UNITED STATES AIR FORCE AIRCRAFT ACCIDENT INVESTIGATION BOARD REPORT

F-16CM, T/N 89-2144

4TH FIGHTER SQUADRON
388TH FIGHTER WING
HILL AIR FORCE BASE, UTAH

ACCIDENT LOCATION: BAGRAM AIR FIELD, AFGHANISTAN

DATE OF ACCIDENT: 8 OCTOBER 2010

BOARD PRESIDENT: COLONEL KYLE W. ROBINSON

Conducted IAW Air Force Instruction 51-503

EXECUTIVE SUMMARY

AIRCRAFT ACCIDENT INVESTIGATION

F-16CM, T/N 89-2144
HILL AIR FORCE BASE, UTAH
8 OCTOBER 2010

On 8 October 2010, at 1717 local time, an F-16CM, Tail Number 89-2144, crashed after landing at Bagram Air Field (BAF), Afghanistan. The Mishap Pilot (MP) was unable to stop the Mishap Aircraft (MA) and departed the runway, traveling 1500 feet before coming to rest in a perimeter fence. After stopping, the MP egressed the MA unharmed. The MA is assigned to the 4th Fighter Squadron, 388th Fighter Wing, Hill Air Force Base, Utah.

The MP was leading a flight of two F-16s on a Close Air Support mission supporting Operation ENDURING FREEDOM. After an uneventful mission, the MP flew back to BAF to land. Strong crosswinds were observed that were near the limit for the F-16, creating the possibility that the MP might have to divert to another airfield. Per standards, the MP had to carry and land with additional fuel in case of the need to divert from BAF to an alternate airfield for landing.

When the MP arrived at BAF, the crosswinds were within limits for landing. The MP elected to land with 2200 pounds of fuel over the amount required to divert to an alternate airfield. The MP touched down approximately 2000 feet down the runway. When the MP lowered the nose to the runway and applied the brakes, the left brake did not work, resulting in difficulty slowing the MA down and maintaining a position in the middle of the runway. The MP started running the checklist for brake failure, including lowering the arresting hook. The hook failed to engage the arresting cable strung across the runway. After the MA passed the arresting cable, the MP shut the engine off as the MA departed the runway. The MA continued 1500 feet across a dirt field and the landing gear collapsed as the MA struck an elevated paved road. The MA came to rest in a chain link fence and suffered extensive damage to several bulkheads, air-to-air missiles, and the Sniper targeting pod was destroyed. The total cost of the mishap is $4,868,575.

The Accident Investigation Board (AIB) President found by clear and convincing evidence the causes of this mishap were failure of the left wheel brake and the MP's decision to land with excess fuel beyond the desired touchdown point. These factors combined to yield a situation where the MP had insufficient time to react to the brake failure and complete the brake failure checklist before departing the end of the runway at a high speed.

SUMMARY OF FACTS AND STATEMENT OF OPINION
F-16CM, T/N 89-2144
8 OCTOBER 2010

TABLE OF CONTENTS

COMMONLY USED ACRONYMS AND ABBREVIATIONS

12 AF	12th Air Force
388 FW	388th Fighter Wing
388 MXG	388th Maintenance Group
4 FS	4th Fighter Squadron
AC	Alternating Current
ACC	Air Combat Command
AF	Air Force
AFB	Air Force Base
AFE	Aircrew Flight Equipment
AFI	Air Force Instruction
AFPET	Air Force Petroleum Agency
AFTO	Air Force Technical Order
AGL	Above Ground Level
AHLTA	Armed Forces Health Longitudinal Technology Application
AIB	Accident Investigation Board
AIMWTS	Aeromedical Information and Medical Waiver Tracking System
AOA	Angle of Attack
AOR	Area of Responsibility
ATIS	Automatic Terminal Information Service
ATO	Air Tasking Order
BAF	Bagram Air Field
BINGO	Minimum Fuel Required to Head Home
BIT	Built in Test
BLOS	Beyond Line of Site
BP	Board President
BPO/PR	Basic Post or Pre-Flight Inspection
C	Celsius
CAPS	Critical Action Procedures
CAS	Close Air Support
Col	Colonel
COMMS	Communications
CSFDR	Crash Survivable Flight Data Recorder
DC	Direct Current
DTC	Digital Transfer Cartridge
EEPROM	Electrically Erasable Programmable Read Only Memory
EMS	Emergency Medical Services
EMSC	Engine Monitoring System Company
EP	Emergency Procedures
EPU	Emergency Power Unit
FCIF	Flight Crew Information Files
Ft	feet
FOB(s)	Forward Operating Base(s)
FOD	Foreign Object Damage
FPS	Feet Per Second
GLO	Ground Liaison Officer
HITL	Hardware in the Loop
HPO	Hourly Post Flight Inspection
HUD	Heads up Display
IAW	In Accordance With
ID	Identification
ILS	Instrument Landing System
IMDS	Integrated Maintenance Data System
ISB	Interim Safety Board
JFS	Jet Fuel Starter
JTAC	Joint Tactical Air Controller
JTAR	Joint Tasking Air Requests
KCAS	Knots Calibrated Airspeed
L	Local
LA	Legal Advisor
LAO	Local Area Orientation
LANTIRN	Low Altitude Navigation and Targeting Infrared for Night
lbs	Pounds
MA	Mishap Aircraft
MAAS	Mobile Aircraft Arresting System
ME	Mishap Engine
MM	Medical Member
MP	Mishap Pilot
MQT	Mission Qualification Training
MS	Mishap Sortie
MSL	Mean Sea Level
MW	Mishap Wingman
MXM	Maintenance Member
NAI	Named Areas of Interest
nm	Nautical Miles
NOTAMS	Notices to Airmen
NSTR	Nothing Significant to Report

OEF	Operation ENDURING FREEDOM	sec	Seconds
OG	Operations Group	SOF	Supervisor of Flying
Ops	Operations	SOPs	Standard Operating Procedures
PHA	Preventative Health Assessment	SPINS	Special Instructions
PM	Pilot Member	SPO	System Program Office
PRD	Pilot Reported Discrepancy	T.C.T.O.	Time Compliance Technical Order
PRF	Personnel Read File	T/N	Tail Number
RAPCON	Radar Approach Control	T.O.	Technical Order
REC	Recorder	U.S.	United States
Regs	Regulations	USAF	United States Air Force
RTB	Return to Base	VFR	Visual Flight Rules
SA	Situational Awareness	VMC	Visual Meteorological Conditions
SAR	Search and Rescue	WOW	Weight on Wheels
SM	Statute Miles	Z	Zulu

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 29 October 2010, Lieutenant General William J. Rew, Vice Commander, Air Combat Command (ACC), appointed Colonel Kyle W. Robinson to convene an aircraft accident investigation under Air Force Instruction (AFI) 51-503, *Aerospace Accident Investigations*. The Accident Investigation Board (AIB) investigated the 8 October 2010 mishap of an F-16CM aircraft, tail number (T/N) 89-2144, at Bagram Air Field (BAF), Afghanistan. The investigation was conducted at Hill Air Force Base (HAFB), Utah (UT), and BAF, Afghanistan from 6 December 2010 to 6 January 2011. Technical advisors were the Maintenance Member (MXM), Legal Advisor (LA), Pilot Member (PM), Medical Member (MM), and Recorder (REC). (Tabs Y-3 thru Y-6)

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

At 1717 hours local time (L), 8 October 2010, the Mishap Aircraft (MA), an F-16CM, T/N 89-2144, was damaged after landing at BAF, Afghanistan. (Tabs S-3, S-6, V-1.19) The MA and Mishap Pilot (MP) were assigned to the 4th Fighter Squadron (4 FS), 388th Fighter Wing (388 FW) at HAFB. The MP had completed a combat sortie and upon touching down at BAF, the MA's left brake failed, and the MA missed catching the arresting cable with the hook. The MA drifted to the right and departed the end of the runway. The MA then traveled 1500 feet through a dirt field and came to a stop halfway through a perimeter fence. (Tabs S-3, V-1.20) The MP did not eject from the aircraft and did not sustain any injuries. (Tabs V-1.20, V-1.25) The MA was damaged resulting in a mishap cost of $4,868,575, with no damage to private property. (Tab P-7)

3. BACKGROUND

a. Air Combat Command (ACC)

ACC is the primary force provider of combat airpower to America's warfighting commands. To support the 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.

