary of Events (Tab EE-3)

5. MAINTENANCE

a. Forms Documentation

(1) General Definitions

Air Force aircraft maintenance and inspection histories are documented through Air Force Technical Order (AFTO) 781 series forms and the Integrated Maintenance Data System (IMDS) in accordance with AFI 21-101, *Aircraft and Equipment Maintenance Management*, AFI 11-301, *Aircrew Flight Equipment (AFE) Program*, and AFI 21-102, *Depot Maintenance Management* (Tab BB-30, BB-32, BB-34, and BB-36). In addition to scheduling and documenting routine maintenance actions, these tools allow aircrew to report discrepancies and maintenance personnel to document actions taken to resolve any reported discrepancy (Tab BB-61).

AFTO 781 series forms are divided into active forms and inactive forms (Tab BB-62). The active forms are those currently in use by maintenance personnel to record aircraft inspections, conditions, and repair actions (Tab BB-62). The inactive forms consist of completed maintenance actions and historical data, with uncorrected discrepancies transferring to the active forms (Tab BB-62).

Time Compliance Technical Orders (TCTOs) are used to process aircraft system changes (e.g., parts upgrades) that must be accomplished within a specific timeline, depending on the severity of the issue as indicated by the TCTO (Tab BB-54). A TCTO may also direct inspections or adjustments to existing parts or equipment already installed on the aircraft (Tab BB-54).

(2) Documentation Review

A review of the MA's IMDS information, maintenance shift turnover logbooks, and AFTO 781 series forms (both active and inactive) did not reveal any significant recurring maintenance issues (Tab FF-3 to FF-5).

(a) Active Forms

The physical AFTO 781 series forms binder was on the MA at the time of the mishap and was destroyed (Tab FF-5). Thus, the most recent forms, beginning with 26 August 2014, could not be reviewed (Tab FF-5). The physical AFTO 781 series forms that remained at Barnes ANGB had no discrepancies relevant to the mishap (Tabs D-2, D-3.1 to D-3.160, U-3 to U-9, and FF-5).

All inspection items were current at the time of the mishap and there were no TCTOs pending that were relevant to the mishap (Tab FF-4 to FF-5 and FF-7). On 26 August 2014, there were five open discrepancies noted in the AFTO 781K series forms (Tabs U-9 and FF-4). However, there was no evidence to suggest that these open discrepancies were a factor in the mishap.

The Exceptional Release, which authorized the MA for flight, was completed at 0715L, indicating the MA had a valid preflight inspection and had been released for takeoff (Tab V-13.6 to V-13.13 and V-11.10 to V-11.11). Maintenance personnel from Barnes ANGB completed the preflight inspection prior to 0730L on 27 August 2014, documenting the inspection on the

physical AFTO 781 forms and placing those forms on the MA (Tab V-13.6 to V-13.13 and V-11.10 to V-11.14).

(b) Inactive Forms

The MA's inactive AFTO 718 series forms and 24-month historical files (including TCTOs, AFTO Forms 95 (*Significant Historical Data Form*), major inspection packages, and archived IMDS data) revealed no evidence to suggest that any maintenance act or omission was a factor in the mishap (Tab FF-5).

b. Inspections

(1) Aircraft Inspections

Periodic inspections are accomplished based on the accrual of an airframe-specified number of flying hours and augment Basic Post-flight or any calendar-based inspection requirements (Tab BB-56). These inspections consist of checking components, areas, or systems to determine that no condition exists which, if not corrected, could result in failure or malfunction before the next scheduled inspection (Tab BB-68). The F-15C has a 400 flight hour combined Hourly Post-flight/Periodic inspection cycle (Tab BB-68). At the time of the mishap, the MA had 271.6 hours remaining before the next required Hourly Post-flight/Periodic inspection (Tab FF-3). The MA underwent a routine major 72-month Programmed Depot Maintenance inspection on 24 January 2013 (Tab FF-3). At the time of the mishap, the MA was not scheduled for Programmed Depot Maintenance until September 2019 (Tab FF-3).

On 22 August 2014, maintenance personnel at Barnes ANGB completed three routine 180-day oxygen system inspections: (1) the Oxygen Regulator Control Panel Leakage Test, (2) Oxygen System Purging, and (3) Liquid Oxygen Convertor Purging (Tabs D-3.135 to D-3.136, V-14.3, and FF-3 to FF-4). No defects or additional maintenance actions were noted (Tabs D-3.135 to D-3.136, V-14.3, and FF-4).

