UNITED STATES AIR FORCE
AIRCRAFT ACCIDENT INVESTIGATION BOARD REPORT

F-16C, T/N 87-0315

194TH FIGHTER SQUADRON
144TH FIGHTER WING
FRESNO ANGB, CALIFORNIA

LOCATION: NEAR FRESNO, CALIFORNIA

DATE OF ACCIDENT: 27 DECEMBER 2012

BOARD PRESIDENT: COLONEL NATHAN B. ALHOLINNA

CONDUCTED IAW 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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- 5 APR 2013

ACTION OF THE CONVENING AUTHORITY

The Report of the Accident Investigation Board, conducted under the provisions of AFI 51-503, that investigated the 27 December 2012 mishap near Fresno, CA, involving F-16C, T/N 87-0315, assigned to the 144 FW, Fresno ANGB, CA, complies with applicable regulatory and statutory guidance; on that basis it is approved.

WILLIAM J. REW
Lieutenant General, USAF
Vice Commander

EXECUTIVE SUMMARY

AIRCRAFT ACCIDENT INVESTIGATION

F-16C, T/N 87-0315
NEAR FRESNO, CALIFORNIA
27 DECEMBER 2012

On 27 December 2012, at approximately 1533 local time (L), the mishap aircraft (MA), an F-16C Fighting Falcon, tail number (T/N) 87-0315 assigned to the 144th Fighter Wing, Fresno Air National Guard Base (ANGB), California (CA) went out of control during a training mission and impacted the ground 84 nautical miles east of Fresno, CA. The mishap pilot (MP) ejected safely with minor injuries. The MA was destroyed upon impact with total loss valued at $21,405,503.25. The aircraft impacted the ground in a desolate area on government land causing superficial landscape damage. There was no damage to private property and there were no civilian casualties.

The mishap flight (MF) departed Fresno ANGB as a formation of two F-16Cs. The MF mission included air to air training opposing a separate two-ship of F16Cs. The MF then split up to accomplish one-against-one air combat training, or Basic Fighter Maneuvers (BFM). On the third and mishap BFM engagement, the MP maneuvered the MA into a nose high and low airspeed state. The MP's actions to recover from this nose high, low airspeed state were inappropriate and not in accordance with published guidance, resulting in the MA departing controlled flight. The MP incorrectly applied out of control emergency procedure actions and was unable to recover the MA from the out of control situation. The MP safely ejected below recommended ejection altitude.

The board president (BP) found, by clear and convincing evidence, the cause of the mishap was failure of the MP to properly recover the MA from a high pitch, low airspeed state resulting in an inverted deep stall. In addition, the MP failed to properly apply Out-of-Control Recovery Critical Action Procedures, resulting in an inability to recover the MA before ejection was initiated.

Furthermore, the BP found three human factors causal to the mishap: Complacency evident throughout the entire flight, Pressing beyond reasonable limits, and Procedural Error in the last few minutes of flight. Finally, by a preponderance of the evidence, the BP found six other human factors substantially contributed to the mishap: Violation-Lack of Discipline in three separate areas, Seating and Restraints, Illusion-Vestibular, Spatial Disorientation (Type 1) Unrecognized, Channelized Attention, and Error Due to Misperception.

SUMMARY OF FACTS AND STATEMENT OF OPINION
F-16C, T/N 87-0315
27 DECEMBER 2012

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COMMONLY USED ACRONYMS AND ABBREVIATIONS

’	Minutes
°	Degree
%	Percent
1V1	1 versus 1
2V2	2 versus 2
4V2	4 versus 2
AB	Afterburner
ACA	Aerospace Control Alert
ACC	Air Combat Command
ACCEL	Acceleration
ACES II	Advanced Concept Ejection Seat
ACMI	Air Combat Maneuvering Instrumentation
ADC	Air Data Converter
AF	Air Force
AFB	Air Force Base
AFE	Aircrew Flight Equipment
AFI	Air Force Instruction
AFMES	Armed Forces Medical Examiner System
AFPAM	Air Force Pamphlet
AFTO	Air Force Technical Order
AFTTP	Air Force Tactics, Techniques, and Procedures
AGL	Above Ground Level
AGR	Active Guard & Reserve
AHC	Aircraft Handling Characteristics
AIB	Aircraft Investigation Board
AIM	Air Intercept Missile
AMXS	Aircraft Maintenance Squadron
ANG	Air National Guard
ANGB	Air National Guard Base
AOA	Angle of Attack or “alpha”
ARB	Air Reserve Base
ARMS	Aviation Resource Management System
ATAGS	Advanced Tactical Anti-G System
BIT	Built in Test
BFM	Basic Fighter Maneuver
BP	Board President
BPO/PF	Basic Post-flight/Pre-flight
BRI	Briefing Room Interactive
BRAG	Breathing Regulator/Anti-G
BVR	Beyond Visual Range
CA	California
CADC	Central Air Data Computer
CAF	Combat Air Force
CAMS	Core Automated Maintenance System
CAPS	Critical Action Procedures
Capt	Captain
CAT-1	Category I
CDDAR	Crash Damaged or Disabled Aircraft Recovery
CG	Center of Gravity
CMR	Combat Mission Ready
Col	Colonel
CR	Court Reporter
CSFDR	Crash Survivable Flight Data Recorder
CSMU	Crash Survivable Memory Unit
CT	Continuation Training
DC	District of Columbia
DE	Denver
DoD	Department of Defense
DRS	Data Recovery Sequencer
DSCA	Defense Support to Civilian Authorities
DTC	Data Transfer Cartridge
DVR	Digital Video Recorder
EGI	Embedded Global Positioning and Inertial Navigation Set
EOT	Engine Operating Time
ETD	Estimated Time of Departure
F	Fahrenheit
FCC	Fire Control Computer
FCF	Functional Check Flight
FLCC	Flight Control Computer
FLCS	Flight Control System
FLTS	Flight Test Squadron
FLUG	Flight Lead Upgrade
FOD	Foreign Object Damage
FS	Fighter Squadron
FTIT	Fan Turbine Inlet Temperature
ft.	Feet
FW	Fighter Wing
FW/CV	Vice Commander
FW/IP	Instructor Pilot
FW/SE	Chief of Safety
G	Gravitational Force
GCU	Generator Control Unit
G-Ex	G-Awareness Exercise
HABFM	High Aspect Basic Fighter Maneuver
HFACS	Human Factors Analysis and Classification System
HUD	Head-Up Display
I-Flight	Instructor Flight
IAP	International Airport
IAW	In Accordance With
IFA	In-Flight Alignment
IFR	Instrument Flight Rules
IMDS	Integrated Maintenance Data System
INS	Inertial Navigation System
IO	Investigating Officer
IP	Instructor Pilot
IPUG	Instructor Pilot Upgrade
ISA	Integrated Servo Actuator
ISB	Interim Safety Board
JOAP	Joint Oil Analysis Program
K	Thousand

KCAS	Knots Calibrated Airspeed
KFAT	Fresno Yosemite International Airport
KIAS	Knots Indicated Airspeed
KIO	Knock It Off
L	Local Time
LA	Legal Advisor
lb.	Pound
LM-Aero	Lockheed Martin Aeronautics Company
Lt Col	Lieutenant Colonel
MA	Mishap Aircraft
MAAF	Mishap Analysis & Animation Facility
Maj	Major
MAJCOM	Major Command
ME	Mishap Engine
MED	Medical Member
MF	Mishap Flight
MFL	Maintenance Fault List
MFR	Memorandum For Record
MM	Maintenance Member
MOA	Military Operating Area
MP	Mishap Pilot
MPO	Manual Pitch Override
MQT	Mission Qualification Training
MS	Mishap Sortie
MSgt	Master Sergeant
MSL	Mean Sea Level
MW	Mishap Wingman
MX	Maintenance
ND	Nose Down
NGB	National Guard Bureau
NM	Nautical Miles
NORAD	North American Aerospace Defense
NORTHCOM	Northern Command
NOTAM	Notice to Airmen
NU	Nose Up
OG	Operations Group
Ops Tempo	Operations Tempo
ORM	Operational Risk Management
OSC	On-Scene Commander
OSF	Operations Support Flight
PA	Public Affairs
PHA	Physical Health Assessment
PLA	Power Lever Angle
PM	Pilot Member
PR	Pre-Flight
PRD	Pilot-Reported Discrepancy
PSI	Pounds Per Square Inch
PTO	Power Take Off
PTP	Production Test Procedures
RAP	Ready Aircrew Program
REC	Recorder
ROE	Rules of Engagement
RPM	Revolutions Per Minute
SADL	Situation Awareness Data Link
SAR	Search and Rescue
SAU	Signal Acquisition Unit
SDR	Seat Data Recorder
Sec	Second
SIB	Safety Investigation Board
SIM	Simulator
S/N	Serial Number
SOF	Supervisor of Flying
SPINS	Special Instructions
TCTO	Time Compliance Technical Order
TEU	Trailing Edge Up
TI	Tactical Intercepts
T/N	Tail Number
T.O.	Technical Order
TR	Training Rule
TSgt	Technical Sergeant
UHF	Ultra High Frequency
U.S.	United States
USAF	United States Air Force
U.S.C.	United States Code
Va.	Virginia
VHF	Very High Frequency
VID	Visual Identification
VFR	Visual Flight Rules
VVI	Vertical Velocity Indication
WCD	Work Control Document
WVR	Within Visual Range
WX	Weather