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 U.S. Central, Southern and Northern Commands, with Headquarters ACC serving as the air component to Joint Forces Command. ACC also augments forces to U.S. European, Pacific and Strategic Command.

More than 67,000 active-duty members and 13,500 civilians make up ACC's work force. When mobilized, more than 50,000 members of the Air National Guard and Air Force Reserve, along with approximately 675 aircraft, are assigned to ACC. In total, ACC and ACC-gained units fly more than 1,800 aircraft. (Tabs CC-2 thru CC-4)

b. 12th Air Force (12 AF)

12 AF is located at Davis-Monthan Air Force Base, Tucson, Arizona. 12 AF is one of three numbered air forces assigned to ACC.

The 12 AF mission is to provide combat ready forces to ACC, train and equip 10 active duty wings and one direct reporting unit. Additionally, 12 AF is responsible for the operational readiness of 12 AF-gained units of the Air Force Reserve and Air National Guard in the western and midwestern United States.

12 AF serves as a primary conventional fighter and bomber Warfighting Headquarters trained and ready for worldwide employment of airpower. It is responsible for the combat readiness of 10 active-duty wings and one direct reporting unit. These subordinate commands operate more than 520 combat aircraft with more than 42,000 uniformed and civilian Airmen. The command is also responsible for the operational readiness of 13 12 AF-gained wings and other units of the Air Force Reserve and Air National Guard. These units include more than 220 aircraft and 18,900 Total Force Airmen. (Tabs CC-5 thru CC-6)

c. 388th Fighter Wing (388 FW)

Air Combat Command's 388 FW is a tenant unit at Hill AFB. The wing is home to an operations and maintenance group responsible for the readiness of the Air Force's largest combat-capable fleet of F-16 Fighting Falcons. Eight squadrons and approximately 2,200 Airmen make up the two groups. The 388th Range Squadron, which oversees the Utah Test and Training Range operations, also belongs to the wing.

In 2007, the active duty 388 FW began sharing aircraft with Hill's Reserve 419th Fighter Wing under the Air Force's Total Force Integration initiative. Operations and maintenance personnel from both wings now work side-by-side on a daily basis to fix and fly the fleet of F-

16s. (Tabs CC-7 thru CC-9)

d. 388th Operations Group (388 OG)

The 388 OG was established as the 388 Bombardment Group on 19 December 1942 and trained in the United States for bombardment operations. During World War II, the group moved to England and conducted strategic bombardment attacks in the European Theatre of Operations (ETO) against a wide range of targets. The group also participated in support and interdictory missions, to include the D-Day operation in Normandy. After giving airborne assistance in the final drive through Germany, the group flew humanitarian missions to Holland and air dropped food for victims in flood-stricken areas.

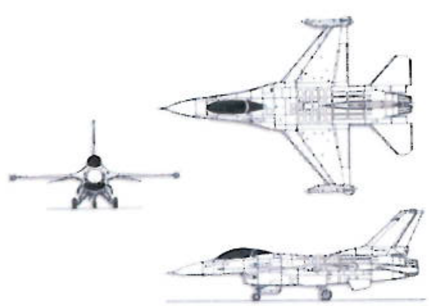
In 1953 the group trained for fighter operations and moved to France to support North Atlantic Treaty Organization (NATO) operations and exercises until 1957. In 1991 the group assumed control of the 388 FW's operational squadrons, and was re-designated as the 388th Operations Group. The 4th and 421st Fighter Squadrons and the 388th Operational Support Squadron are all units within the 388 OG. (Tabs CC-10 thru CC-11)

e. 4th Fighter Squadron (4 FS)

The 4 FS is one of two fighter squadrons assigned to the 388 FW at HAFB, UT. The unit operates and maintains Low Altitude Navigation and Targeting Infrared for Night, or LANTIRN, F-16s.

As part of the world's largest LANTIRN F-16 wing, the 4 FS conducts flying operations and equipment maintenance to maintain combat readiness of an 18-aircraft F-16C LANTIRN squadron. It prepares to deploy worldwide to conduct air-to-air and air-to-ground operations for daylight and nighttime missions. (Tabs CC-12 thru CC-13)

f. The 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. Since Sept 11, 2001, the F-16 has been a major component of the combat forces flying thousands of sorties in support of Operations NOBLE EAGLE (Homeland Defense), ENDURING FREEDOM in Afghanistan, and IRAQI FREEDOM. (Tabs CC-14 thru CC-16)

4. SEQUENCE OF EVENTS

a. Mission

The mishap sortie (MS) was tasked by the Combined Forces Air Component Commander in the daily Air Tasking Order (ATO) for Operation ENDURING FREEDOM (OEF) on 8 October 2010. The MS was planned, briefed, and flown as a Close Air Support (CAS) sortie in which two F-16CM aircraft fulfilled air support requests from ground forces. The two aircraft in the MS were piloted by the MP and Mishap Wingman (MW), with the MP as the flight lead. (Tabs K-4, V-1.17)

b. Planning

The MP arrived, as scheduled, to the squadron at approximately 0815L on the day of the incident. (Tab V-1.6) The MP began the duty day by checking the flying schedule for any changes and looking over mission materials. Mission materials consist of the location of the mission, supported ground forces, and any other relevant information for the sortie. (Tab V-1.7) At approximately 0915L the formal briefing started which consisted of Notices to Airmen (NOTAMs), current and forecasted weather and winds, status of the airfield, flight crew information files (FCIFs), and any applicable local procedures. NOTAMS are daily changes to airfield operations. FCIFs are time-sensitive updates to local operating procedures. The formal briefing was conducted by a qualified squadron supervisor referred to as "Top 3." (Tab V-1.8)

Following the formal brief the MP briefed the MW on the tactical procedures that would govern the way the flight executes the mission and the expected flow of the sortie. The planned flow of the sortie included a combat departure, a medium altitude cruise to locations for non-traditional intelligence, surveillance, and reconnaissance taskings, several trips to air refueling tracks described in the special instructions (SPINS), and finally a combat recovery to a day landing at approximately 1715L. (Tab V-1.3) Mission planning was accomplished according to standard procedures.

c. Preflight

At approximately 1015L the MP gathered the required life support equipment. The MP and MW then proceeded to the Top 3's desk to receive the step brief. The step brief is given by the Top 3 to ensure crews are qualified and prepared for the mission. The step brief consisted of current runway conditions, weather updates, local NOTAM changes, and any operations or supervisory concerns. The day of the mishap the step brief focused on the high crosswinds expected at the anticipated landing time. The F-16 crosswind limit is 25 knots on a dry runway. The Top 3 reminded the aircrew to have a backup plan if the winds were out of limits. (Tabs V-1.8, V-4.6)