A preflight inspection includes fluid servicing, inlet and exhaust inspection, and a complete walk around inspection of the aircraft for panel and fastener security (Tab BB-64). The preflight inspection was completed the night prior to the mishap and remained valid for the MA's departure from Barnes ANGB (Tabs D-3.128 to D-3.129 and V-11.3). A prelaunch inspection was completed on 27 August 2014, which included checking the MA to ensure readiness for flight (Tabs V-11.3, V-13.8, and BB-66). This was the last maintenance inspection completed on the MA prior to launch (Tab V-13.6 to V-13.13 and V-11.10 to V-11.14).

The AFTO 781 series forms and IMDS data confirmed that all inspections were accomplished in accordance with applicable maintenance directives (Tab FF-3 to FF-4).

(2) Engine Inspections

Maintenance personnel visibly inspect the F-15C engine inlets and exhausts before and after every flight (Tabs V-11.11 and FF-5). In addition, the engines are inspected before and after every engine maintenance run (Tab FF-5). Each engine also requires a different type of

inspection every 100, 200, and 400 flight hours (Tab FF-5). All engine inspections were current for the MA at the time of the mishap (Tab FF-5).

Engine components and modules have limited lifetimes that are tracked by engine operating time and cycles (Tab FF-5). IMDS did not show any modules or components due for time change or adjustment at the time of the mishap (Tab FF-5).

c. Maintenance Procedures

AFTO 781 series forms and IMDS reflect all maintenance actions conducted on an aircraft's systems and subsystems (Tab BB-62). Personnel from Barnes ANGB described the MA as "one of the best jets" at the base (Tab V-2.17 and V-11.13). All maintenance procedures on the MA were performed in accordance with applicable regulations (Tab FF-3 to FF-4).

d. Maintenance Personnel and Supervision

All personnel assigned to the 104th Maintenance Group, Barnes ANGB, who maintained the MA were properly qualified (Tab FF-4). The training records and special certification rosters (i.e., staff progress records and staff certification records) for all personnel performing maintenance on the MA reflected proper training and full qualifications on all tasks accomplished (Tabs BB-38 and FF-5). The 104th Fighter Wing supervision engaged with the 104th Maintenance Group leadership on a weekly basis, as required by AFI 21-101, *Aircraft and Equipment Maintenance Management*, and saw no issues with maintenance practices and procedures (Tabs R-91 and BB-34).

There was no evidence to suggest that acts or omissions by maintenance personnel or supervision were a factor in the mishap.

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

Following the mishap, fuel samples were taken from the fuel truck that supplied fuel to the MA. These samples were tested at Wright-Patterson Air Force Base (AFB), Ohio (Tab FF-6). The fuel used on the MA met specification requirements (Tab FF-6).

Following the mishap, liquid oxygen (LOX) samples were taken from the LOX servicing cart that supplied LOX to the MA (Tab FF-4). The samples were tested at Wright-Patterson AFB. The LOX used on the MA met specification requirements (Tab FF-6).

Gaseous oxygen (GOX) samples were taken from the GOX tanks that were utilized to purge the MA's oxygen systems prior to the mishap (Tab FF-6). The samples were tested at Wright-Patterson AFB (Tab FF-6). The GOX used on the MA met specification requirements (Tab FF-6).

Post-mishap hydraulic fluid and lubricating oil samples were not taken from servicing equipment used on the MA because the servicing equipment had recently been sampled with no abnormal results (Tabs V-19.5 and FF-6). No fluid samples were taken from the MA post-mishap due to the severity of the crash (Tab FF-6). However, recent routine post-flight inspections from the

MA revealed no defects in the fluids, and other aircraft had flown with no issues using fluids from the same servicing equipment (Tabs D-3.128, V-19.5, and FF-6). The MA did not appear to have flight control issues related to hydraulics during the descent (Tab J-22).

There was no evidence to suggest that the fuel, hydraulics, oil, LOX, or GOX were a factor in the mishap.

f. Unscheduled Maintenance

The 90-day aircraft history in IMDS and historical AFTO 781 series forms detailed the unscheduled maintenance actions accomplished by maintenance personnel from Barnes ANGB (Tab FF-4 to FF-5). The maintenance personnel completed the corrective actions for all but five unscheduled maintenance items (Tab FF-4). These five unscheduled maintenance items did not require immediate action (Tab FF-4). There was no evidence to suggest that any of these five unscheduled maintenance items were a factor in the mishap.