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

SUMMARY OF FACTS

1. AUTHORITY AND PURPOSE

a. Authority

On 24 January 2013, Lieutenant General William J. Rew, Vice Commander, Air Combat Command (ACC), appointed Colonel Nathan B. Alholinna to conduct an aircraft accident investigation of the 27 December 2012 mishap of an F-16C Fighting Falcon aircraft, tail number (T/N) 87-0315, near Fresno, California (CA). The F-16C aircraft accident investigation was conducted in accordance with (IAW) Air Force Instruction (AFI) 51-503, *Aerospace Accident Investigations*, at Fresno Air National Guard Base (ANGB), CA, from 29 January 2013 through 22 February 2013. The following Accident Investigation Board (AIB) members were also appointed: [Legal Advisor (LA)], [Pilot Member (PM)], [Maintenance Member (MM)], [Medical Member (MED)], [Recorder (REC)] and [Court Reporter (CR)] (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 27 December 2012, at approximately 1533 local time (L), the mishap aircraft (MA), an F-16C Fighting Falcon, T/N 87-0315, assigned to the 144th Fighter Wing (FW), Fresno ANGB, CA departed controlled flight during a continuation training (CT) tactical intercept (TI) and high aspect basic fighter maneuver (HABFM) mission and impacted the ground near Fresno, CA (Tabs Q-5, U-9, V-1.10, DD-13, HH-31 to HH-32, HH-35, HH-37 to HH-38). The mishap pilot (MP) ejected safely with minor injuries (Tabs Q-5, X-7). The MA was destroyed upon impact with total loss valued at $21,405,503.25 (Tabs P-3 to P-4). The MA impacted in a desolate area on government land causing superficial landscape damage. There was no damage to private property, and there were no civilian casualties (Tab P-1). The 144 FW Public Affairs (PA) office responded to media interest with an initial press release on 27 December 2012, the date of the mishap (Tab FF-3).

3. BACKGROUND

The MA belonged to the 144 FW stationed at Fresno ANGB, CA and was operated by the 194 FS (Tabs U-9, CC-11 to CC-17). The MP was assigned to the 194 FS (Tab G-3).

a. Air Combat Command

Air Combat Command (ACC), with headquarters at Langley Air Force Base, Va., is a major command created June 1, 1992, by combining its predecessors Strategic Air Command and Tactical Air Command. 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. 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. 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. It is one of the seven Reserve components of the United States armed forces that augments the active components in the performance of their missions. ANG has both a federal and state mission. 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-7).

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). 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-7).

c. 144th Fighter Wing

The California ANGB in Fresno is home to the 144 FW. The federal mission of the 144 FW is to provide air superiority in support of the worldwide joint operations as well as air defense of the U.S. Additionally, the 144 FW provides agile combat support as well as intelligence, surveillance and reconnaissance to combatant commanders around the

globe. The 144 FW also provides a variety of homeland defense capabilities to U.S. Northern Command (NORTHCOM) (Tab CC-11).

The 144 FW's state mission provides a variety of Defense Support of Civil Authorities (DSCA) capabilities to the Governor of California. Primary contributions include ready manpower, reconnaissance assets, response to chemical, biological and radiological attacks, security, medical, civil engineering and command and control (Tab CC-11).

The 144 FW is comprised of four groups including the Maintenance Group (Maintenance Squadron, Aircraft Maintenance Squadron, and Maintenance Operations Flight); Operations Group (194th Fighter Squadron and Operations Support Flight); Mission Support Group (Civil Engineer Squadron, Security Forces Squadron, Logistics Readiness Squadron, Communications Flight, Force Support Squadron); and the Medical Group (Tab CC-14).

The 144 FW also maintains an Aerospace Control Alert (ACA) mission both at Fresno-Yosemite International Airport (IAP) and Detachment 1 at March Air Reserve Base (ARB) in Riverside, CA. The ACA mission is to ensure air sovereignty and air defense of the airspace of the U.S. using an operations system designed to quickly detect, identify, and engage air, land, and sea threats to the U.S (Tabs CC-15, CC-17).

In September 2011, North American Aerospace Defense Command (NORAD) stopped using the term "Air Sovereignty Alert" and created a new term "Aerospace Control Alert" (Tab CC-25).

d. 194th Fighter Squadron

The 194 FS's mission is to perform Homeland Defense Air Sovereignty throughout the Southwestern United States and be ready to provide air superiority worldwide (Tabs CC-17, CC-19).

e. F-16 Fighting Falcon

The F-16 Fighting Falcon is a compact, multi-role fighter aircraft. It is highly maneuverable and has proven itself in air-to-air combat and air-to-surface attack. It provides a relatively low-cost, high-performance weapon system for the 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. It can locate targets in all weather conditions and detect low flying aircraft in radar ground clutter. 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. An all-

weather capability allows it to accurately deliver ordnance during non-visual bombing conditions (Tab CC-21).

In designating the F-16, advanced aerospace science and proven reliable systems from other aircraft such as the F-15 and F-111 were selected. These were combined to simplify the airplane and reduce its size, purchase price, maintenance costs and weight. The light weight of the fuselage is achieved without reducing its strength. With a full load of internal fuel, the F-16 can withstand up to nine times the force of gravity (G), which exceeds the capability of other current fighter aircraft (Tab CC-21).

The cockpit and its bubble canopy give the pilot unobstructed forward and upward vision, and greatly improved vision over the side and to the rear. The seat-back angle was expanded from the usual 13 degrees to 30 degrees, increasing pilot comfort and G-tolerance. The pilot has excellent flight control of the F-16 through its "fly-by-wire" system. Electrical wires relay commands, replacing the usual cables and linkage controls. For easy and accurate control of the aircraft during high G-force combat maneuvers, a side stick controller is used instead of the conventional center-mounted stick. Hand pressure on the side stick controller sends electrical signals to actuators of flight control surfaces such as ailerons and rudder (Tab CC-21).

Avionics systems include a highly accurate enhanced global positioning and inertial navigation systems, or EGI, in which computers provide steering information to the pilot. The plane has ultra high frequency (UHF) and very high frequency (VHF) radios plus an instrument landing system. It also has a warning system and modular countermeasure pods to be used against airborne or surface electronic threats. The fuselage has space for additional avionics systems (Tab CC-22).

4. SEQUENCE OF EVENTS

a. Mission

The mishap sortie (MS) was a routine training mission for Dogs 41 flight, comprised of two F-16C aircraft, flown on the afternoon of 27 December 2012 (Tab K-9). The MS was planned, briefed, and flown as a TI Red Air and HABFM CT mission in the R-2508 Military Operating Area (MOA) (Tabs K-5, K-9, V-1.10, V-3.4, HH-31 to HH-32, HH-37 to HH-38). CT missions are training sorties flown to maintain pilot proficiency. The MP, radio call sign Dogs 41, was mission flight lead in the MA, T/N 87-0315 (Tab HH-35). Dogs 42 was the radio call sign for mishap wingman (MW) (Tab HH-35). Planned mission tasks included an afterburner takeoff, G-awareness exercise (G-Ex), three sets of TI with Razor 31 flight, comprised of two F-16C aircraft, and HABFM, concluding with return to Fresno ANGB, CA (Tabs K-5, K-9, V-1.10, V-3.4, V-4.2). The 194 FS Operations Officer authorized the mission on an Aviation Resource Management System (ARMS) fighter authorization form (Tab K-8).

b. Planning

Mission planning was conducted on the day of the MS IAW AFI 11-2F-16, Volume 3, *F-16 Operations Procedures*, and 194 FS CT Standards (Tabs V-1.10, V-3.3, BB-3). The MP

completed a 48-hour alert tour at 0730L and proceeded directly to the 194 FS for the morning flight brief (Tabs V-1.8, X-3). The first flight took off at 1030L and after an uneventful flight landed at 1206L (Tabs K-9, V-1.8 to V1.9, V-2.4). The MP ate lunch and expeditiously debriefed motherhood (administrative) and safety items from the morning mission and transitioned into the afternoon flight brief (Tabs V-1.10, V-2.4 to V-2.5, V-3.5, V-6.4). The MS was briefed approximately two hours prior to takeoff by Razor 31 flight lead with Razor 32, the Operations Group Commander, in attendance (Tabs V-1.10, V-2.4 to V-2.5, V-3.4). The combined flight brief covered motherhood and adversary coordination from Briefing Room Interactive (BRI) slides (Tabs V-1.11, V-2.5, V-3.5, AA-7 to AA-21). Dogs 41 flight then split from Razor 31 flight, and the MP briefed flight Red Air TI presentations and standard HABFM setups (Tabs V-1.10 to V-1.12, V-2.4 to V-2.5, HH-31 to HH-32).

c. Preflight

After donning their aircrew flight equipment, Dogs 41 flight, the mishap flight (MF) proceeded to the operations desk and received a step briefing from the Supervisor of Flying (SOF). MF step brief included an update to weather, notices to Airmen (NOTAMs), and the airfield status (Tabs F-2 to F-4, K-12 to K-24, V-6.5, AA-23). The step briefing was unremarkable and considered standard (Tabs V-1.13, V-6.5, AA-23). MP and MW then proceeded to their assigned aircraft and performed preflight operations IAW Technical Order (T.O.) 1F-16C-1CL-1, *Flight Crew Checklist USAF Series F-16C/D Blocks 25, 30, and 32 Aircraft* and T.O. 1F-16C-34-1-1CL-1, *Flight Manual Checklist, Avionics and Nonnuclear Weapons Delivery Flight Crew Procedures, USAF Series F-16C/D Aircraft Blocks 25, 30, and 32* (Tabs V-1.13, BB-11). The aircraft was configured with two external wing fuel tanks, two missiles on the outboard ends of each wing, three missile launcher rails on each wing, an empty pylon on the centerline fuselage, and a safe gun (Tab K-25). The MF started on time IAW the brief and completed all normal ground procedures without incident (Tabs K-5, V-1.13, V-13.1 to V-13.2).