The MP arrived at the assigned aircraft at approximately 1035L. The MP checked the maintenance forms and conducted the exterior inspection. (Tab V-1.9) The exterior inspection is a visual inspection of the exterior components of the aircraft to check the general condition of the airframe, landing gear, engine, brakes, and flight controls. Once the exterior inspection was completed the MP climbed into the cockpit and completed the interior inspection. The interior inspection includes checking all the switches in the cockpit prior to starting the F-16. The first assigned aircraft could not fly due to radio failure and the MP was then assigned to the MA. After accomplishing the form review and exterior inspection the MP had an uneventful engine start, but experienced a similar radio failure on the MA. After shutting down the MA two times for radio failure and working the problem with maintenance, the MP resolved the issue. The MP taxied without further delay to takeoff on time at 1215L. (Tabs V-1.9 thru V-1.10) After shutting down the MA to work the radio problem the MP did note he began to feel somewhat rushed. (Tab V-1.10)

d. Summary of Accident

The MP took off at 1215L, followed shortly by the MW and proceeded to the assigned area of responsibility via their flight plan. The departure to the airspace, tactical portions of the sortie, and the air refuelings throughout the sortie were uneventful. During the tactical portion of the sortie the Top 3 contacted the MP and relayed that crosswinds were currently out of limits for landing at BAF. (Tabs V-4.2 thru V-4.3)

The MP began the Return to Base (RTB) at approximately 1649L. (Tab V-1.29) During the RTB the MW contacted the Top 3 and listened to the Automated Terminal Information Service (ATIS) for a weather update. The information reported that the crosswinds were gusting to the limit for landing at BAF. The MW relayed this information to the MP. (Tabs V-1.11 and V-2.6 thru V-2.7) The Top 3 advised the MP and MW to carry sufficient fuel in order to divert safely from BAF to their primary alternate airfield in the event crosswinds were beyond limits for landing. (Tabs V-4.3 thru V-4.4) On this MS, the divert fuel required was 4100 lbs (commonly referred to as "4.1"). (Tabs V-1.29, V-4.4) The Top 3 also told the MP and MW to get real-time wind information from the Air Traffic Control tower to ensure that winds were within landing limits. (Tab V-4.3)

The MP and MW executed an uneventful visual approach into BAF. (Tabs V-1.12 thru V-1.13) When the MP put the landing gear down and called the tower to land, the MP recalled the fuel onboard was about 5500 lbs, 1400 lbs higher than the required divert fuel. (Tabs V-1.12, V-1.22) The data downloaded from the Crash Survivable Flight Data Recorder (CSFDR) indicated the MP started the approach with approximately 6300 lbs of fuel, which was 2200 lbs higher than divert fuel. (Tabs L-3 thru L-8, V-3.34 thru V-3.39) The post-mishap photo of the MA's fuel gauge indicates that the MA had 6300 lbs of fuel when it stopped. (Tab S-13) According to squadron standards, the recommended maximum landing fuel weight with prescribed divert fuel is 4100 lbs. (Tabs V-4.4 thru V-4.5, BB-9) Landing with additional fuel weight over the recommended amount will increase the landing roll and stopping distance of the F-16. (Tabs V-4.4 thru V-4.7)

The tower cleared the MP to land and updated the current winds as within limits for landing. (Tab N-6) The MP flew a normal approach into BAF. (Tab V-1.16) The normal aim point for a visual approach is the beginning of the runway. (Tab BB-3) The recommended touchdown zone is 150 – 1000 feet from the start of the runway with a desired touchdown point at 500 feet. (Tabs

BB-3, BB-9) The MP touched down at 1716L at the appropriate speed (160 knots), but approximately 2000 feet down the runway slightly to the right of the centerline. (Tabs L-3 thru L-8, V-1.29, V-3.34 thru V-3.39) The BAF runway is 11819 feet long. (Tab BB-52)

Due to the crosswinds the MP appropriately touched down in a crab and applied left rudder and left aileron into the wind to maintain the runway centerline. (Tabs V-1.13, V-1.16) Touching down in a crab means the aircraft's nose was offset into the wind in order to maintain a straight ground track. (Tab V-4.3) Applying aileron prevents the wing from rising due to crosswinds during landing rollout. Rudder inputs steer the aircraft at higher speeds prior to engaging nose wheel steering. The MP appropriately lowered the nose at 110 knots with approximately 5000 feet of runway remaining. (Tabs L-3 thru L-8, V-1.14, V-3.34 thru V-3.39)

After touching the nose down, the MP properly applied the brakes. The MP recalled that upon initially applying wheel brakes, they functioned normally. However, shortly thereafter the MP felt the brakes abnormally cycling and the MA pulling to the right. (Tab V-1.14) The brake failure occurred with approximately 3900 feet of runway remaining. In accordance with the brake failure checklist, the MP released the brakes and switched from Channel 1 to Channel 2. (Tabs V-1.22, BB-14 thru BB-15)

The MA's brake system has a redundant electrical and hydraulic design, allowing the pilot to switch to a different control channel should one fail. (Tab V-3.3) After switching to Channel 2, the MP first noticed the anti-skid caution light, indicating a failure possibly affecting braking performance. (Tab V-1.29, V-5.2) The MP immediately applied brakes and felt no braking action at all. The MP maintained full left rudder in an attempt to remain on the centerline. (Tab V-1.22) Data from the anti-skid control box indicated the right brake was responding normally throughout the landing. The data indicated the left brake malfunctioned and did not respond to the MP's inputs. (Tabs J-25 thru J-30, U-7, V-3.22, V-3.26) F-16 aircraft are capable of differential braking, which allows the pilot to control the left and right brakes independently. This capability allows the pilot to steer the aircraft simply through brake application. For example, if the pilot only applied the right brake, the plane would steer to the right. (Tabs V-3.35 thru V-3.36) Based on the MA's left brake failure, every time the MP applied the brakes, only the right brake functioned, causing the MA to veer to the right. (Tabs V-3.32 thru V-3.34) (See Figure 1)

