UNITED STATES AIR FORCE
AIRCRAFT ACCIDENT INVESTIGATION
BOARD REPORT

A-10C, T/N 79-0141
75TH FIGHTER SQUADRON
23RD WING
MOODY AIR FORCE BASE, GEORGIA

LOCATION: MOODY AIR FORCE BASE, GEORGIA

DATE OF ACCIDENT: 10 MAY 2010

BOARD PRESIDENT: COLONEL BRYAN K. TURNER

Conducted IAW Air Force Instruction 51-503

EXECUTIVE SUMMARY

AIRCRAFT ACCIDENT INVESTIGATION

A-10C, T/N 79-0141
MOODY AIR FORCE BASE, GEORGIA
10 MAY 2010

On 10 May 2010 at 1655 local time, A-10C, tail number 79-0141, assigned to the 75th Fighter Squadron, 23rd Wing, Moody Air Force Base (AFB), Georgia, departed the right edge of runway 18L when the mishap pilot (MP) did not successfully stop the aircraft during an aborted takeoff. As the mishap aircraft (MA) departed the runway, the MP ejected sustaining minor injuries. The MA continued traveling over soft uneven grassland until the nose gear collapsed and the right main landing gear and MA nose became lodged into the ground causing a catastrophic fuselage failure just forward of the right wing's leading edge. The MA stopped approximately 500 feet into the grassland at a 45° angle off the end of the runway. Minutes later, the MA was engulfed in fire due to the ruptured forward main fuel tank. The MA was destroyed with loss valued at $17,306,077 to include $52,095 in environmental clean-up on Moody AFB.

As the wingman in the two-ship formation, the MP was briefed to takeoff 20 seconds behind his flight lead. After his flight lead began his takeoff roll, but prior to the MA brake release, the MP realized he had not put on his prescription glasses. The MP released brakes at the 20 second mark; however donning his glasses distracted him from immediately advancing the throttles to their takeoff setting. The MP noted a lower than calculated airspeed at the required airspeed check point 1000 feet down the runway and attributed it to his late application of power, so he continued the takeoff. The MP checked his speed again at 1500-2000 feet and the indicator showed negligible to no change. At 3500 feet, the MP correctly diagnosed a pitot-static issue but elected to continue with the takeoff versus executing an abort. Approaching the calculated takeoff distance, the MP rechecked the airspeed indicator and noted an unexpected airspeed rise to 90-100 knots indicated airspeed (KIAS). At the same time, the MP had a visual misperception that the MA was no longer accelerating. The MP concluded that the airspeed indicator was working properly and for an unknown reason the MA was unable to attain the takeoff speed of 136 KIAS. The MP aborted the aircraft with approximately 3500 feet of runway remaining. Evidence supports that the MA was traveling 160-170 KIAS at the time the abort commenced. Due to his perceived lower airspeed, the MP did not apply the required maximum braking. In a final attempt to stop the MA on a prepared surface, the MP attempted a ninety degree right turn onto the last taxiway at the end of the runway. The MP recognized the MA was traveling too fast to complete the turn and subsequently ejected as the MA departed the prepared surface.

The accident investigation board (AIB) president found clear and convincing evidence that the cause of the mishap was human factor error. Specifically, the MP's initial decision not to abort the takeoff, and then once the decision to abort was made, the MP applying an inappropriate braking procedure that was based on his perception of being at a lower airspeed. Additionally, the AIB president found by a preponderance of the evidence, that the pitot-static system blockage, task misprioritization, distraction, and procedural error were substantially contributing factors to the mishap.