d. Summary of Accident

The MF taxied on time in accordance with the lineup card (Tabs K-5, HH-37). Prior to takeoff, the MP noticed a degraded navigation system (Tabs V1.14, HH-37). At 1424L, the MF took off from Fresno Yosemite International Airport (IAP) and departed on an R2508A stereo route to the R2508 military operating area (MOA) (Tabs K-11, AA-4 to AA-5). On departure, the MP performed an in-flight alignment (IFA) of the navigation system due to MA position error in excess of 100 miles (Tabs V-1.15, HH-37). At 1435L, the MF entered R2508 on a subsection of R2508 clearance that included the Owens, Saline, and Panamint areas below flight level 290 (29,000 ft.) (Tabs V-1.20, AA-5, HH-37). Neither the MP nor the MW accomplished the planned and required G-Awareness Exercise (Tab HH-37). The G-Ex is a maneuver involving two tactical turns of increasing Gs to check both pilot and aircraft tolerance for follow on high G maneuvers. The tactical portion of the mission involved three TI engagements with Dogs 41 as Red Air followed by two HABFM and one 9000 ft. perch BFM engagement (Tabs HH-31 to HH-32, HH-37 to HH-38). The MF executed all three TI engagements with Razor 31 flight as planned (Tabs V-1.10, HH-37 to HH-38).

The first HABFM engagement on the MS was an airborne audibled nonstandard high-to-low set (Tabs V-1.22, V-1.38, V-1.41, DD-3, HH-37 to HH-38). The engagement started at 1517L with a 7,000 ft. altitude difference between Dogs 41 and Dogs 42 with 4.1 nautical miles (NM) separation and no established training aid (Tab HH-37 to HH-38). This engagement ended at 1519L (Tabs DD-4, DD-9, HH-37 to HH-38).

The second engagement on the MS was also a nonstandard, in-flight directed HABFM set with a 6,000 ft. altitude differential. At 1522L this set started with a 2.3 NM separation and Dogs 41 as the low fighter (Tabs HH-37 to HH-38). During this set, the MP experienced the low speed warning tone during two vertical maneuvers (Tabs DD-5, HH-37 to HH-38). The low speed warning tone sounds to aid the pilot in recognizing that critical high pitch, low airspeed flight conditions have been reached. The first low speed warning tone lasted approximately eight seconds and the second approximately 12 seconds (Tabs DD-5, HH-37 to HH-38). During the engagement, the MP reset an air data converter (ADC) caution light while continuing to maneuver, ending the set approximately 30 seconds later at 1524L (Tabs J-6, HH-37 to HH-38). The ADC light notifies the pilot of a possible flight control malfunction.

The final BFM engagement, which led to the mishap, began at 1531:22L (Tabs DD-7, DD-12, HH-37 to HH-38). This set was a 9,000 ft. perch BFM with Dogs 42 in a 1.5 NM trail at 18,000 ft. mean sea level (MSL) with the MP as the defensive fighter (Tabs DD-6 to DD-7, HH-31 to HH-32, HH-37 to HH-38). The MP executed a right-hand defensive break turn of 7.5 Gs ten degrees nose low, bleeding airspeed to approximately 210 knots indicated airspeed (KIAS) (Tabs HH-37 to HH-38). The MP executed a vertical nose down maximum aft stick maneuver resulting in a high aspect merge with the MW (Tabs V-1.26, HH-31 to HH-32, HH-37 to HH-38). The MP continued maximum aft stick pull into the vertical from 13,840 ft. and 241 KIAS (Tabs J-9, AA-27, HH-37 to HH-38). The MP held maximum aft stick input constant with the aircraft established on the angle-of-attack (AOA) limiter as airspeed decreased and pitch attitude increased (Tab J-9). According to AFMAN 11-217, Volume 3, *Flying Operations Supplemental Flight Information*, paragraph 3.4.8, the AOA is the difference between pitch and flight path angle. The low speed warning tone sounded at approximately 165 knots with the MA nose nearly in the pure vertical position (Tabs J-9, DD-7). The MP then commanded a maximum left roll stick input while continuing the maximum aft stick pull (Tab J-9). The MP maintained aft and left stick maximum inputs until the aircraft was no longer in controlled flight as communicated by the MP calling “ballistic” over the radio (Tabs J-9, DD-7).

The MA sliced into an inverted attitude as forward momentum slowed, and entered a negative AOA departure (Tabs J-9 to J-10, HH-9). A departure is defined as a loss of aircraft control characterized by significant, large amplitude, and uncommanded motions (Tab HH-5). The automatic flight control system (FLCS) features of the F-16 normally prevent departures but may be defeated if maneuvering limits are not observed (Tab HH-5). The F-16 depends on its horizontal tails to limit AOA and typically reaches its controllability limit at approximately ±40 degrees AOA (Tab HH-5). Exceedance of the AOA value is used for departure recognition (Tab HH-5). This type of departure is characterized as a pitch departure, because the inability to control AOA leads to an out-of-control situation. Pitch departures are typically slow speed where the MA is in a nose high pitch attitude. Airspeed is bled off until the ballistic path of the airplane drives AOA to increase quicker than the tail can control due to limited control authority (Tab

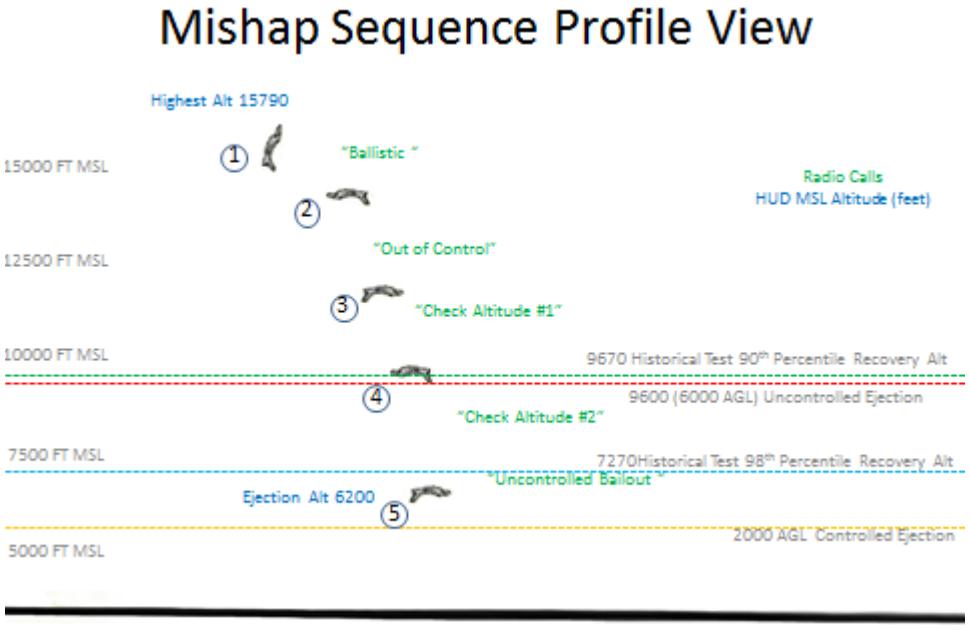
HH-5). If the departed aircraft does not self-recover, a deep stall may develop. The MA did not self-recover and established in an inverted deep stall with an approximate descent rate of 12,000 ft. per minute (Tabs H-6, J-6). The MP attempted to execute an Out-of-Control Recovery using Critical Action Procedures (CAPS) by letting go of the flight controls and moving the throttle to idle IAW the CAPS (Tabs J-10, V-1.26 to V-1.27, HH-10 to HH-11). During inverted deep stalls in analog F-16s, such as the MA, the yaw rate limiter is not active, meaning the pilot must provide anti-spin inputs to the rudder (Tab BB-25). The MP did not use rudder control inputs in an attempt to control yaw (Tabs J-10, V-1.28). The MP proceeded to attempt pitch rocking with the manual pitch override (MPO) switch engaged as required for deep stall recovery IAW the CAPS (Tabs J-10 to J-11, V-1.27, V-1.29, HH-10 to HH-11). The MPO switch allows the pilot to manually override the FLCS limiter allowing maximum deflection of the horizontal tail.

At 1533L, after multiple failed recovery attempts and two check altitude radio calls from the MW, the MP initiated a successful ejection at approximately 6200 ft. (3000 ft. above ground level (AGL)) with no significant injuries (Tabs H-6, X-7, DD-8).

e. Historical Comparison

Analysis from 416th Flight Test Squadron (FLTS) flight testing provided comparison for departures resulting from the maneuvers performed with similar aircraft configurations to the MA (Tabs HH-6 to HH-7). Out-of-Control Recovery characteristics for maneuvers performed with the wing tank loadings resulted in recovery from all departures within two pitch rocking cycles (Tab HH-6). Historically, during test programs, the 90th percentile altitude lost during recovery is 6100 ft., while the 98th percentile altitude lost during recovery is 8500 ft. (Tab HH-7). Post-maneuver analysis determined insufficient rudder pedal force was applied to counter the yaw rates, and that pitch rocking was not performed in phase with pitch cycles, both of which combined to delay the recovery (Tabs J-10 to J-11, HH-10 to HH-13). Figure 4.1 below overlays the historical 90th and 98th percentile recoveries with the mishap sequence and parameters (Tabs HH-39 to HH-40).