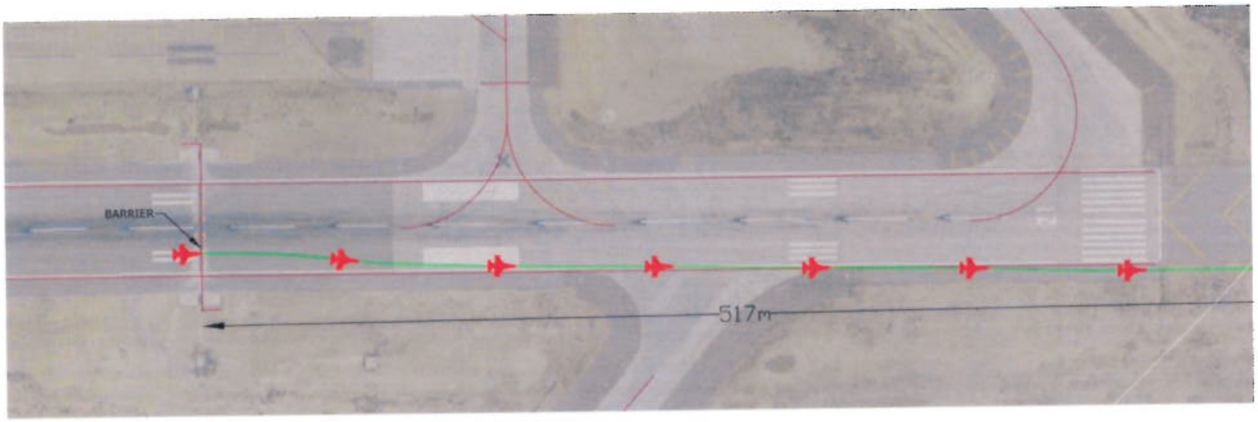


Figure 1. Diagram of MA Runway Landing Path

Based on the MP's assessment of brake failure in Channel 2, the next step in the brake failure checklist is to lower the hook in an attempt to engage the arresting cable. The arresting cable, also known as a barrier, is a tensioned wire running perpendicular across the runway designed to catch a hook that drops down from fighter aircraft. (Tab V-1.15) At BAF, the cable is located 1500 feet from the end of the runway. (Tab BB-52) Based on measurements taken shortly after the mishap, the arresting cable was approximately 2.13 inches above the runway surface. The cable was .25 inches below the recommended height, but above the minimum height requirement of 1.5-1.75 inches. (Tabs J-5, BB-53 thru 56) Regulations state that pilots shall drop the hook at least 1500 feet prior to the departure end cable to ensure a successful engagement. (Tabs V-1.24, BB-16) The MP recalled dropping the hook at approximately 1000 feet prior to the cable. (Tabs V-1.15, V-1.28)

Based on CSFDR data, the MP only had five seconds to recognize and react to brake failure in order to lower the hook prior to 1500 feet. (Tabs L-3 thru L-8) In these five seconds, the MP would have to release all brakes, switch to Channel 2, reapply the brakes, recognize continued brake failure, and then lower the hook. It took the MP eight seconds to complete all of these actions. Therefore, the MP was unable to lower the hook within the 1500-foot parameter. (Tabs BB-14 thru BB-16) The MA passed over the cable but did not engage it. (See Figure 2) Figure 2 below is based on witness testimony, CSFDR data, and data from ground markings.

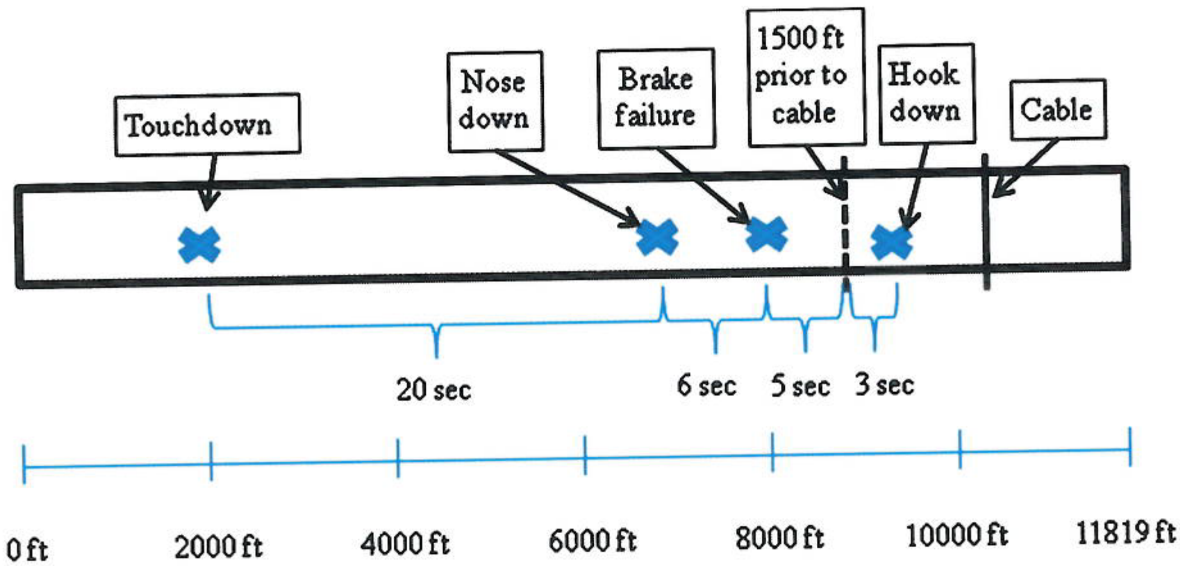


Figure 2. BAF Runway Diagram with Approximate Action Points

After missing the cable, the MP reapplied brake pressure, pulling the MA further to the right due to the continued left brake failure. (See Figure 1) The MP then made a radio call to the Air Traffic Control tower that the MA was going off the end of the runway. (Tab V-1.19) The CSFDR data indicates the MA was traveling 67 knots as it departed the runway. (Tabs L-3 thru L-8) The MP shut the engine off prior to departing the edge of the runway. (Tab V-1.19)

The MP continued using the rudder to steer the aircraft as it traveled approximately 1500 feet across the dirt, narrowly missing the Instrument Landing System antennas. (Tab V-1.20) The MP braced for impact as the MA passed through a chain link fence. The MA then impacted a raised perimeter road, which collapsed the landing gear. The MA then became airborne for a short distance and came to rest partially entangled in a second chain link fence. The MP performed an emergency ground egress at approximately 1720L. (Tabs V-1.20 thru V-1.21)

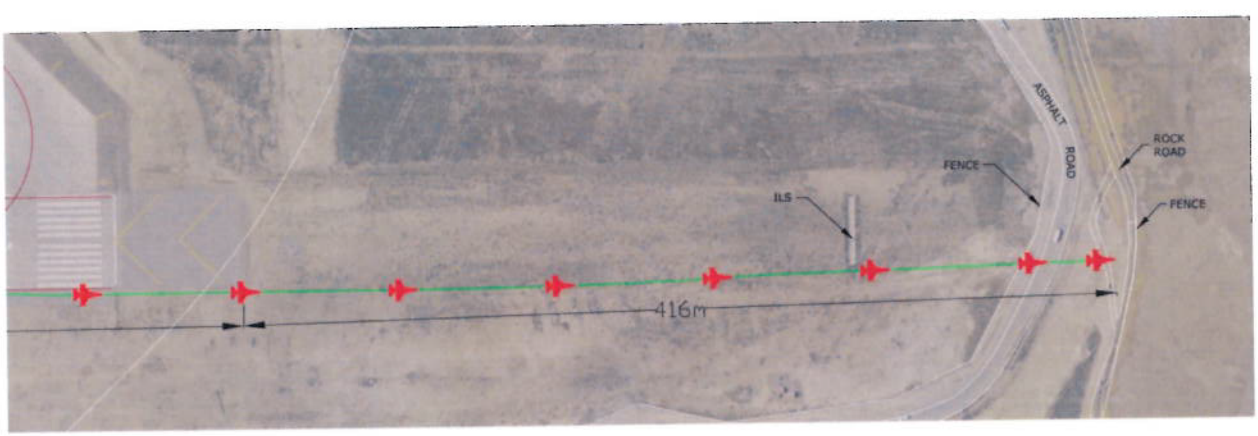


Figure 3. Diagram of Post-Runway MA Path

e. Impact

The MA came to rest approximately 1500 feet from the end of the runway. The MA crossed BAF's perimeter road and stopped entangled in the second fence at 1718L. (See Figures 3 and 4)

Figure 4. MA Final Resting Position

f. Egress and Aircrew Flight Equipment

All required life support and survival equipment inspections were current. The MP was wearing the appropriate life support equipment for the mission. All equipment was inspected post-flight and was current and in good condition. (Tabs R-19 thru R-20)

g. Search and Rescue (SAR)

At 1717L the MP made a radio call to the Air Traffic Control tower that the MA was going off the runway. Shortly thereafter the Tower asked if the MP would require any assistance to which the MP responded "Affirm". (Tabs N-6, V-1.20) After the MA came to a stop, passers-by were the first people on the scene. The passers-by directed traffic until emergency vehicles, command and control, and security forces responded minutes later. (Tabs N-7 thru N-8, R-13 thru R-16) Traditional search and rescue assets were not utilized during the mishap. The MP exited the aircraft and was evaluated at a BAF medical clinic with no injuries. (Tab V-1.21)

h. Recovery of Remains

Not applicable.