Numerous radar system components were removed and replaced with ballast before the MA departed Barnes ANGB for radar modification (Tabs D-3.124 to D-3.127 and V-11.10). The ballast ensures that the aircraft maintains proper weight and balance for safe flight (Tab FF-4). There were no issues reported when installing the ballast (Tabs D-3.124 to D-3.127, V-1.8, V-9.3, V-11.5 to V-11.6, V-11.10, and V-15.3). There is no evidence to indicate that removal of the radar system components impacted the MA's functionality.

6. AIRFRAME, MISSILE, OR SPACE VEHICLE SYSTEMS

a. Engines and Fuel System

The F-15C is powered by two Pratt and Whitney F100-PW-220 turbofan engines (Tab CC-12). The F100-PW-220 engine is a low bypass ratio, high compression ratio, twin-spool turbofan engine with a mixed flow augmentor (Tabs J-78.1 and CC-12). Each engine's main fuel pump supplies fuel to the main engine gas generator and augmentor fuel pump (Tabs J-78.7 and CC-12).

The F100 System Program Office (SPO) and Pratt & Whitney completed an analysis of all recovered components for both engines (Tab J-78.10). Analysis showed that both engines were functioning at mid-range power settings at time of impact (Tab J-78.10). All engine damage was consistent with ground impact and post-impact fire (Tab J-78.10).

The F-15 SPO completed analysis on all the recovered fuel system components (Tab J-78.7 to J-78.8). The main fuel control units for both engines had a fuel flow rate consistent with a mid-range power setting, indicating that the engines and fuel system were functioning properly (Tab J-78.8 to J-78.10).

b. Oxygen System

The F-15C utilizes a LOX convertor, manufactured by Essex Cryogenics, to supply the pilot with breathable air (Tabs J-7 and FF-5). The LOX boils into GOX and is routed by oxygen

pressure into the cockpit-mounted heat exchanger where it is heated to a comfortable breathing temperature (Tab J-7). The LOX convertor and aircraft oxygen system are purged every 180 days to ensure system purity (Tabs J-7 and FF-3 to FF-4). On 22 August 2014, the oxygen system purge and LOX convertor purge were completed on the MA (Tabs V-14.3 and FF-4). No defects or non-functioning conditions were noted (Tabs V-14.4 to V-14.7 and FF-4). The MA's LOX convertor was not recovered due to the severity of the crash (Tab J-7).

GOX from the heat exchanger is supplied to a cockpit-mounted oxygen regulator, manufactured by Cobham plc (Cobham), for delivery of breathing gas to the pilot (Tabs J-8 and FF-3). On 22 August 2014, the MA's cockpit-mounted oxygen regulator was inspected (Tabs V-14.3 to V-14.5 and FF-3). No defects or non-functioning conditions were noted (Tabs V-14.3 to V-14.5 and FF-3). The MA's oxygen regulator was recovered from the crash site and provided to Cobham for analysis (Tabs J-8 and GG-4). However, due to the severity of damage sustained during impact, Cobham's analysis was inconclusive concerning the status of the regulator prior to impact (Tab GG-3 and GG-37).

See Figure 5 for an image of an undamaged cockpit-mounted oxygen regulator and an image of the MA's cockpit-mounted oxygen regulator recovered from the crash site and analyzed by Cobham.

Figure 5: Image of Intact Oxygen Regulator and Image of Damaged Oxygen Regulator from the Mishap Aircraft (Tab J-7 and J-9)

The cockpit oxygen regulator in the F-15C connects to the communications panel via the cockpit oxygen hose (Tab J-10). From the communications panel, the pilot connects his or her oxygen mask to the aircraft oxygen system via the CRU-60/P hose and connector (Tab J-10). The aircraft's ejection seat mounted emergency oxygen supply connects to the CRU-60/P and functions as a backup oxygen supply for high altitude ejection or oxygen system malfunction. (Tab J-11). The MA's mask, oxygen hose, and connectors were not recovered due to the severity of the crash (Tab J-10 and J-12).