Figure 4.1. Mishap Sequence Profile View (Tab HH-40)



f. Impact

The MA impacted the ground at approximately 1533L (Tabs V-2.19, DD-13), 84 NM east of Fresno ANGB, CA and was completely destroyed (Tab H-2). The MA exploded on impact in an inverted attitude (Tabs R-10, V-2.19). No impact analysis was accomplished by the Safety Investigation Board (SIB) (Tab H-1), but the majority of the wreckage was contained within a 25 to 30 yard undeveloped area (Tabs S-4, S-8, V-6.16).

g. Egress and Aircrew Flight Equipment

The MP was wearing all appropriate aircrew flight equipment for a daytime BFM mission (Tab V-1.13). All required Aircrew Flight Equipment (AFE) inspections were current (Tabs EE-23 to EE-28). The MP initiated a successful Mode I ejection within the performance envelope of the ACES II ejection system (Tab H-2). The MP initiated ejection at 2627 ft. AGL or 6200 ft. MSL, below recommended uncontrolled ejection altitude of 6000 ft. AGL, or 9573 ft. MSL (Tabs V-1.12, HH-39 to HH-40). All aircrew flight equipment and escape system components recovered from the mishap site were in serviceable condition and functioned as designed (Tab H-2).

h. Search and Rescue

The MW maintained visual of the MA and the MP throughout the mishap sequence and immediately assumed the role of On-Scene Commander (OSC). The MW contacted the airspace controller, Joshua Approach, at 1534L (one minute after impact) on the radio and relayed the MA was down, the MP was okay, and crash coordinates (Tabs R-10, DD-12 to DD-13). The MW requested the information be relayed to the Fresno ANGB Command Post. Due to fuel limitations, the MW began coordinating for a return to Fresno Yosemite IAP (Tabs DD-12 to DD-13). Winder 41, an F-18 airborne in Owens Valley Airspace, assisted the MW at 1537L

(Tabs R-11, AA-5, DD-14 to DD-17). Winder 41 proceeded to the accident site to relieve the MW as OSC (Tabs R-4, DD-14 to DD-17). The MW initiated return to Fresno Yosemite IAP on a minimum fuel profile at 1539L and directed Winder 41 to the mishap site via radio utilizing ground visual cues with respect to a nearby highway and burning MA wreckage (Tabs R-11, DD-14 to DD-16). At 15:39L the MP contacted the MW on UHF Guard frequency (243.0) via his survival radio stating he was okay and was proceeding to walk towards the highway with an F-18 Hornet overhead (Tabs V-1.35, DD-16 to DD-17).

At approximately 1545L, the Fresno SOF at the Command Post was notified of the MP ejection by telephone from Joshua Approach and began completing the aircraft accident/incident checklist (Tabs V-1.36 to V-1.37, V-6.5, V-6.13, HH-33). At approximately the same time, the California Highway Patrol made contact with the MP (Tabs V-1.36 to V-1.37). The MP was able to contact the SOF via cell phone three to four minutes later to relay status and provide updates (Tab V-1.36). After establishing security for the MA wreckage, the MP was driven by ambulance to Southern Inyo Hospital in Lone Pine, CA, approximately 10 miles north of the crash site (Tabs V-1.36 to V-1.37). There were no significant delays or difficulties during this recovery process. After recovery, the Southern Inyo emergency department physician and later the 194 FS flight surgeon examined the MP who had minor injuries (Tab X-7). The MP returned to Fresno Yosemite IAP via a California Army National Guard helicopter, landing at Fresno Yosemite IAP at approximately 2310L the night of the mishap (Tabs V-1.38, V-6.14). Since an extended search and rescue (SAR) effort was not required, efforts quickly transitioned to incident site management and Interim Safety Board (ISB) actions (Tabs V-6.5, V-6.13 to V-6.15).

5. MAINTENANCE

a. Forms Documentation

The total airframe operating time of the MA at the time of the mishap was 4,944.4 hours. The Mishap Engine (ME) was a Pratt & Whitney F100/220 engine, serial number (S/N) 697390, and was installed in the MA on 11 December 2012. It had 7,299.5 hours total engine operation time (EOT) (Tab D-2).

The Air Force Technical Order (AFTO) 781 series forms are used to document aircraft maintenance, inspections, servicing, and airworthiness of the aircraft. The AIB conducted a detailed review of active and historical AFTO Forms for the MA covering the 60-day period prior to the mishap. The Integrated Maintenance Data System (IMDS) is an electronic system used for maintenance data collection, maintenance management, and trend analysis. Maintenance documentation was satisfactorily accomplished IAW applicable maintenance directives (Tabs D-3 to D-24).

b. Inspections

(1) Mishap Aircraft

AFTO Forms 781Ks are used to track and document all scheduled inspections. A detailed review for the MA revealed no overdue scheduled inspections or open Time Compliance Technical Orders (TCTOs) in the active forms to restrict the MA from flying. Phase Inspections are major inspections conducted on AF aircraft at specific flying hour intervals. The F-16 has a 300-flight hour inspection cycle and the last Phase Inspection was completed in December 2012 at 4937.2 flight hours. Following the Phase Inspection, the MA was released from a Functional Check Flight (FCF) after a .9 hour sortie and landed Code 1 (no significant maintenance problems noted) (Tabs D-7 to D-8).

A Basic Post-flight/Pre-flight (BPO/PR) is a flight preparedness inspection performed by maintenance personnel prior to flight and is a valid inspection for 72 hours once completed. The BPO/PR inspections are performed IAW T.O. 00-20-1, *Aerospace Equipment Maintenance Inspection, Documentation, Policies, and Procedures*. The purpose of the Pre-Flight Inspection is to visually inspect and operationally check various areas and systems of the aircraft in preparation for a flying period. The last PR inspection was completed on 26 December 2012 at 0830 (Tabs D-3 to D-4).

(2) Mishap Engine

All engine work packages were reviewed for accuracy and overdue inspections to include information from IMDS, Joint Oil Analysis Program (JOAP) and Comprehensive Engine Management System to determine serviceability of the ME. No discrepancies were noted (Tabs D-7 to D-20).

c. Maintenance Procedures

Maintenance procedures are described in applicable AFTO, Major Command, ANG and local procedures. Maintenance procedures and practices were not relevant to the mishap (Tabs J-7, J-14).

d. Maintenance Personnel and Supervision

144th Aircraft Maintenance Squadron personnel performed pre-mission maintenance for the MA. Upon a detailed review by the MM, all maintenance activities were normal and all personnel involved with the MA had adequate training, experience, expertise, and supervision to perform their assigned tasks. The individual training records and the special certification roster for all personnel performing maintenance on the MA reflected proper training and full qualifications on all tasks accomplished and were not relevant to the mishap.

e. Fuel, Hydraulic and Oil Inspection Analyses

Pre-mishap JOAP samples from the ME and associated servicing carts were normal and no unusual volatiles were noted in the spectrum (Tab D-24). Oil contamination is not suspected as a contributing factor to the mishap. Fuel samples from the fuel truck and fuel tank used to service the MA were normal and the material tested complied with T.O. 42B-1-1, *Quality Control of Fuels and Lubricants* requirements and was satisfactory for use. Fuel contamination is not suspected as a contributing factor in the mishap. Hydraulic fluid was not analyzed, because the aircraft had not been serviced with hydraulic fluid in the last five sorties (Tab D-24). Post mishap testing samples from the MA and ME for hydraulic fluid, JOAP, and fuel were available. All fluid materials met requirements with respect to the test(s) conducted. Contamination was not a contributing factor to the mishap (Tabs U-3 to U-6).

f. Unscheduled Maintenance

Unscheduled maintenance is any maintenance action taken that is not the result of a scheduled inspection, and normally is the result of a pilot-reported discrepancy (PRD) during flight operations, or a condition discovered by ground personnel during ground operations. The MA flew four sorties following the post phase FCF and all sorties were effective with Code 1 landing statuses. There was no relevant unscheduled maintenance that had any bearing on the mishap (Tab U-7).

6. AIRFRAME

a. Structures and Systems

The MA was destroyed upon impact with the ground. Lockheed Martin Aeronautics Company and the Air Force Life Cycle Management Center completed post mishap data recovery and analysis of several components (Tabs J-3 to J-5, J-12). Analysis of flight data records indicated there was no evidence of any flight control, electrical, or hydraulic malfunctions that would have contributed to the mishap (Tab J-7).

b. Evaluation and Analysis

The Crash Survivable Flight Data Recorder (CSFDR) system was recovered from the MA and consists of two units of non-volatile memory. The first unit, the Crash Survivable Memory Unit (CSMU), contains Type 1 data to include the baseline and approximately the last 15 minutes of data from the mishap flight and was successfully decompressed and illustrated in SIB Tab L (Tabs J-2 to J-15, L-3 to L-110, EE-7). The engine data was typical of normal flight and was not unusual. Unfortunately, this Type 1 data did not include functioning pitch angle, roll angle, and heading angle (Tabs J-3 to J-5). The second unit, the Signal Acquisition Unit (SAU), is non-crash-hardened and was destroyed (Tab J-4). The SAU contains aircraft pitch, roll and yaw rates, which were therefore not available for analysis (Tab J-4).

The Flight Control System (FLCS) seat data recorder (SDR) was recovered and sent to the United States Air Force (USAF) Mishap Analysis and Animation Facility (MAAF) (Tab J-4).

Due to internal damage, normal recovery was not successful and Lockheed Martin Aeronautics Company performed an alternate memory chip download method resulting in the data depicted in Tab L (Tabs J-3 to J-15, L-3 to L-110).