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

SUMMARY OF FACTS AND STATEMENT OF OPINION
A-10C, T/N 79-0141
MOODY AIR FORCE BASE, GEORGIA

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COMMONLY USED ACRONYMS AND ABBREVIATIONS

°	Degree
-21	Aircraft Inventory Record Master Guide
781	Aircrew/Mission Flight Data Document
9 AF	9th Air Force
23 WG	23rd Wing
23 FG	23rd Fighter Group
75 FS	75th Fighter Squadron
ACC	Air Combat Command
ACES II	Advance Concept Ejection Seat
AEF	Air Expeditionary Force
AF	Air Force
AFB	Air Force Base
AFE	Aircrew Flight Equipment
AFFF	Aqueous Fire Fighting Foam
AFI	Air Force Instruction
AFTO	Air Force Technical Order
AGL	Above Ground Level
AHLTA	Armed Forces Health Longitudinal Technology Application
AIB	Accident Investigation Board
AIMWTS	Aeromedical Information Medical Waiver Tracking System
AMU	Aircraft Maintenance Unit
AMXS	Aircraft Maintenance Squadron
ARMS	Aviation Resource Management System
ATC	Air Traffic Control
BAK	Barrier Arresting Kit
BASH	Bird Aircraft Strike Hazard
BDU-33s	Bomb Dummy Unit
BFM	Basic Flight Maneuvers
BPO/PR	Basic Post Flight/Preflight
BRAC	Base Realignment and Closure
CADC	Central Air Data Computer
CAMS	Core Automated Maintenance System
Capt	Captain
C	Celsius
CAS	Close Air Support
CCAF	Community College of the Air Force
CD	Deputy Commander
CEF	Civil Engineering Fire Protection
CES	Civil Engineering Squadron
CGSC	Command and General Staff College
CIT	Compressor Inlet Temperature
Col	Colonel
Comm	Communication
CSAR	Combat Search and Rescue
CT	Continuation Training
DCC	Dedicated Crew Chief
DVADR	Digital Video Airborne Data Recorder
EGI	Embedded GPS/INS
ELT	Emergency Locator Transmitter
EMS	Equipment Maintenance Squadron
ENJJPT	Euro-Nato Joint Jet Pilot Training
EOR	End of Runway
EP	Emergency Procedure
EPLRS	Enhanced Position Location Reporting System
ER	Exceptionally Released
F	Fahrenheit
FCF	Functional Check Flight
FG	Fighter Group
FOD	Foreign Object Damage
FS	Fuselage Station
FTD	Field Training Detachment
G	Gravity
GPS	Global Positioning System
GSU	Geographically Separated Unit
HFACS	Human Factors Analysis and Classification System
HUD	Head-Up Display System
IAW	In accordance with
IFE	In-flight Emergency
IMDS	Integrated Maintenance Data System
INS	Inertial Navigation System
IP	Instructor Pilot
ISB	Interim Safety Board
JOAP	Joint Oil Analysis Program
JTACs	Joint Tactical Air Control Support
k	Kilometer
KIAS	Knots Indicated Air Speed
L	Local Time
L	Left
LATN	Low Altitude Tactical Navigation
Lt Col	Lieutenant Colonel
M	Million
MA	Mishap Aircraft
Maj	Major
MAJCOM	Major Command
Max	Maximum
MEF	Mission Execution Forecast
MFCD	Multi-Function Color Display
MF	Mishap Flight
MFL	Mishap Flight Lead
Min	Minimum
MLG	Main Landing Gear
MOA	Military Operating Area
MP	Mishap Pilot
NAF	Numbered Air Force
NAVAIDS	Navigation Aids
NOTAMs	Notices to Airmen
OAT	Outside Air Temperature

OEF	Operation ENDURING FREEDOM
OIF	Operation IRAQI FREEDOM
Ops	Operations
Ops Sup	Operations Supervisor
ORI	Operational Readiness Inspection
ORM	Operational Risk Management
OSS	Operations Support Squadron
PEX	Patriot Excalibur
PHA	Preventive Health Assessment
PLA	Power Lever Angle
PLF	Parachute Landing Fall
PFPS	Portable Flight Planning System
PSI	Pounds per Square Inch
QUAL	Qualification
R	Right
RPM	Revolutions Per Minute
SAV	Staff Assistance Visit
SE	South East
SEI	Special Experience Identifier
SIB	Safety Investigation Board
Sim	Simulator
SOF	Supervisor of Flying
Sortie	Flight
SPO	Sustainment Program Office
TDY	Temporary Duty
TEMS	Turbine Engine Monitoring System
T/N	Tail Number
TO	Technical Order
TOLD	Takeoff Landing Data
TSgt	Technical Sergeant
UHF	Ultra High Frequency
USAF	United States Air Force
U.S.C.	United States Code
USDA	United States Department of Agriculture
Vol	Volume
VG	Variable Inlet Guide Vanes
VHF	Very High Frequency
VFR	Visual Flight Rules
WIC	Weapons Instructor Course
WIP	Water Intrusion Plug