5. MAINTENANCE

a. Forms Documentation

The 388th Maintenance Group (388 MXG), HAFB, maintained the aircraft forms for the MA. All maintenance was documented on Air Force Technical Order (AFTO) 781 forms and in IMDS (Integrated Maintenance Data System). The purpose of AFTO 781 forms is to document various maintenance actions, and the forms are maintained in a binder specifically assigned to each aircraft. IMDS is an automated database of aircraft discrepancies, maintenance repair actions, and flying history. A comprehensive review of all AFTO 781 series forms and IMDS was accomplished to determine the airworthiness of the MA. (Tabs D-5 thru D-32) Historical records and IMDS maintenance documentation were properly documented and complete. There is no evidence that compliance with any reviewed historical maintenance records was a factor in this mishap, despite common minor discrepancies in documentation. A detailed 90-day review of records and forms was conducted. (Tabs U-2 thru U-3)

Time Compliance Technical Orders (TCTOs) are inspections or maintenance procedures required to be completed by specific dates or flight hours. The AFTO 781-series forms and IMDS track and record compliance times and dates. No TCTOs restricted the MA from flying. Historical records showed all TCTOs were accomplished IAW applicable guidance. (Tab D-29)

Prior to the mishap sortie, the MA accumulated 7063.7 flight hours. (Tab D-3) The mishap engine (ME), F110-GE-100-C, serial number GE0E509974, was installed on the MA on 1 November 2008. The engine had 2035.1 hours. (Tab D-3)

The MA flew 12 sorties, for a total of 48.6 hours, within the 90 days prior to the mishap. Historical records did not reveal any recurring maintenance problems. (Tabs U-2 thru U-3)

b. Inspections

(1) **Mishap Aircraft**

The hourly post-flight inspection (HPO) is an in-depth flying-hour based inspection to ensure the airworthiness of the aircraft, and is considered major maintenance. The HPO inspections are conducted IAW Technical Order (TO) 1F-16CG-6-11, *Scheduled Inspection and Maintenance*. The F-16CM is on a 400-hour HPO schedule. The MA underwent a 400-hour HPO in May 2009, at 6692.7 flight hours. (Tab D-3) No discrepancies were noted.

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 TO 00-20-1, *Aerospace Equipment Maintenance Inspection, Documentation, Policies and Procedures*. The purpose of this inspection is to visually inspect and operationally check various areas and systems of the aircraft in preparation for a flying period. The last BPO/PR inspection was completed on 7 October 2010. The BPO/PR was current. (Tab D-21)

(2) **Mishap Engine**

The 400-hour engine phase inspection was completed at 1694.3 hours, on 4 May 2009. All scheduled engine inspections were current. (Tab D-3)

c. Maintenance Procedures

The most recent major maintenance was performed by the 388 MXG and the Ogden Air

Logistics Center, HAFB, within 30 days preceding the mishap. The MA underwent an extensive rebuild in September 2010 as a result of extended downtime for the Beyond Line of Site (BLOS) radio modification and the 341 bulkhead, a major structural component of the MA. (Tab U-3)

d. Maintenance Personnel and Supervision

Pre-mission maintenance for the MA was performed by Aircraft Maintenance Unit personnel. All maintenance activities were normal and all personnel involved in the preflight, servicing, inspecting, and launch of the MA were qualified and proficient in their duties. Maintenance training records (AF Forms 623 and AF Forms 797) were reviewed and revealed no training deficiencies. (Tab U-3)

e. Fuel, Hydraulic and Oil Inspection Analysis

Fuel, oil lubricants, and hydraulic samples from the fuel truck, service carts, and MA aircraft were sent to Air Force Petroleum Agency (AFPET) at Wright Patterson AFB, Ohio. AFPET found that fuel, oil lubricants, and hydraulic fluid samples met material test requirements. (Tab J-3) However, particulates were found in the MA hydraulic fluid analysis. (Tab J-3) These particulates are most likely a result of individual system compromise when the landing gear was damaged and the internal and external fuel tanks ruptured at impact. Additionally, the inspection records were reviewed for the servicing carts used on the MA and all equipment inspections were current. (Tabs D-45 thru D-47)

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. Unscheduled maintenance was performed on the MA on 7 October 2010 as a result of PRDs on the previous sortie. Maintenance was performed on the ARC-210 BLOS radio system, resulting in removal and replacement of the receiver/transmitter. Maintenance was also performed on the manual depressurization system, resulting in the removal and replacement of the manual depressurization valve. Maintenance was also performed on the landing gear system due to a "landing gear failed to retract" discrepancy, resulting in the removal and replacement of the landing gear control panel. All follow-on actions and operational checks were completed and properly documented for each unscheduled maintenance action. (Tabs D-8 thru D-22)

6. AIRFRAME, MISSILE, OR SPACE VEHICLE SYSTEMS

a. Structure and Systems

Analysis by the F-16 System Program Office (SPO) Engineering department at HAFB concluded there was an electrical malfunction in the main wiring harness between the anti-skid control box and the left brake metering valve. (Tab V-3.26) Various systems and components were recovered, including the CSFDR, the anti-skid control box, the anti-skid and brake control wiring harness, the brake control manifold, the wheel speed sensors, and the left and right brakes. Additionally, the Engine Monitoring System Computer (EMSC) data was downloaded. (Tabs L-10 thru L-14) All components were inspected and analyzed independently and together via Hardware-in-the-Loop (HITL) testing procedures by the SPO engineers at HAFB. All individual components were operating normally throughout the mishap with the exception of the left brake electrical circuit. (Tab J-12, Tabs U-4 thru U-8)

b. Evaluations and Analysis

(1) **MA Fuselage and Control Surfaces, Post Impact Summary**

The MA's fuselage remained mostly intact. The landing gear collapsed and all three struts sustained significant damage but did not separate from the MA. The nose landing gear components collapsed in the aft position consistent with normal retraction. Both main landing gear struts collapsed aft, opposite the normal forward retraction direction, resulting in substantial damage to the lateral structural bulkheads. All three tires and both main landing gear brake stacks remained attached to the landing gear struts. The forward fuselage was deformed with partial separation of the radome. Both wings remained attached, but sustained dents and abrasions along the entire leading edge. The horizontal and vertical stabilizers remained attached, with both the left and right horizontal stabilizer tips sustaining impact damage. Both ventral fins remained attached but sustained significant damage. (Tabs S-6 thru S-18)

Figure 5. Post Impact Damage

(2) **Engine Performance**

The data downloaded from the EMSC indicated the engine was operating as commanded throughout the mishap sortie. (Tabs L-10 thru L-14) The ME remained with the aircraft and sustained internal foreign object damage (FOD) due to ingestion of rocks and sand once the MA departed the paved runway surface. Once the MA came to rest, debris was present in both the intake and exhaust section. (Tabs Z-3 thru Z-7)