The digital video recorder (DVR) was recovered and found operable (Tab J-11). The Head-Up Display (HUD) video was contained in the DVR and was reviewed to fill in or approximate missing Type 1 data from the CSMU (Tab J-12). The data transfer cartridge (DTC) was recovered with severe damage and downloading of the data was attempted but not successful (Tab J-12). The MA also contained several other recorded data sources. These memory devices were either destroyed or contained redundant information from the above mentioned recorders (Tab J-12).

7. WEATHER

a. Forecast Weather

The forecast weather for Fresno Yosemite International Airport (KFAT) around takeoff time was scattered clouds at 3,000 ft. with no significant precipitation or hazards, visibility six or more statute miles, and northwest winds at seven knots (Tab F-2). The forecast weather for Edwards AFB Range 2508 was scattered clouds at 4,000 ft., 12,000 ft. and 25,000 ft., visibility of seven or more statute miles, and wind at 20,000 ft. was out of the northwest at 86 knots (Tab F-4).

b. Observed Weather

The only available aviation observations at the time of the mishap were taken from Naval Air Weapons Base China Lake, CA approximately 51 NM to the south of the mishap (Tab F-5). The observations revealed clear skies, visibility of 10 statute miles, calm winds, and a temperature of 54 degrees Fahrenheit (F) (Tab F-5). The closest weather station in Lone Pine, CA reported winds out of the north, northwest at six miles per hour with gusts to 10 miles per hour at 1525L (Tabs W-3 to W-5). This observation was the final weather report on the date of the mishap; therefore, no post mishap reports were available (Tabs W-3 to W-5).

c. Space Environment

Not applicable.

d. Operations

Based on the forecast and prevailing conditions, weather was not a contributing factor to the mishap and was within limits for the MS (Tabs F-2 to F-5, W-3 to W-5).

8. CREW QUALIFICATIONS

a. Mishap Pilot

The MP is a current and qualified F-16 Four-Ship Flight Lead and met required flying continuity training (Table 8.1) (Tab G-7). The MF was the MP's second flight of the day (Tab HH-35). The MP had a total of 2284.5 flight hours and 2042.1 flight hours in the F-16 (Tab G-5). The MP was current on all Go/No-Go items (Tabs G-15 to G-23). The MP attended formal High AOA Training at Edwards AFB (Tab G-3).

Table 8.1 Mishap Pilot's Supplemental 30/60/90 Day History

	Flights	Hours
30 days	5	8.7
60 days	13	19
90 days	23	34

(Tab G-7)

9. MEDICAL

a. Qualifications

The AIB Medical Member (MED) reviewed all available MP medical and dental records in their entirety. The MP was medically qualified to perform flying duties without restrictions at the time of the mishap. The MP's annual Preventative Health Assessment (PHA) was current. The associated AF Form 1042 was also current. The MP displayed no physical or medical limitations prior to the mishap (Tab X-3).

b. Health

Medical and dental record review indicated the MP was in good health and had no performance-limiting condition or illness prior to the mishap (Tab X-3). Furthermore, the MP's health was self-described as "good" on the day of the mishap (Tab V-1.7). There was no evidence of any MP medical or dental condition, which might have contributed to the mishap. Review of MP post-mishap history and physical examination revealed minor injuries (Tab X-7).

c. Toxicology

Immediately following the mishap toxicology testing was performed on the MP. Blood and urine samples were submitted to the Armed Forces Medical Examiner System (AFMES), Dover AFB, Delaware, for toxicological analysis. Testing included carbon monoxide and ethanol levels in the blood and drug testing of the urine (Tab X-5).

Carboxyhemoglobin saturation of zero to three percent is expected for non-smokers and three to 10 percent for smokers. Saturations above 10 percent are considered elevated and are confirmed

by gas chromatography. The carboxyhemoglobin saturation in the blood for the MP was three percent as determined by spectrophotometry (Tab X-5).

AFMES examined the blood for the presence of ethanol at a cutoff of 20 milligrams per deciliter. AFMES detected no ethanol in the MP's blood (Tab X-5). Additionally, AFMES screened the MP's urine for amphetamine, barbiturates, benzodiazepines, cannabinoids, cocaine, opiates and phencyclidine by immunoassay or chromatography. None of these substances were detected (Tab X-5).

d. Lifestyle

Based upon witness testimony and review of 72-hour/14-day histories, no lifestyle factors were found to be relevant to the mishap (Tabs V-1.7 to V-1.8, V-1.13, X-3).

e. Crew Rest and Crew Duty Time

Chapter 9 of AFI 11-202, Volume 3, *General Flight Rules,* paragraph 9.8 requires all air crew to have proper "crew rest" prior to performing in-flight duties. Chapter 9, paragraph defines normal crew rest as a minimum of a 12-hour non-duty period before the designated flight duty period begins. During this time, an aircrew member may participate in meals, transportation, or rest as long as he or she has had at least 10 hours of continuous restful activity with the opportunity for at least eight hours of uninterrupted sleep. The MP met crew rest requirements (Tab V-1.8). There is no evidence that fatigue had any bearing on the mishap.

10. OPERATIONS AND SUPERVISION

a. Operations

The 194 FS is tasked with an Aerospace Control Alert (ACA) mission to provide homeland defense from two separate locations, home station at Fresno ANGB and March ARB, Riverside, CA. The 194 FS commits 6-8 aircraft to both ACA sites. In addition to the ACA mission, 194 FS personnel execute normal local CT and upgrade training missions, executing 3447 flying hours in Fiscal Year 2012 and are allocated 3000 flying hours in Fiscal Year 2013 (Tabs CC-15 to CC-19, GG-11).

In 2012, the 194 FS deployed to Klamath Falls, Oregon, for one week; Fallon Naval Air Station, Nevada, for one week; Combat Archer, Tyndall AFB, Florida for two weeks, and a Rim of the Pacific exercise in Hawaii for three weeks. In addition, the 194 FS had three one-week deployments to Burlington, Vermont for advanced simulator training at the Mission Training Center. Scheduled deployments for 2013 include Global Guardian in Savannah, Georgia for two weeks and a return trip to the simulators in Vermont (Tab GG-11).

Of 34 total pilots, 11 have been formally qualified in the F-15C and are temporarily assigned to other F-15C units (Tabs GG-5, GG-9). This transition leaves 23 local F-16C pilots to accomplish ACA and support the local flying mission. The 194 FS is augmented with guest pilots from other units to meet their commitments. In addition, the 114 FW from South Dakota fills one pilot alert

position at March ARB (Tab V-10.5). The 194 FS has 23 current and qualified F-16C pilots; 20 are experienced, three are inexperienced; eight are Instructor Pilots; five are wingmen; all are ACA qualified (Tabs G-3, GG-7).

Operations tempo was normal for the unit, with the above mentioned manning constraints, at the time of the mishap and was not considered to be contributory to the mishap (Tabs V-1.7 to V-1.9, V-7.5, V-9.5 to V-9.6, V-10.4 to V-10.6, V-11.6 to V-11.7, GG-3 to GG-11).

b. Supervision

The mission was authorized by the 194 FS Operations Supervisor on an Aviation Resource Management System (ARMS) Flight Authorization Form (Tab K-8). The flight received a step brief from the SOF and all operational risk management elements were appropriately covered (Tabs K-10, AA-23). The Operations Group Commander attended the afternoon motherhood and adversary coordination briefing and flew as Razor 32 (Tabs K-9, V-4.2). Nothing abnormal was noted from his vantage point (Tabs V-4.2 to V-4.4). Supervision is actively engaged in monitoring cases of pilots flying twice in a day (Tab V-9.5). In addition, supervision is actively engaged in monitoring pilot monthly work schedule to manage workload (Tabs V-11.6 to V-11.7). Supervision was not considered a factor in this mishap.

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 (DoD) Human Factors Analysis and Classification System (HFACS) guide, implemented by AFI 91-204, *USAF Safety Investigations and Reports,* dated 24 September 2008. A human factor is any environmental, technological, physiological, psychological, psychosocial, or psycho-behavioral factor a human being experiences that contributes to or influences his performance during a task. The DoD has created a framework to analyze and classify human factors and human error in mishap investigations.

The framework is divided into four main categories: Acts, Preconditions, Supervision, and Organizational Influences. Each category is subdivided further into related human factor subcategories. The main categories allow for a complete analysis of all levels of human error and how they may interact together to contribute to a mishap. The AIB reviewed a substantial amount of evidence during its proceedings to include, but not limited to, cockpit voice recorder transcripts, flight data recorder information, video recordings, and witness interviews. The human factors relevant to this mishap are defined below as contained in AFI 91-204.

b. Applicable Human Factors

(1) PC208 Complacency

Complacency is a factor when the individual's state of reduced conscious attention due to an attitude of overconfidence, undermotivation or the sense that others "have the situation under

control" leads to an unsafe situation.

There is evidence that a high level of complacency existed for both the MP and the MW throughout the MS planning, briefing and execution. MP testimony stated little mission planning time was available, required, or dedicated to the MS (Tabs V-1.8 to V-1.12, V-1.22, V-1.38). While a combined motherhood and coordination brief occurred, the separate MF brief was lacking in detail and did not cover critical BFM-specific training rules or include any BFM tactical discussion (Tabs V-1.8 to V-1.12). Additionally, there appeared to be little to no discussion with regard to BFM setups, desired learning objectives, designated training aids/limitations, low speed warning tones, and basic operating limitations with regard to configuration (Tabs V-1.9 to V-1.12, V-1.22, V-1.38 to V-1.39, V-1.41). This is evident during the three BFM engagements when the MP was forced to audible directions to the MW multiple times regarding position, altitude, and setups (Tabs DD-3 to DD-7). The MP referenced the simple nature of the mission and the frequency of similar missions as justification for the minimal planning, and while all required items were completed, this highlighted complacency in mission preparation (Tab V-1.9).