c. Environmental Control System

The ECS draws high-temperature compressed air, known as bleed air, from both the left and right engines to produce cooling and pressurization air for the cockpit and avionics equipment on the F-15C (Tab J-12). At the time of the mishap, there were no open maintenance discrepancies

or issues noted with the ECS (Tab FF-3 to FF-4). Multiple ECS valves (manufactured by Honeywell International Incorporated (Honeywell) and the Boeing Company (Boeing)), one primary heat exchanger, and the ECS turbine (manufactured by Honeywell), were recovered from the impact site and sent to the F-15 SPO and Boeing for analysis (Tabs J-25, J-59, and FF-5). The analysis of the ECS indicated that the MA's ECS warning light activated due to higher than normal temperature in the avionics bay (Tab J-58 to J-59 and J-73). That analysis also showed that at the time of impact the overall ECS system was still functioning sufficiently to provide cooling and pressurization air for the cockpit (Tab J-72 to J-75).

d. Flight Controls

The F-15C has three separate hydraulic systems that provide pneumatic force to actuate flight control surfaces and landing gear positioning (Tab J-22). Several flight control components, manufactured by the Parker Hannifin Corporation and Boeing, were found at the impact site and sent to Boeing for analysis (Tabs J-22 and FF-5). The analysis, along with observations of the hydraulic systems at the crash site, showed no evidence that the MA had flight control issues (Tab J-22 and J-30 to J-55).

e. Electrical System

The F-15C SPO conducted an analysis based on all available data to determine the likelihood that the MA experienced electrical failure prior to impact (Tab J-22). The analysis determined that it was unlikely that the MA had a major electrical system failure because MP was able to declare an emergency to Washington Center (Tab J-22). In addition, the MA continued to send altitude data to Washington Center for the duration of the descent (Tab J-22). Although the Air Force Research Laboratory conducted an analysis of canopy glass recovered from the crash site, it could not conclude whether an electrical fire occurred in the cockpit prior to impact (Tab J-79.6). At the time of the mishap, there were no open discrepancies noted with the electrical system (Tab FF-3 to FF-4).

f. Egress System

The F-15C is equipped with a rapid ejection system that utilizes the ACES II ejection seat as the primary vehicle for in flight pilot emergency egress (Tab H-2). The ejection process begins when the pilot actuates either or both connected ejection control handles, located one each on the left and right of the pilot's seat (Tab H-2). Lifting one or both of the handles triggers two JAU-8/A25 initiators, one immediately and one delayed 0.75 seconds, which provides redundant methods of actuating separate Shielded Mild Detonation Cord (SMDC) initiators and the inertia reel gas generator (Tab H-2). The SMDC initiators detonate explosive SMDC lines, which propel the canopy remover into the canopy "catcher's mitt" and rapidly remove the canopy from the aircraft (Tab H-2). Simultaneously, the inertia reel gas generator actuates the inertia reel system and retracts the pilot into proper seat position during the ejection sequence (Tab H-2). The separation of the canopy from the aircraft body activates the rocket catapult located under the ACES II seat or, in the event of primary system failure, the delayed JAU-8/A25 initiator (Tab H-2). The rocket catapult propels the seat and pilot away from the aircraft frame prior to actuating the built-in seat stabilization components, seat separation sequence, and parachute

deployment (Tab H-2). The timing and sequencing of the seat parachute deployment and separation is determined by on board seat sensors, aircraft altitude, and speed (Tab H-3).

The inspection of the egress system was current at the time of the mishap (Tab FF-3). Post-mishap evaluation of the ejection seat system of the MA indicated that the ejections sequence had not been initiated prior to impact (Tab H-8). Witness marks on the left ejection control handle pivot point and the angles at which both handles were broken indicate the handles were down during the impact (Tabs H-4, H-8, and V-20.4). One of the two JAU-8/25 initiators was recovered, and analysis determined that the initiator had been fired by ground impact (Tab H-5). The analysis concluded that MP did not attempt to eject from the MA (Tabs H-4, H-8, and V-20.4)

7. WEATHER

a. Forecast Weather

On the day of the mishap, the forecast weather for takeoff at Barnes ANGB was clear skies, nine statute miles of visibility, and calm winds (Tab F-5). The forecast surface temperature was 63 degrees Fahrenheit, with a freezing level at 15,000 feet above ground level (Tab F-3 to F-7).

The forecast weather for the route of the mishap flight was clear skies and unlimited visibility (Tab F-2 to F-13).

During mission planning, MP noted the possibility of thunderstorms developing near the destination late in the day (Tab V-1.23, V-2.3 to V-2.4, V-2.17, V-13.9, and V-13.11).

b. Observed Weather

MP did not report any weather conditions prior to the mishap (Tab N-3.1 to N-3.12). Observed weather at the crash site at the time of the mishap was clear skies, 10 statute miles of visibility, and calm winds (Tabs F-14 and V-7.5).

c. Space Environment

This subsection does not apply.

d. Operations

The mission complied with weather requirements (Tabs F-2 to F-13 and BB-28).