(3) **Hydraulic System Performance**

The F-16 has a dual-redundant hydraulic system operating at 3,000 pounds per square inch. The hydraulic system operating pressures were tracked and recorded on the CSFDR, and were operating within the normal parameters throughout the mishap sortie. (Tabs L-3 thru L-8)

(4) **Flight Control System Performance**

The flight control system on the F-16 is electrically controlled and hydraulically actuated, commonly known as "fly by wire." Pilot-directed inputs via the control stick and rudder pedals in the cockpit are transmitted via electrical signals to the hydraulic actuators at each control surface, rather than via traditional cable-and-pulley systems. The system is designed with multiple redundancies. Flight control inputs and outputs are tracked and recorded on the CSFDR. The flight control system was operating properly throughout the mishap sortie. (Tabs L-3 thru L-8)

(5) **Brake System Performance**

The brake system on the F-16 is electrically controlled, and hydraulically actuated. The brakes are equipped with an anti-skid control system that is designed to prevent skidding conditions during normal and excessive braking inputs. Much like the flight control system, there are no traditional cables and pulleys, rather the pilot inputs are transmitted electrically between the brake pedals and the hydraulic valves and cylinders that apply pressure to the brakes. The system is designed with redundant electrical and hydraulic systems for safety. During analysis of the data downloaded from the anti-skid control box, SPO engineers determined that an electrical malfunction occurred during landing rollout at 143 feet per second (85.7 knots) measured at the left wheel speed sensor. (Tab J-12, Tabs V-3.25, V-3.27) A Built-in Test (BIT) Fault Code 66 asserted at that measured point, indicating a short circuit in the main wiring harness leading to the left brake metering valve. (Tab J-12)

The entire record downloaded from the anti-skid control box was compared to the ground path of the aircraft prior to and after departing the paved surface of the runway. The data from the anti-skid control box is consistent with a left brake failure. (Tab J-13, Tabs L-16 thru L-18) Finally, a Hardware-in-the-Loop (HITL) test was conducted by electrical engineers at the Ogden Air Logistics Center utilizing the actual brake system components from the MA. The results of this testing duplicated the failure indicated by the anti-skid control box during the mishap sortie. (Tabs J-12 thru J-14)

Chafing of the wiring harness created a condition where a bare wire came in contact with a clamp, resulting in metal-to-metal contact and a short circuit. This chafing occurred over time through normal wear and tear of the Kapton wire used when the MA was originally manufactured. No regular inspection would have revealed this chafing. (Tab U-9) The short circuit occurred in the wiring harness between the anti-skid control box and the left metering valve. The short circuit affected both redundant brake channels. (Tabs J-25 thru J-30, U-5 and V-3.27)

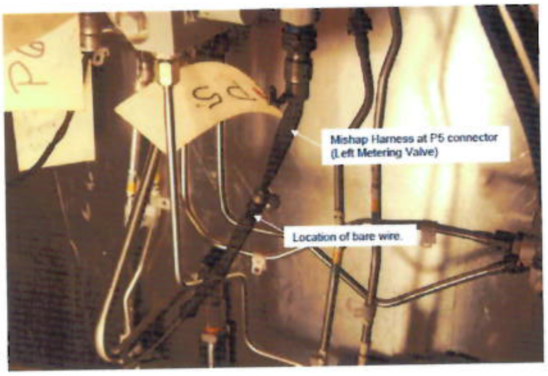


Figure 6. MA Wiring Harness

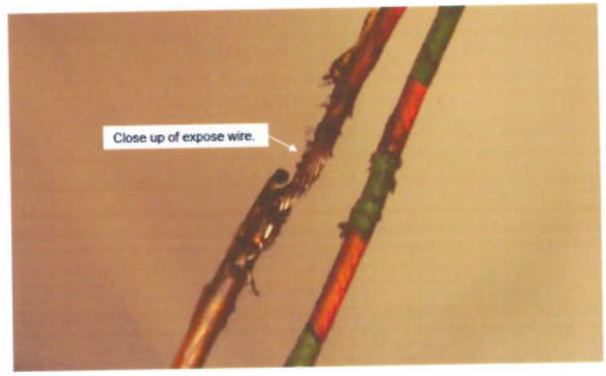


Figure 7. MA Exposed Wiring

Due to this short circuit condition, which occurred during the landing roll, electrical signals between the anti-skid control box and the left brake metering valve were interrupted. This created a condition where the hydraulic pressure exerted on the left brake was substantially lower than the input from the pilot, causing left brake failure. (Tabs J-28 and U-9)

7. WEATHER

a. Forecast Weather

At brief time weather for takeoff was forecast to have a scattered cloud layer at 10000 feet Above Ground Level (AGL), skies clear with winds out of the northwest, 330 degrees at 18 knots gusting to 28 knots. (Tab F-3)

b. Observed Weather

At the time of the mishap the actual weather issued by the control tower was winds 330 degrees at 16 knots gusting to 25 knots. (Tab N-6) Post-mishap surface weather observations were recorded at 1725L. (Tab F-5) The winds were northwest, 330 degrees at 18 knots gusting to 25 knots and few clouds at 10000 feet AGL with 10 statute miles visibility. Surface temperature was observed at 23 degrees Celsius (73.4 degrees Fahrenheit) and the Runway Condition Report was 23, meaning the runway was dry at the time of the incident. (Tabs W-2 thru W-5) Weather was within limits during the mishap.

c. Space Environment

Not applicable.

d. Operations

Based on the forecast, the weather was within limits for the MS. Operations were conducted IAW applicable directives.

8. CREW QUALIFICATIONS

a. Mishap Pilot

The MP was a current two-ship flight lead with 472.1 total flying hours in the F-16C. (Tab G-8) The MP arrived at BAF on 1 October 2010 and was on the fourth combat sortie for the current deployment. (Tab V-1.2)

The MP had previously deployed to BAF from January to May 2010 as a wingman. The MP returned to HAFB for approximately four months. During this period the MP was qualified as a flight lead. The MP deployed to BAF again in October 2010. (Tab G-7)

The MP met all currency and training requirements prior to the mishap sortie, and was qualified for the mission. (Tab V-4.6)

At the time of the mishap, the MP's recent flight time was as follows:

	Hours	Sorties
30 Days	40.8	9
60 Days	57.3	21
90 Days	66.7	28

9. MEDICAL

a. Qualifications

The MP was medically qualified to perform flying duties at the time of the mishap. The MP's annual Preventative Health Assessment (PHA) was current and a review of the Aeromedical Information and Medical Waiver Tracking System (AIMWTS) database showed the MP never required a medical waiver. Furthermore, the MP had no physical or medical restrictions and was worldwide qualified prior to the mishap. (Tab X-2)

b. Health

The MP's medical records, both in hard copy and an electronic medical record called the Armed Forces Health Longitudinal Technology Application (AHLTA 3.0), were reviewed. No significant medical history was a factor in this mishap. On the day of the mishap, the MP's health was self-described as "healthy…and feeling good." (Tabs V-1.4 thru V-1.5) In addition, the MP suffered no significant injuries from the incident. (Tabs V-1.25, X-2)

c. Toxicology

Immediately following the mishap, toxicology testing was conducted by the Interim Safety Board (ISB) for all persons involved, including the MP and 26 maintainers. The blood and urine samples were submitted to the Department of the Army Armed Forces Medical Examiner