The Head-Up Display (HUD) tape revealed multiple examples of complacency. After taxi, the MP elected to take off six minutes early with a known corrupt navigation system (Tabs V-1.14 to V-1.15, V-1.24, HH-37 to HH-38). The MP attempted to correct the bad system without referencing the EGI failure checklist (Tabs V-1.15, HH-37 to HH-38). While performing the second HABFM set, the MP reset the FLCS in response to an ADC malfunction (Tabs J-6, V-1.19 to V-1.20, V-1.25, V-1.43). However, the MP again failed to reference the associated checklist and failed to TERMINATE/KIO IAW AFI 11-2F-16, Volume 3, paragraph 7.1.6 (Tabs BB-6, HH-37 to HH-38). The MW also reset a FLCS light between BFM sets without checklist reference, querying the MP on procedures (Tabs DD-5 to DD-6). The MP testified that he would normally reference the checklist or expect the wingman to reference the checklist in both instances (Tabs V-1.25, HH-37 to HH-38). The MP failed to complete the planned and required G-Ex IAW AFI 11-214, *Air Operations Rules and Procedures*, paragraph 3.2 and AFI 11-2F-16, Volume 3, paragraph 3.11.1 (Tab BB-5). Furthermore, the MW failed to provide in-flight cross monitoring to ensure that this required exercise took place (Tabs DD-3 to DD-18, HH-37 to HH-38).

The MS consisted of three BFM sets. The two HABFM sets started from inconsistent and non-standard parameters (Tabs DD-3 to DD-6, HH-37 to HH-38). There were several variances in starting parameters apparent on the HUD video with regard to the BFM setups (approximately 50 knots in airspeeds, 7,000 ft. in altitude, and 2 NM in separation) (Tabs HH-37 to HH-38). Additionally, the MP attempted three separate over the top maneuvers during the second and third BFM sets with setup airspeeds of 278, 260, and 241 knots (Tabs AA-25 to AA-27, HH-37 to HH-38). During these maneuvers, the MP activated and remained within the low speed warning tone for approximately eight to 12 seconds, demonstrating little urgency to correct the low speed condition IAW AFI 11-2F-16, Volume 3, paragraph 3.9.5 and IAW T.O. 1F-16C-1, *Flight Manual USAF Series F-16C/D Blocks 25, 30, and 32 Aircraft* or ceasing to fight IAW AFI 11-214, paragraphs 3.4.1.1, 3.4.1.2, and 3.4.3.1.3 (Tabs BB-4, BB-14 to BB-15, DD-5, DD-7, HH-37 to HH-38).

A combination of these factors indicated an air of complacency, which resulted in direct violation of multiple guidelines and training rules.

(2) PC207 Pressing

Pressing is a factor when the individual knowingly commits to a course of action that presses them and/or their equipment beyond reasonable limits.

F-16 T.O.s and AFIs define low speed limitations, rules, and pilot actions. AFI 11-214, paragraphs 3.4.1.1, 3.4.1.2, and 3.4.3.1.3 state that KIO/TERMINATE is required when safety of flight is a factor, Desired Learning Objectives (DLOs) are unattainable, or training rules or other limits are met. T.O. 1F-F16-1, section six, states the low airspeed warning tone sounds to aid in recognizing that critical high pitch, low airspeed flight conditions have been reached (Tab BB-28). AFI 11-2F-16, Volume 3, paragraphs 3.9.4 and 3.9.5 state that minimum airspeed is activation of the low speed warning tone; upon activation, the pilot will take action to correct the low speed condition, and will not assault two or more limiters at low airspeed (Tab BB-4). According to T.O. 1F-F16-1, maximum maneuvering in a low speed state, especially maximum roll coupled with maximum aft stick, significantly predisposes the aircraft to departure (Tab BB-28).

All pilot testimony, including the MP, agreed that upon activation of the low speed warning tone, the pilot should take immediate action to alleviate the condition, indicating a clear understanding of the above limitations and rules (Tabs V-1.16 to V-1.17, V-1.22 to V-1.23, V-1.42, V-3.8, V-5.4, V-6.9, V-7.6, V-7.8, V-9.7). All pilot testimony, including the MP, described continuous activation of the low speed warning tone beyond two to three seconds as excessive and would warrant some degree of debrief or counseling (Tabs V-1.17, V-1.22 to V-1.23, V-1.42 to V-1.43, V-2.10, V-2.16, V-3.12, V-4.6 to V-4.7, V-5.7, V-8.12, V-9.9, V-9.13). Additionally, the MP demonstrated a clear understanding of the limitation precluding assault of two or more limiters (Tab V-1.18). In consideration of setup airspeeds for over the top maneuvers in a two-tank configuration, the local culture seemed to agree that it would vary depending on the individual pilot (Tabs V-3.8, V-6.9, V-7.8, V-8.8, V-9.8). Nonetheless, there did appear to be a consensus that 300 to 350 knots was the required minimum airspeed in order to safely accomplish the maneuver in a two-tank configuration (Tabs V-2.7, V-3.8, V-5.4, V-6.9, V-7.8, V-8.8, V-9.8). The MP testified to an established personal minimum setup speed of 250 knots (Tabs V-1.16, V-1.23, V-1.26 to V-1.27). While the MP conceded that he “swore it [airspeed] was 245…” at the setup of the final maneuver, he would have remained below his personally established minimum of 250 knots and well below the culturally accepted minimum of 300-350 knots for a two-tank configuration (Tabs V-1.26 to V-1.27).

The MP attempted three over the top (vertical loop) maneuvers during the second and third BFM sets. During the initial maneuver of the second BFM set, as exhibited in the unclassified HUD tape, the MP completed a 278 knot setup with continuous activation of the low speed warning tone for approximately eight seconds without a TERMINATE/KIO (Tabs AA-25, DD-5, HH-37 to HH-38). During the second maneuver of the second set, the MP completed a 260 knot setup with continuous activation of the low speed warning tone for approximately 12 seconds without a TERMINATE/KIO (Tabs AA-26, DD-5, HH-37 to HH-38). During the final setup that led to

departure, the MP reached a maximum airspeed of 241 knots and continuously activated the low speed warning tone for approximately 10 seconds without a TERMINATE/KIO (Tabs AA-27, DD-7, HH-37 to HH-38). This low speed state coupled with inappropriate/aggressive recovery maneuvers, as discussed below, predisposed the MA to an uncontrolled departure.

These instances of progressively borderline starting airspeeds for over the top maneuvers, excessive time spent within the low speed warning tone with little urgency to terminate or recover, and aggressive maneuvering in a low speed state indicated a tendency of pressing beyond reasonable limits. This tendency ultimately placed the MA in a position where departure was imminent.

(3) AE103 Procedural Error

Procedural Error is a factor when a procedure is accomplished in the wrong sequence or using the wrong technique or when the wrong control or switch is used. This also captures errors in navigation, calculation or operation of automated systems.

Procedural errors occurred during two critical phases of the MS, the low speed warning tone recovery and the Out-of-Control Recovery. T.O. 1F-F16C-1, section six, states to avoid a departure, specific control techniques are required (Tab BB-29). A pilot should first release aft stick pressure to reduce AOA and then smoothly roll inverted to the nearest horizon. After completing the roll, the pilot should smoothly apply aft stick pressure as required to keep the nose tracking towards the horizon (Tab BB-29). All pilot testimony, to include the MP, agreed that upon activating the low speed warning tone, the pilot should take immediate action to alleviate the condition, IAW the techniques described in the T.O. guidance (Tabs V-1.17, V-1.22 to V-1.23, V-1.42, V-3.8, V-6.9, V-7.6, V-7.8, V-9.9). The MP testified that upon hearing the low airspeed warning tone, he proceeded to recover the MA (Tab V-1.42). The CSFDR data showed maximum aft stick continued upon activation of the low speed warning tone while adding maximum left roll (Tab J-9). This unsuccessful recovery technique was not IAW T.O. 1F-F16C-1. The MA subsequently departed controlled flight (Tab BB-29).

Out-of-Control Recoveries are detailed in section three of T.O. 1F-F16C-1 (Tabs BB-24 to BB-27). Successful recoveries require CAPS per AFI 11-2F-16, Volume 3. The AFI directs pilots to immediately accomplish the procedures in the published sequence without reference to the checklist. These include (1) controls release (2) throttle idle (3) rudder opposite yaw direction (4) MPO switch override and hold with (5) forward and aft cycling of the stick in phase with nose oscillation. T.O. guidance further states any deviations or delay could reduce effectiveness of the recovery and therefore delay recovery (Tabs BB-26 to BB-27).

The MP correctly accomplished steps one, two and four as required. The third step was omitted due to contributing factors discussed below. Proper pitch rocking, step five, is accomplished by allowing the nose to lead stick motion and maintaining full stick inputs until the maximum pitch attitudes are reached (Tabs BB-25 to BB-27). Data analysis reflects the MP pitch inputs were not held to maximum values or for sufficient duration (Tabs J-10, HH-11). Additionally, these MP pitch inputs were not performed in phase with pitch cycles (Tabs HH-10 to HH-13). These inputs are clearly illustrated in the Comparison of Recovery Inputs Figure of the 416 FLTS mishap

analysis. The MP control inputs (solid blue lines) are overlaid upon the proper control technique (black dashed lines) (Tabs HH-12 to HH-13). According to the 416 FLTS analysis, "Comparison of the MP technique and proper technique show that aerodynamic recovery was unlikely to occur since the insufficient duration and magnitude of commands did not result in sufficient trailing edge down deflection of the horizontal tail at any point" (Tab HH-13).