There was no evidence to suggest that weather was a factor in the mishap.

8. CREW QUALIFICATIONS

After graduating from the United States Air Force Academy in 1996, MP served on active duty until 2014 when MP joined the Massachusetts Air National Guard (Tabs T-3 and DD-11). MP was a fully qualified F-15C Standardization Evaluation Flight Examiner and United States Air

Force Weapons Instructor Course graduate (Tabs G-2, T-3, and DD-13). MP had 2,363.2 total flying hours, to include 2,112.3 hours in the F-15C and 230 hours of combat time (Tabs G-3 to G-4 and DD-11). MP was current in all flight areas (Tab G-14 to G-15).

See Figure 6 for MP's most recent flight times as of 27 August 2014.

	Hours	Sorties
Last 30 Days	8.5	7
Last 60 Days	15.0	11
Last 90 Days	32.5	19

Figure 6: Mishap Pilot's Recent Flight Times (Tab G-3 to G-4)

MP was a leader within the F-15C community and had a reputation as a professional pilot that adhered to rules and regulations (Tabs R-90 to R-91, V-2.9, V-3.3 to V-3.5, V-4.9 to V-4.10, V-5.9, V-5.11, V-12.4, and V-12.9). The Chief of Weapons and Tactics at 131 FS described MP as "a great officer, a great leader, a great mentor" (Tab V-3.5). A member of 131 FS who recently deployed with MP to Malaysia described MP as "the best of the best" (Tab V-12-4 and V-12.9). Leadership at 104 FW believed MP's "future was bright" and that MP was likely to become a future commander (Tab V-5.6).

There was no evidence to suggest that MP's qualifications were a factor in the mishap.

9. MEDICAL

a. Qualifications

MP was medically qualified for flight duty on the day of the mishap (Tab X-3). MP's annual periodic health assessment was up-to-date and the AF Form 1042, *Medical Recommendation for Flying or Special Operational Duty*, was current and valid through 4 March 2015 (Tab X-3). MP had no medical waivers, no documented disqualifying medical conditions, and no documented use of unapproved medications (Tab X-3).

b. Health

The day prior to the mishap, MP informally removed himself from the flying schedule due to a self-reported illness, which MP described as a head cold or sinus infection (Tab V-1.11, V-1.14, V-6.4, V-6.8 to V-6.10, V-12.3, and V-21.2). There was no evidence that MP sought medical care for this condition (Tabs V-12.3 and X-3). On the day of the mishap, MP did not appear congested or otherwise unfit to fly (Tab V-2.11, V-2.13, V-2.17, V-3.4, V-6.3 to V-6.4, and V-6.9 to V-6.10).

Other than symptoms of what MP described as a head cold or sinus infection exhibited the day prior to the mishap, MP's overall health on the day of the mishap was excellent (Tabs V-4.4 to V-4.6, V-5.6 to V-5.7, and X-3 to X-4). There was no other evidence to suggest that MP had any mental or physical health condition or history that was a factor in the mishap (Tabs V-4.4 to V-4.6, V-5.6 to V-5.7, and X-3 to X-4).

c. Pathology

MP died from multiple injuries sustained during impact (Tab X-4). Toxicology testing on MP could not be completed (Tab X-4). Toxicology tests for 23 maintenance members who worked on the MA prior to the mishap were negative for alcohol and illegal substances (Tab X-4).

d. Lifestyle

There was no evidence to suggest MP's lifestyle was a factor in the mishap (Tab X-3).

e. Crew Rest and Crew Duty Time

Crew rest is defined as a minimum 12-hour non-duty period before the flight duty period begins (Tab BB-6 to BB-7). Its purpose is to ensure crew members are adequately rested before flight (Tab BB-6 to BB-7). There was no evidence that MP violated crew rest or crew duty time requirements prior to the mishap (Tabs V-2.13, V-3.4, V-6.3, and X-4).