System in Rockville, MD, for toxicology analysis. Lab studies included carbon monoxide and ethanol levels in the blood as well as an investigation for any traces of drugs in the urine to include amphetamines, barbiturates, benzodiazepines, cannabinoids, cocaine, opiates, and phencyclidine. The toxicology samples arrived at the lab in good condition and the results were negative for all members tested, to include the MP. (Tab X-2)

d. Lifestyle

The MP's lifestyle had no indication of unusual stresses, behaviors, or habits. Even though the MP had just recently arrived at BAF, the description of the MP's lifestyle is typical for pilots as they adjust to a deployed location. The MP described life at Bagram as "it had been two weeks since I left HAFB, so obviously, the trip across the pond, huge time changes, somewhat hectic, a lot of stuff going on [but] all things considered relatively stable." (Tab V-1.5) When specifically questioned about stress levels, the MP responded there was "nothing significant that would affect my health or well being." (Tab V-1.5) With regards to the MP's behavior and habits, again, nothing unusual was identified. (Tabs V-1.5, X-2)

e. Crew Rest and Crew Duty Time

All aircrew are required to have proper crew rest prior to performing flying duties. Proper crew rest is defined as a minimum of a 12-hour non-duty period before the designated flight duty period begins. During this time, an aircrew member may participate in meals, transportation, or rest as long as he or she has had at least ten hours of continuous restful activity with the opportunity for at least eight hours of uninterrupted sleep. (Tabs BB-5 thru BB-7) The MP met crew rest requirements with 14.3 hours of crew rest. Furthermore, the MP recalled being well rested after approximately eight hours of sleep on the day of the mishap. (Tab V-1.4)

10. OPERATIONS AND SUPERVISION

a. Operations

The 4 FS had a normal operations tempo for a deployed FS in the Area of Responsibility (AOR). The 4 FS operations tempo during the six months prior to the MS was consistent with other F-16 combat Air Force units. In the month prior to the MS, the 4 FS had a slight decrease in operations tempo in preparation for the deployment to the AOR. (Tabs V-1.25 thru V-1.26)

b. Supervision

Supervision of the MP at the time of the mishap was above average. The 4 FS was well prepared for operations at BAF through pre-deployment training that focused on the primary mission and contingencies. The pre-deployment training included training sorties specifically geared to prepare the pilots for deployed operations. In addition, all pilots were required to attend briefings focused on squadron standards in the AOR. The contingencies discussed were heavyweight landings, landing at a high density altitude, and landing with high crosswinds. (Tabs V-4.2 thru V-4.5) The day of the mishap the MP and MW were thoroughly briefed on the expected crosswinds as well as updated throughout the sortie on the conditions at BAF. (Tab V-4.2)

11. HUMAN FACTORS ANALYSIS

The Department of Defense Human Factors Analysis and Classification System (DoD-HFACS) is a systematic and comprehensive tool that is comprised of a list of potential human factors that can be contributory or causal to a mishap. The DoD-HFACS classification taxonomy describes four main tiers of human factors including Acts, Pre-Conditions, Supervision, and Organizational Influences, which are briefly described below: (Tabs BB-17 thru BB-34)

> *Acts* are those factors that are most closely tied to the mishap, and can be described as active failures or actions committed by the operator that result in human error or unsafe situation. (Tab BB-17)
>
> *Preconditions* are factors in a mishap if active and/or latent preconditions such as conditions of the operators, environmental or personnel factors affect practices, conditions or actions of individuals and result in human error or an unsafe situation. (Tab BB-20)
>
> *Supervision* is a factor in a mishap if the methods, decisions, or policies of the supervisory chain of command directly affect practices, conditions, or actions of individuals and this result in human error or an unsafe situation. (Tab BB-33)
>
> *Organizational Influences* are factors in a mishap if the communications, actions, omissions or policies of upper-level management directly or indirectly affect supervisory practices, conditions or actions of the operator(s) and result in system failure, human error or an unsafe situation. (Tab BB-34)

A total of three human factors were identified and described below for this mishap:

a. AE201 Risk Assessment – During Operation

Risk Assessment – During Operation is a factor when the individual fails to adequately evaluate the risks associated with a particular course of action and this faulty evaluation leads to inappropriate decision and subsequent unsafe situation. This failure occurs in real-time when formal risk assessment procedures are not possible. (Tab BB-18)

The MP accepted greater risk by landing at BAF with 6300 lbs of fuel, 2200 lbs more fuel than recommended. (Tabs V-1.12, V-1.29, V-4.4, BB-9) A lighter MA would have allowed more time for the MP to assess and react to the situation and stop the jet. The 4100-lb weight limit was clearly communicated to all members of the squadron including the MP during pre-deployment briefings and promulgated via written standards. (Tabs V-4.6 thru V-4.7, BB-9) The 4 FS Director of Operations (DO) offered multiple options to preclude landing with excess fuel, including burning off more fuel prior to landing. (Tabs V-4.7 thru V-4.8) In addition, the MP assumed excess risk by accepting a touchdown 1500 feet beyond the recommended touchdown point. (Tabs L-3 thru L-8, V-1.29, V-3.34 thru V-3.39)

b. PC207 Pressing

Pressing is a factor when an individual knowingly commits to a course of action that presses them and/or their equipment beyond reasonable limits. (Tab BB-24)

The MP opted to land at BAF with excess fuel. (Tab V-4.6) Landing with 6300 pounds of fuel was beyond reasonable limits. (Tab V-4.9) The MP recalled prioritizing this heavyweight landing at BAF while the crosswinds were within limits over diverting to an unfamiliar airfield. (Tabs V-1.23, V-1.25, V-1.29)

c. PC206 Overconfidence

Overconfidence is a factor when the individual overvalues or overestimates personal capability, the capability of others or the capability of aircraft/vehicles or equipment and this creates an unsafe situation. (Tab BB-24)

The MP demonstrated overconfidence in the capability of the MA to stop in the remaining runway by accepting a long landing with excess fuel. (Tabs V-1.13, V-1.29, V-4.8 thru V-4.9, BB-3, BB-11)

12. GOVERNING DIRECTIVES AND PUBLICATIONS

a. Primary Operations Directives and Publications

(1) AFI 11-2F-16, Volume 3, *F-16--Operations Procedures*, 18 February 2010
(2) AFI 11-202, Volume 3, *General Flight Rules*, 22 October 2010
(3) AFI 32-1043, *Managing, Operating, and Maintaining Aircraft Arresting Systems*, 4 April 2003
(4) Air Force Tactics, Techniques, and Procedures (AFTTP) 3-3.F16, *Combat Aircraft Fundamentals, F-16*, 30 March 2010
(5) AFI 51-503, *Aerospace Accident Investigations*, 26 May 2010
(6) AFI 91-204, *Safety Investigations and Reports*, 24 September 2008
(7) Technical Order (T.O.) 1F-16CM-1, *Flight Manual, USAF Series F-16C and F16/D CCIP Aircraft Blocks 40, 42, 50 and 52*, 15 December 2009

b. Maintenance Directives and Publications

(1) AFI 21-101, *Aircraft and Equipment Maintenance Management*, dated 26 July 2010
(2) TO 00-20-1, *Aerospace Equipment Maintenance Inspection, Documentation, Policies and Procedures*, dated 20 September 2010
(3) TO 1F-16CG-6-11, *Scheduled Inspection and Maintenance*, dated 15 December 2010

(4) TO 1F-16CG-2-32FI-00-1, *Landing Gear System*, dated 1 August 2010
(5) TO 1F-16CG-2-10JG-00-1, *Organizational Maintenance, Aircraft Safety*, dated 15 September 2009

NOTICE: The AFIs listed above are available digitally on the AF Departmental Publishing Office Internet site at http://e-publishing.af.mil.

c. Known or Suspected Deviations from Directives or Publications

Not applicable.