(4) AV003 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. These violations are unusual or isolated to specific individuals rather than larger groups. There is no evidence of these violations being condoned by leadership.

As described within the human factors of Complacency, Pressing and Procedural Error, there were several violations of AFIs, Training Rules, and T.O.s within the MS. The AIB found evidence the MP intentionally violated these regulations without cause or need. There is no indication the MP was unaware or unfamiliar with any rules or regulations (Tabs V-1.13 to V-1.17, V-1.21, V-1.40). There is also no evidence to suggest a lack of experience given the MP had more than 2000 flying hours and was a highly experienced four-ship flight lead (Tab G-5).

The MP knowingly and intentionally took off with an inaccurate navigation system with a positional error in excess of 100 NM (Tabs V-1.14 to V-1.15, V-1.24, HH-37 to HH-38). This was in direct violation of AFI 11-2F-16, Volume 3, paragraph 7.1.1: "Do not accept an aircraft for flight with a malfunction which is addressed in the emergency/abnormal procedures section of the flight manual until appropriate corrective actions have been accomplished." Additionally, 144 FW *In-Flight Guide*, page 2-13, lists the Inertial Navigation System (INS) on the Mission Essential Subsystem List (Tab AA-6). This was without cause or need, especially considering that the MP took off six minutes ahead of schedule which would have afforded time to correct the problem (Tabs HH-37 to HH-38).

The MP knowingly and intentionally reset a Flight Control System Malfunction and continued to engage the opposing fighter (Tabs J-6, V-1.19, V-1.25, V-1.43, HH-37 to HH-38). This was in direct violation of AFI 11-2F-16, Volume 3, paragraph 7.1.6: "For actual/perceived flight control malfunctions, pilots will terminate maneuvering and take appropriate action." This was without cause or need given the engagement could have been terminated at any point for any reason without significant consequence.

While attempting over the top maneuvers on three separate occasions, the MP entered the low speed warning tone for a duration of 8-12 seconds without a TERMINATE/KIO and continued aggressive maneuvering in multiple axes of flight (Tabs AA-25 to AA-27, HH-37 to HH-38). This was in direct violation of AFI 11-2F-16, Volume 3, paragraph 3.9.5: "The minimum airspeed for all maneuvering is based upon activation of the low speed warning tone. When the low speed warning tone sounds, the pilot will take action to correct the low speed condition." Intent was demonstrated by the MP during the MS by the number of times entering the low speed warning tone, the excessive duration of continuous activation of the warning tone with little urgency to recover, and progressively borderline setup parameters. According to MP

testimony, these setup parameters are what he intentionally uses on a routine basis (Tabs V-1.16, V-1.23, V-1.26 to V-1.27). It is implausible that a pilot would not encounter or expect to encounter the low speed warning tone in a two-tank configuration using these parameters; particularly, if a pilot employs more aggressive setup parameters for a maneuver immediately following one in which the tone was encountered using less aggressive parameters. These actions indicated the MP's intent to repeatedly place the MA in a low speed state with little urgency to recover or TERMINATE/KIO. This was done without cause or need given the engagement could have been terminated at any point for any reason without significant consequence.

The above violations indicate a lack of discipline by the MP.

(5) PE201 Seating and Restraints

Seating and Restraints is a factor when the design of the seat or restraint system, the ejection system, seat comfort or poor impact-protection qualities of the seat create an unsafe situation.

The MP recalled appropriate and adequate application of the lap belt prior to takeoff. Specifically, he stated that it is his routine to "…keep the seat kit loose, so I can turn and look over my shoulder in the jet but I tighten the lap belt up as tight as I can get it" (Tabs V-1.13, V-1.31). Nonetheless, during the inverted departure the MP recalled falling away from the seat at least "1-2 inches" resulting in axial/inferior transfer of body mass to the canopy (Tab V-1.30). This transfer left the MP with his helmet pinned against the canopy causing forward flexion of his neck, pulled his feet off the rudders, caused difficulty finding and deflecting the MPO switch in a timely manner, and caused difficulty maintaining positive control of the stick (Tabs V-1.26 to V-1.32).

The MP specifically recalls that the abutment of his helmet to the glass of the canopy restricted his field of vision and limited his ability to effectively visualize terrain (Tabs V-1.28 to V-1.29, V-1.33). He recalled being disoriented in this position, but not incapacitated. Even so, the MP stated that he never perceived the yaw rate (Tabs V-1.26, V-1.28, V-1.32). At this point, he was focused solely on the nose of the MA in an effort to track vertical movement of the nose and cycle appropriate pitch rock maneuvers. He did not perceive horizontal movement of terrain (Tabs V-1.26 to V-1.29).

The inadequate restraint also hindered his ability to implement the MPO in a timely manner. The MP stated in his testimony that "…I kind of had to feel for it and I was using my right hand to hold onto the towel rack and kind of trying to push myself into the seat and brace myself a little bit with the right hand" (Tab V-1.26). This assertion is further supported by CSFDR data that showed a 31-second delay from aircraft departure to MPO switch deflection (Tabs J-10, V-1.26 to V-1.28). Given his altitude at departure (15,770 ft. according to HUD tape) and the typical altitude required for recovery according to Lockheed Martin Flight Engineers, any delay in time would have been invaluable for MA recovery prior to ejection altitude (Tab J-10).

Finally, the MP's displaced position within the cockpit affected his ability to make appropriate stick inputs. MP stated difficulty maintaining positive control of the stick since he required use of his stick hand/arm to improve his position within the cockpit using the right body positioning

handle or “towel rack” (Tab V-1.26). Lockheed Martin mishap analysis of the CSFDR data revealed stick inputs of a duration and magnitude inadequate to provide an effective pitch rock maneuver, particularly in the forward/push cycle. Specifically, the data showed that several forward/push cycles did not move beyond neutral. This is clearly illustrated in the Comparison of Recovery Inputs Figure of the 416 FLTS Mishap Analysis where the MP control inputs (solid blue lines) are overlaid upon the proper control technique (black dashed lines) (Tabs HH-12 to HH-13). Since the FLCS automatically applies trailing-edge-up commands (or aft stick pull), it is critical for the pilot to apply full forward (push) stick force to facilitate successful recovery (Tabs J-10, HH-13). A positional displacement towards the canopy and a resultant maximum extension of the MP’s right arm could have precluded his ability to push the stick beyond neutral to an effective magnitude. Therefore, this positional displacement contributed to the procedural anomaly of ineffective pitch rocking, precluding effective recovery.

The aforementioned factors resulting from inadequate restraint, in combination or alone, contributed to a significant delay in effective MA recovery from a negative AOA departure prior to ejection altitude.

(6) PC502 Illusion – Vestibular

Illusion – Vestibular is a factor when stimuli acting on the semicircular ducts or otolith organs of the vestibular apparatus cause the individual to have an erroneous perception of orientation, motion or acceleration leading to degraded performance.

(7) PC508 Spatial Disorientation (Type 1) Unrecognized

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

(8) PC102 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. This may be described as a tight focus of attention that leads to the exclusion of comprehensive situational information.

(9) AE301 Error Due to Misperception

Error due to Misperception is a factor when an individual acts or fails to act based on an illusion, misperception or disorientation state, and this act or failure to act creates an unsafe situation.

The MP stated he did not perceive yaw at any time during the departure (Tabs V-1.26, V-1.28 to V-1.31). Following the onset of the negative AOA (inverted) departure, the MP recalled his field of vision being restricted due to a positional displacement into the canopy where his helmet had

contacted the canopy (Tabs V-1.26, V-1.28 to V-1.29). While the MP denied incapacitation, he did recall some degree of disorientation during the deep stall (Tabs V-1.28 to V-1.31). The MP recalled focusing his attention on the pitot tube on the nose of the MA as he attempted to cycle the pitch rocking maneuver in phase with vertical oscillation (Tabs V-1.28 to V-1.29). He did not recall the terrain or horizon moving in the horizontal plane. The MP never assessed the turn and slip indicator for direction and magnitude of yaw (Tab V-1.29). Secondary to fixed attention on the vertical oscillation on the nose and limited field of vision due to his displaced position within the cockpit, the MP was unable to employ visual indicators of yaw. Particularly in a daylight scenario, visual cues serve as the most reliable indicators for perceptual orientation. Consequently, the MP was forced to rely solely on vestibular cues that erroneously suggested a state of neutral yaw. Data reproduced by the CSFDR revealed a consistent yaw rate between 10 to 30 degrees per second, which was evident on the HUD tape as horizontal terrain movement and rate of change of the heading angle (Tab J-10).

Appropriate CAPS for recovery from an inverted deep stall IAW AFI 11-2F-16, Volume 3, as compared to the MP's actions were previously reviewed in detail. While the MP did eventually deflect the MPO switch and made an attempt at the pitch rock maneuver, CSFDR data revealed no rudder inputs were made to neutralize yaw (Tabs J-10, HH-12 to HH-13). Given the MP did not perceive yaw for the reasons discussed above, he made no attempt to input rudder (Tab V-1.28). T.O. 1F-16C-1 states attempts at pitch rocking before the yaw rotation stops or is minimized reduces the effectiveness of pitch rocking and delays successful aerodynamic recovery (Tab BB-25). According to the Lockheed Martin and Edwards AFB flight engineer departure analysis for similar F-16 configurations, the MA should have recovered within two pitch rocking cycles assuming yaw rate control and proper pitch inputs (Tabs J-10, HH-7). In this instance, several cycles of the pitch rocking maneuver alone proved ineffective in recovering the MA prior to ejection altitude.