10. OPERATIONS AND SUPERVISION

a. Operations

MP was an experienced F-15C pilot, with more than 2,100 hours in the F-15C (Tabs G-2 and BB-4). The 131st Fighter Squadron was in the Air Combat Maneuvering (focusing operations on close-range fighting) phase of their normal training plan (Tab V-2.7 and V-22.5).

b. Supervision

The 131st Fighter Squadron Director of Operations, who was on duty as the Supervisor of Flying at the time of the mishap, was experienced and qualified (Tabs G-2). The Director of Operations reviewed and authorized the mission on the day of the mishap and briefed MP immediately prior to departure (Tabs K-4 and V-2.5).

Operational Risk Management (ORM) is a decision making process to systematically evaluate possible courses of action and identify risks and benefits to determine the best course of action for any given situation (Tab BB-50 to BB-51). Specific items included in the ORM assessment include: (1) type of mission, (2) events on mission, (3) days since the last similar mission, (4) weather at home station and in airspace, (5) F-15C flying hours, (6) days since last flight, (7) show time, (8) number of days working, and (9) a self-assessment of health, life stressors, and quality of sleep (Tab AA-7 to AA-8). The ORM level of the mishap flight was eight, which is in the lowest risk category (Tab AA-8).

There was no evidence to suggest that squadron operations or supervision were a factor in the mishap.

11. HUMAN FACTORS

There were no human factors found to be relevant to the cause of the mishap. The following human factors from the Department of Defense Human Factors Analysis and Classification System (AFI 91-204, *Safety Investigations and Reports*, 12 February 2014, Attachment 6) were specifically considered:

a. Inattention

Inattention is a factor when an individual has a state of reduced conscious attention due to a sense of security, self-confidence, boredom, or a perceived absence of threat from the environment which degrades crew performance.

b. Channelized Attention

Channelized attention is a factor when an individual is focusing all conscious attention on a limited number of environmental cues to the exclusion of others cues that are a subjectively equal, higher, or more immediate priority, leading to an unsafe situation.

c. Cognitive Task Oversaturation

Cognitive task oversaturation is a factor when the quantity of information an individual must process exceeds that individual's cognitive or mental resources in the amount of time available to process the information.

d. Distraction

Distraction is a factor when an individual has an interruption of attention or inappropriate redirection of attention by an environmental cue or mental process that degrades performance.

12. GOVERNING DIRECTIVES AND PUBLICATIONS

a. Publically Available Directives and Publications Relevant to the Mishap

(1) AFI 11-2F-15, Volume 1, *F-15 Aircrew Training*, 7 September 2010

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

(3) AFI 11-202, Volume 3, *General Flight Rules, Air Combat Command Supplement*, 22 October 2010

(4) AFI 11-301, Volume 1, *Aircrew Flight Equipment (AEF) Program*, 25 February 2009 (incorporating Change 1, 2 May 2014)

(5) AFI 11-301, Volume 2, *Management and Configuration Requirements for Aircrew Flight Equipment (AFE)*, 20 December 2013

(6) AFI 21-101, *Aircraft and Equipment Maintenance Management, United States Air National Guard Supplement*, 19 May 2014 (incorporating Change 1, 16 August 2014) (corrective actions applied on 12 August 2014)

(7) AFI 21-102, *Depot Maintenance Management*, 18 July 2012

(8) AFI 36-2650, *Maintenance Training*, 20 May 2014

(9) AFI 51-503, *Aerospace Accident Investigations*, 26 May 2010 (including Air Force Guidance Memorandum 2013-02)

(10) AFI 91-204, *Safety Investigations and Reports*, 12 February 2014 (corrective actions applied on 10 April 2014)

(11) Air Force Pamphlet 90-803, *Risk Management (RM) Guidelines and Tools*, 11 February 2013

(12) TO 00-5-1, *AF Technical Order System*, 1 April 2014

(13) TO 00-20-1, *Aerospace Equipment Maintenance Inspection, Documentation, Policies, and Procedures*, 1 April 2013

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) TO 1F-15A-1, *F-15A/B/C/D Aircraft*, 15 February 2009, Change 6, 15 January 2014

(2) TO 1F-15A-2-95JG-10-1, *Crew Escape and Safety System - Ejection Seat - Aces II S/S/SN 95-10-01 through 95-10-20*, 15 April 1996, Change 27, 1 November 2014

(3) TO 1F-15A-6, *Inspection and Maintenance Requirements Manual*, 1 March 2011, Change 9, 15 March 2014

(4) TO 1F-15A-6WC-1, *Combined Preflight/Postflight Inspection*, 1 May 2007

(5) TO 1F-15A-6WC-2-1, *Aircraft Pre-Launch Inspection Procedures*, 1 July 1991

(6) TO 1F-15A-6WC-5, *Combined Hourly Postflight/Periodic Inspection*, 15 October 2008