13. ADDITIONAL AREAS OF CONCERN

Not applicable.

14 FEB 2011

KYLE W. ROBINSON, Colonel, USAF
President, Accident Investigation Board

STATEMENT OF OPINION

F-16CM, T/N 89-2144 ACCIDENT
8 October 2010

Under 10 U.S.C. § 2254(d), the opinion of the accident investigator as to the cause of, or the factors contributing to, the accident set forth in the accident investigation report, if any, may not be considered as evidence in any civil or criminal proceeding arising from the accident, nor may such information be considered an admission of liability of the United States or by any person referred to in those conclusions or statements.

1. OPINION SUMMARY

I find by clear and convincing evidence the causes of this mishap were failure of the left wheel brake of the mishap aircraft (MA) and the mishap pilot's (MP) decision to accept a landing past the desired touchdown point with excess fuel weight. These factors combined to yield a situation where the MP had insufficient time to analyze the brake failure and complete the brake failure checklist before departing the end of the runway at a high speed.

The MP was leading a flight of two F-16s on a Close Air Support mission supporting Operation ENDURING FREEDOM. After an uneventful mission, the MP flew back to Bagram Air Field (BAF) to land. Strong crosswinds were observed that were near the limit for the F-16, creating the possibility that the MP might have to divert to another airfield. Per standards, the MP had to carry and land with additional fuel in case of the need to divert from BAF to an alternate airfield for landing.

When the MP arrived at BAF, the crosswinds were within limits for landing. The MP elected to land with 2200 pounds of fuel over the amount required to divert to an alternate airfield. The MP touched down approximately 2000 feet down the runway. When the MP lowered the nose to the runway and applied the brakes, the left brake did not work, resulting in difficulty slowing the MA down and maintaining a position in the middle of the runway. The MP started running the checklist for brake failure, including switching brake channels and lowering the arresting hook. The hook failed to engage the arresting cable strung across the runway. After the MA passed the arresting cable, the MP shut the engine off as the MA departed the runway. The MA continued 1500 feet across a dirt field and the landing gear collapsed as the MA struck an elevated paved road. The MA came to rest in a chain link fence and suffered extensive damage to several bulkheads, air-to-air missiles, and the Sniper targeting pod was destroyed.

I developed my opinion by analyzing factual data from historical records, guidance and directives, engineering analysis, witness testimony, and information provided by technical experts. I used the MP testimony in conjunction with information downloaded from the anti-skid control box and the Crash Survivable Flight Data Recorder to determine the mishap sequence of events.

2. DISCUSSION OF OPINION

a. Causes

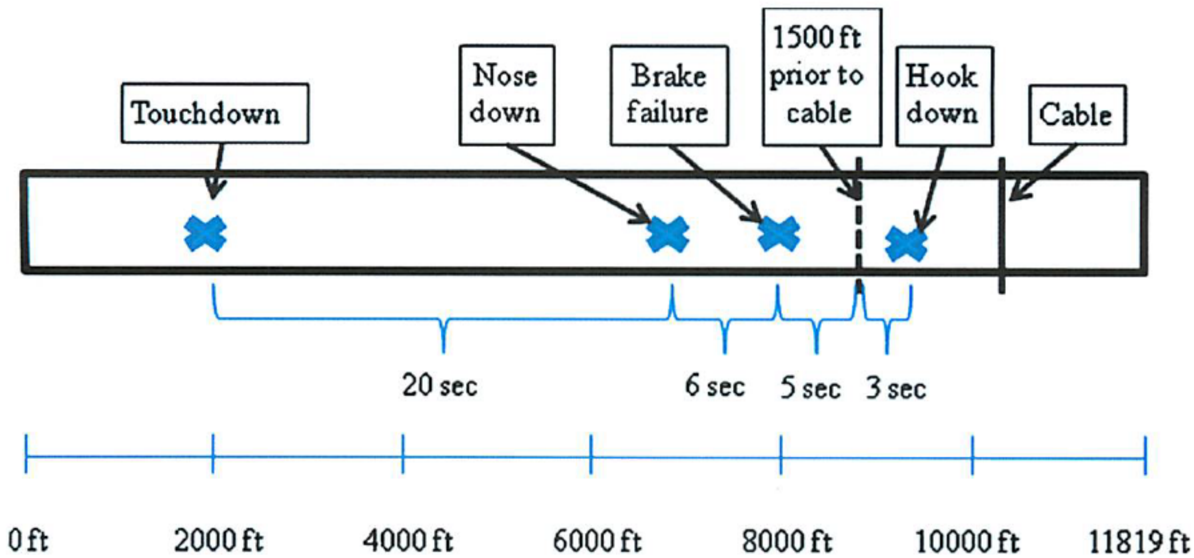
(1) Left Brake Failure

During analysis of the data downloaded from the anti-skid control box, engineers determined that an electrical malfunction occurred during landing rollout. Through normal wear and tear, chafing of the main brake wiring harness caused a bare wire to come in contact with a clamp, resulting in metal-to-metal contact and a short circuit. Due to this short circuit, electrical signals between the anti-skid control box and the left brake metering valve were interrupted and caused failure of the left brake. This left brake failure caused the MA to drift to the right and fail to slow down before the end of the runway.

(2) Faulty Risk Assessment for a Long and Heavy Landing

The MP assumed excess risk by landing at BAF with 2200 pounds more fuel than recommended. The squadron's recommended landing weight for BAF with the required divert fuel is 4100 pounds. This weight limit was clearly communicated to all members of the squadron, including the MP, during pre-deployment briefings and promulgated via written employment standards. Landing with excess fuel extended the overall landing distance and reduced the time available to react to the brake failure.

In addition, the MP assumed excess risk by accepting a touchdown 1500 feet beyond the recommended 500-foot touchdown point. With overconfidence in the MA's ability to stop, the MP pressed and accepted the risks of this long landing instead of going around for another attempt. Landing past the recommended touchdown point shifted the landing roll further down the runway and reduced the time available to react to the brake failure.



BAF Runway Diagram with Approximate Action Points

The above illustration portrays the relevant shifted and extended action points due to a long and heavy landing in this mishap. This left the MP with insufficient time to troubleshoot and effectively handle any complications during landing roll. Specifically, when the left brake failed, the MP took eight seconds to run through the first two steps of the brake failure checklist and lower the arresting hook. The MP actually had five seconds to lower the hook before the prescribed 1500 feet prior to the arresting cable. While the cable was suspended .25 inches below the prescribed height, it was still within operational range. I do not find that the cable's height was a factor in this mishap. Had the MA landed at the recommended touchdown point and fuel weight, the MP would have had more time to lower the hook within parameters and increase the likelihood of successfully engaging the cable.

3. CONCLUSION

I find by clear and convincing evidence the causes of this mishap were failure of the left wheel brake and the MP's decision to land with 2200 pounds of excess fuel 1500 feet beyond the desired touchdown point. These factors combined to yield a situation where the MP had little time to analyze the brake failure and complete the brake failure checklist before departing the end of the runway at high speed.

14 FEB 2011

KYLE W. ROBINSON, Colonel, USAF
President, Accident Investigation Board