The MP's erroneous and unrecognized perception of neutral yaw coupled with channelized attention on the nose to the exclusion of reliable indicators of yaw rate led to the subsequent procedural failure to control yaw with rudder input.

12. GOVERNING DIRECTIVES AND PUBLICATIONS

a. Publicly Available Directives and Publications Relevant to the Mishap

(1) AFI 11-2F-16, Volume 1, *F-16 Pilot Training,* 11 August 2011
(2) AFI 11-2F-16, Volume 3, *F-16 Operations Procedures*, 18 February 2010
(3) AFI 11-202, Volume 3, *General Flight Rules,* 22 October 2010
(4) AFI 11-202, Volume 3, ACC Supplement, *General Flight Rules,* 28 November 2012
(5) AFI 11-214, *Air Operations Rules and Procedures,* 14 August 2012
(6) AFI 11-418, *Operations Supervision,* 15 September 2011
(7) AFI 48-123, *Medical Examinations and Standards,* 24 September 2009
(8) AFI 51-503, *Aerospace Accident Investigations,* dated 26 May 2010
(9) AFI 91-204, *Safety Investigations and Reports,* 24 September 2008, Attachment 5

(10) AFMAN 11-217, Volume 3, *Flying Operations Supplemental Flight*, 23 February 2009
(11) ANGI 10-203, *Air National Guard (ANG) Alert Resource Management*, 22 February 2012

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

b. Other Directives and Publications Relevant to the Mishap

(1) 144 FW *In-Flight Guide*, 16 August 2010, Change 1, dated 30 November 2011
(2) AFI 11-2F-16, Volume 3, 144 FW Supplement, *F-16 Operations Procedures*, Chapter 8, 7 January 2012
(3) AFI 11-418, 144 FW Supplement, *Operations Supervision*, 7 January 2012
(4) AFTTP 3-3.F-16, *Combat Aircraft Fundamentals – F-16*, 29 June 2012
(5) T.O. 00-20-1, *Aerospace Equipment Maintenance, Inspection, Documentation, Policies, and Procedures*, 15 June 2011
(6) T.O. 1F-16C-1, *Flight Manual USAF Series F-16C/D Blocks 25, 30, and 32 Aircraft*, 1 July 2012
(7) T.O. 1F-16C-1CL-1, *Flight Crew Checklist USAF Series F-16C/D Blocks 25, 30, and 32 Aircraft*, 15 August 2009; Change 4 dated 1 July 2012
(8) T.O. 1F-16C-1-2, *USAF Supplemental Flight Manual*, 1 December 2012
(9) T.O. 1F-16C-34-1-1CL-1, *Flight Manual Checklist, Avionics and Nonnuclear Weapons Delivery Flight Crew Procedures, USAF Series F-16C/D Aircraft Blocks 25, 30, and 32*, 1 May 2012
(10) T.O. 42B-1-1, *Quality Control of Fuels and Lubricants*, 13 August 2012

c. Known or Suspected Deviations from Directives or Publications

The MP took off with a known inaccurate navigation system; an error in excess of 100 NM in violation of (1) AFI11-2F-16, Volume 3, paragraph 7.1.1, "Do not accept an aircraft for flight with a malfunction, which is addressed in the emergency/abnormal procedures section of the flight manual until appropriate corrective actions have been accomplished" and (2) 144 FW *In-Flight Guide*, page 2-13, Mission Essential Subsystem List, "Inertial Navigation System."

The MF did not accomplish a G-Awareness Exercise in violation of AFI 11-2F-16, Volume 3, paragraph 3.11.1, "A G-Ex is required if planned maneuvering will exceed 5g."

The MP reset a Flight Control System malfunction during a BFM engagement and continued to engage the opposing fighter in violation of AFI 11-2F-16, Volume 3, paragraph 7.1.6, "For actual/perceived flight control malfunctions, pilots will terminate maneuvering and take appropriate action."

The MP on three separate occasions continued to inappropriately maneuver the MA with a low speed warning tone in violation of AFI 11-2F-16, Volume 3, paragraph 3.9.5, "The minimum

airspeed for all maneuvering is based upon activation of the low speed warning tone. When the low speed warning tone sounds, the pilot will take action to correct the low speed condition."

13. ADDITIONAL AREAS OF CONCERN

Not applicable.

20 March 2013

NATHAN B. ALHOLINNA, Col, ANG
President, Accident Investigation Board

STATEMENT OF OPINION

F-16C, T/N 87-0315
NEAR FRESNO, CALIFORNIA
27 DECEMBER 2012

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 27 December 2012, at 1533 local time, the mishap aircraft (MA), an F-16C Fighting Falcon, T/N 87-0315 assigned to the 194th Fighter Squadron, 144th Fighter Wing, Fresno ANGB, CA departed controlled flight during a continuation training (CT) tactical intercept (TI) and basic fighter maneuver (BFM) mission and impacted the ground near Fresno, CA. The mishap pilot (MP) ejected safely with minor injuries. The MA was destroyed upon impact.

I find by clear and convincing evidence the cause of the mishap was the MP's failure to properly recover the MA from a high pitch, low airspeed state resulting in an inverted deep stall. The MP then failed to properly input Out-of-Control Recovery Critical Action Procedures (CAPS), resulting in an inability to recover the MA before ejection. I also find by clear and convincing evidence three human factors caused the mishap: Complacency, Pressing, and Procedural Error.

I find by a preponderance of the evidence six other human factors substantially contributed to the mishap: Violation-Lack of Discipline, Seating and Restraints, Illusion-Vestibular, Spatial Disorientation (Type 1) Unrecognized, Channelized Attention, and Error Due to Misperception.

I developed my opinion by analyzing factual data from Air Force directives and guidance, technical experts, witness testimony, and flight data.

2. DISCUSSION OF OPINION

a. Cause

There is clear and convincing evidence the MP improperly attempted to recover the MA from a high pitch, low airspeed state in response to a low-speed warning tone. The low-speed warning tone sounds to warn the pilot when critical high pitch, low airspeed flight conditions have been reached. Avoiding a departure from controlled flight under these conditions requires specific control techniques. The pilot must smoothly relax angle of attack (AOA), smoothly roll to the nearest horizon, and smoothly apply aft stick to move the nose towards the horizon. In this mishap, the MP applied full aft stick, full left roll, and flight data shows the rudder fully deflected. These actions defeated Flight Control System limiters, which, combined with high pitch attitude and low airspeed, resulted in the MA departing controlled flight. In addition, AFI 11-2F-16, Volume 3, contains a warning about assaulting two limiters simultaneously. In this

mishap, flight data shows all three limiters, pitch, roll, and yaw were assaulted near simultaneously. It is my opinion that had the MP smoothly relaxed AOA, smoothly rolled to the nearest horizon, and then smoothly continued nose down pressure towards the horizon, the MP would have safely recovered from the low airspeed warning tone. Once the MA departed controlled flight the MP failed to appropriately apply CAPS in an attempt to recover the MA. According to T.O. 1F-16C-1, when in an inverted spin with yaw motion, rudder must be applied opposite yaw to minimize or stop yaw before the aircraft can be pitch rocked out of an inverted spin. Flight data shows no rudder deflection during the course of the inverted spin. In addition, according to T.O. 1F-16C-1, pitch rocking by the pilot must be in phase with aircraft nose pitch movement; that is, the pilot must use full pitch movement following nose movement up and down. Flight data analysis by Edwards AFB flight test engineers determined pitch rocking attempts by the MP were not in phase with pitch movement of the MA and were not held to full deflection, thereby making pitch rocking attempts to recover the MA ineffective.

In my opinion, the MP failed to recover the MA from a high pitch, low airspeed state, which subsequently caused the MA to depart controlled flight. The MP then failed to correctly apply CAPS in response to the out-of-control situation and was forced to eject.

I also find by clear and convincing evidence three human factors directly causal to the mishap:

1) Complacency

The MP demonstrated a high level of complacency throughout the mishap flight. The flight brief was lacking in detail and did not cover items critical to BFM maneuvering. The MP took off with a known inaccurate navigation system and failed to accomplish a required G-Awareness Exercise. He maneuvered into the low speed warning tone on three occasions and demonstrated little urgency to recover the MA. During the second set of BFM, the MP received an aircraft Flight Control System caution and reset the caution without referencing the checklist. In the above instances, the MP continued to fight in lieu of terminating the engagements. A combination of these factors indicated an air of complacency, which resulted in direct violation of multiple guidelines and training rules. Furthermore, it had a direct impact on the ultimate outcome of the MS by allowing such violations to compound.

2) Pressing

The MP on three successive occasions accepted progressively lower airspeeds for over the top maneuvering, significant amounts of time in the low speed warning tone without appropriate attempts to recover, and near maximum and simultaneous control inputs while at low speed states. These actions clearly indicate pressing beyond reasonable limits and ultimately placed the MA in a position where departure was imminent.

3) Procedural Error

The MP incorrectly attempted to recover from the low speed warning tone and then with the MA out-of-control failed to correctly apply CAPS, therefore directly preventing MA recovery.

b. Substantially Contributing Factors

By a preponderance of the evidence six human factors substantially contributed to the mishap:

1) **Violation-Lack of Discipline**

The MP knowingly and intentionally took off with an inaccurate [redacted] violation

[redacted]

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