(7) TO 1F-15C-2-21JG-60-1, *Air Conditioning System - Temperature Control - Bleed Air*, 1 May 1981, Change 29, 1 January 2014

(8) TO 1F-15C-2-33JG-40-1, *Lighting System - Exterior*, 1 March 1981, Change 39, 1 July 2011

(9) TO 1F-15C-2-35JG-10-1, *Oxygen System - Crew*, 15 May 1981, Change 35, 1 February 2011

(10) TO 1F-15C-2-99JG-11-1, *Tactical Electronic Warfare System - Countermeasures Receiving Set AN/ALR-56A/56C S/S/SN 99-11-01 thru 99-11-21 USAF Series F-15C and F-15D Aircraft*, 15 March 1981, Change 52, 1 December 2012

(11) TO 1F-15C-2-99JG-12-1, *Tactical Electronic Warfare System – Countermeasures Set AN/ALQ-128 USAF Series F-15C and F-15D Aircraft*, 15 March 1981, Change 18, 1 July 2010

(12) TO 1F-15C-2-99JG-13-1, *Tactical Electronic Warfare System – Countermeasures Set AN/ALQ-135(V) S/S/SN 99-13-02 thru 99-13-20 USAF Series F-15C Aircraft*, 1 May 1981, Change 35, 1 September 2010

(13) TO 1F-15C-2-99JG-13-2, *Tactical Electronic Warfare System – Countermeasures Set AN/ALQ-135 (V) S/S/SN 99-13-21 thru 99-13-81 USAF Series F-15C Aircraft*, 1 April 1981, Change 22, 15 October 2011

(14) TO 1F-15C-2-23JG-24-3, *Communication System - VHF/UHF Communication, Audio Signal, and ADF S/S/SN 23-24-34 thru end USAF Series F-15C and F-15D Aircraft*, 1 August 1981, Change 25, 1 May 2007

c. Known or Suspected Deviations from Directives or Publications

There were no known or suspected deviations from directives or publications.

13. ADDITIONAL AREAS OF CONCERN

There were no additional areas of concern.

23 APRIL 2015

MICHAEL A. HUDSON
Brigadier General, USAF
President, Accident Investigation Board

STATEMENT OF OPINION

F-15C, TAIL NUMBER 86-0157
GEORGE WASHINGTON NATIONAL FOREST, VIRGINIA
27 AUGUST 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 that the mishap pilot's (MP) inability to recover from the descent, due to MP's incapacitation, caused the mishap.

I developed my opinion by analyzing factual data from historical records, Air Force directives and guidance, engineering analyses, witness testimony, radar data, flight simulations, air traffic control recordings, maintenance and inspection records, and information provided by medical and technical experts.

2. BACKGROUND

On 27 August 2014, at 0806 hours local time (L), the mishap aircraft (MA), an F-15C, Tail Number 86-0157, assigned to the 131st Fighter Squadron, 104th Fighter Wing, Barnes Air National Guard Base, Massachusetts, departed Barnes Air National Guard Base under the call sign HAWK 11 on a cross-country flight to receive a radar upgrade at Naval Air Station Joint Reserve Base New Orleans, Louisiana.

MP was a fully qualified F-15C Standardization Evaluation Flight Examiner with over 2,300 total flying hours, including 2,112.3 hours in the F-15C and 230 hours of combat flight time. The day prior to the flight, MP informally removed himself from the flying schedule due to a self-reported illness that MP described as a head cold or sinus infection. On the day of the mishap, MP did not appear congested or otherwise unfit to fly.

Planning for the cross-country flight followed standard procedures and was adequate for the mission. During mission planning, MP noted the possibility of thunderstorms developing near the destination late in the day. This may have caused MP to depart earlier in the day or to plan the route at Flight Level 430 (approximately 43,000 feet mean sea level (MSL)) to conserve gas in case avoiding the thunderstorms became necessary.

Nothing abnormal was reported during the preflight inspection of the MA. Engine start, taxi, and takeoff were uneventful. MP reached Flight Level 430 around 0823L. MP continued at Flight Level 430 for approximately 33 minutes.

At 0855:58, MP began a descent at approximately 12,000 feet per minute. Washington Air Route Traffic Control Center (Washington Center) requested MP to make a routine radio frequency change. At 0856:24L, while passing Flight Level 380 (approximately 38,000 feet MSL), MP responded, "HAWK 11 declaring emergency." Washington Center acknowledged the emergency and requested MP's status. At 0856:31L, MP responded, "Affirm. Standby." while passing Flight Level 360 (approximately 36,000 feet MSL). This was the last communication received from MP.

The MA continued a rapid descent, reaching supersonic speed, and impacted the ground at approximately 0858L in a densely forested area of the George Washington National Forest near Deerfield, Virginia. At the time of the impact, the MA was inverted between 60 to 70 degrees nose low (i.e., upside down and pointed sharply toward the ground) and traveling at an airspeed greater than 0.83 Mach. The MA was destroyed and MP was fatally injured on impact.

At some point during the mishap flight, MP received an Environmental Control System (ECS) warning light indicating higher than normal temperature in the avionics bay.

3. CAUSE

MP most likely initiated the descent from Flight Level 430 in response to an in-flight emergency. The standard response to any in-flight emergency at a high altitude normally includes descending the aircraft to a lower altitude.

It is possible that MP declared the emergency due to the ECS warning light. Even though an ECS warning light does not normally indicate an immediate threat to the aircraft, an experienced F-15 pilot would declare an in-flight emergency and initiate a descent (e.g., rolling the aircraft to an inverted position and pointing the nose toward the ground) in response. The ECS warning light activated due to higher than normal temperature in the avionics bay. I find no other evidence indicating that the higher than normal temperature in the avionics bay contributed to the mishap. Because the F-15C does not have a flight data recorder, the exact time MP received the ECS warning light is unknown and may have occurred sometime after MP initiated the descent. Thus, MP may have initiated the descent in response to a different, unknown issue.

I find no evidence of catastrophic structural failures of the MA prior to impact, nor do I find evidence that the flight control, electrical, or engine systems failed to function properly. The MA was known as "one of the best jets" at the base. In addition, I find no evidence of maintenance personnel, practices, or procedures that contributed to the mishap. The 131st Fighter Squadron provided adequate supervision of operations, to include planning and execution of the mishap flight.

I find that MP became incapacitated for an unknown reason soon after the final call to Washington Center at 0856:31L. This incapacitation ultimately resulted in MP's inability to

recover from the descent and thereby caused the mishap. My conclusion that MP became incapacitated is based on the following: (1) MP did not attempt to eject from the MA, (2) MP made no additional calls to Washington Center, nor did MP respond to Washington Center's requests for information, (3) MP had sufficient altitude to recover the MA after declaring an emergency to Washington Center, (4) there was no evidence of any aircraft issue that would have prevented MP from maneuvering the MA, (5) MP did not maneuver to recover the MA between the final call to Washington Center and impact, (6) the MA reached supersonic speed during its descent, and (7) at the time of impact, the MA was flying inverted between 60 to 70 degrees nose low. I made this conclusion in light of MP's extensive flying experience, with over 2,100 flying hours in the F-15C, and MP's reputation as a professional pilot that adhered to rules and regulations.

I considered whether inattention, channelized attention, cognitive task oversaturation, and distraction were applicable human factors to the mishap. I find that these human factors did not apply based on the following: (1) weather for the route of the mishap flight was clear skies and unlimited visibility, (2) observed weather at the crash site at the time of the mishap was clear skies and calm winds, (3) MP responded (i.e., initiated a descent, answered Washington Center) to the in-flight emergency (showing attentiveness to the environment), (4) from MP's final call to impact, approximately 1 minute 30 seconds elapsed (giving MP sufficient time to process information or eliminate any interruption of attention), and (5) there was no evidence of catastrophic structural failures on the MA (eliminating the potential for an environmental cue that might result in the focus of all MP's conscious attention or an excessive quantity of information for MP to process). Again, I made this conclusion in light of MP's extensive flying experience and reputation.

With no eyewitness accounts, surviving aircrew members, detailed emergency calls, or flight data recordings, and with minimal information from analysis of recovered MA components, the specific reason MP became incapacitated could not be determined.

4. CONCLUSION

I find by clear and convincing evidence that MP's inability to recover from the descent, due to MP's incapacitation, caused the mishap.

23 APRIL 2015

MICHAEL A. HUDSON
Brigadier General, USAF
President, Accident Investigation Board

INDEX OF TABS

SAFETY INVESTIGATION BOARD TABS

ACCIDENT INVESTIGATION BOARD TABS