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, PURPOSE, AND CIRCUMSTANCES

a. Authority

On 2 June 2010, Lieutenant General William J. Rew, Vice Commander, Air Combat Command (ACC), appointed Colonel Bryan K. Turner, pursuant to Air Force Instruction (AFI) 51-503, to conduct an aircraft accident investigation of a mishap that occurred on 10 May 2010 involving an A-10C aircraft, tail number (T/N) 79-0141, at Moody Air Force Base (AFB), Georgia (Tab Y-3). The investigation was conducted at Moody AFB, Georgia, from 8 June 2010 through 28 June 2010. Technical advisors included a pilot member, medical member, legal advisor, maintenance member, recorder, and reporter (Tab Y-3 to Y-5).

b. Purpose

This is a legal investigation convened to inquire into the facts surrounding the aircraft 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.

c. Circumstances

The accident board was convened to investigate the Class A accident involving an A-10C aircraft, T/N 79-0141, assigned to the 75th Fighter Squadron (75 FS), 23rd Wing (23 WG), Moody AFB, Georgia, which occurred during a continuation training mission on 10 May 2010.

2. ACCIDENT SUMMARY

The mishap aircraft (MA), an A-10C, T/N 79-0141, departed the right edge of the prepared surface of runway 18L when the mishap pilot (MP) was unable to bring the aircraft to a stop during an aborted takeoff. The MP ejected safely from the aircraft sustaining minor injuries. The MA continued traveling over soft uneven grassland until the nose gear collapsed and the right main landing gear and MA nose became lodged into the ground (Tab H-4, Tab J-5, and Tab J-8). This caused a catastrophic fuselage failure just forward of the right wing's leading edge (Tab J-5). The MA stopped approximately 500 feet into the grassland at a 45 degree angle off the end of the runway (Tab H-4, Tab S-3, and Tab S-9). Within minutes, the MA was engulfed in fire due to the ruptured forward main fuel tank (Tab J-8 and Tab V-12.3 to V-12.4). The MA was destroyed with loss valued at $17,306,077 (Tab P-3). This includes $52,095 in environmental clean-up on Moody AFB (Tab P-3). There were no civilian injuries or damage to private property (Tab P-3). Media interest was minimal.

3. BACKGROUND

The 75 FS owned the MA. The 75 FS is a squadron within the 23rd Fighter Group (23 FG). The 23 FG is, in turn, part of the 23 WG and 9th Air Force (9 AF). 9 AF is a Numbered Air Force (NAF) within ACC.

a. 23rd Wing

The mission of the 23 WG, located at Moody AFB, Georgia, is to organize, train and employ combat-ready A-10C, HC-130P, HH-60G, pararescuemen, force protection assets and support personnel consisting of approximately 5,500 military and civilian personnel including geographically-separated units (GSUs) in Nevada, Arizona, and Florida. The wing executes worldwide close air support (CAS), force protection, peacetime and combat search and rescue (CSAR) operations in support of humanitarian and U.S. national security interests, and in support of the global war on terrorism. The 23 WG is composed of five groups: the 347th Rescue Group, the 23rd Mission Support Group, the 23rd Medical Group, the 23rd Maintenance Group, and the 23rd Fighter Group (FG) (Tab CC-3 to Tab CC-5).

b. 23rd Fighter Group

The 23 FG known as "The Flying Tigers" directs flying and maintenance operations for the United States Air Force's (USAF) largest A-10C fighter group, consisting of two combat-ready A-10C squadrons and an Operations Support Squadron (OSS). In response to the attacks on 11 September 2001, the 23 FG landed the first fighter aircraft inside Afghanistan in March 2002 (Tab CC-7 to Tab CC-8).

c. 75th Fighter Squadron

The mishap unit, the 75 FS, moved from Pope AFB, North Carolina to Moody AFB, Georgia in 2007. Simultaneous with the move, all the 23 FG A-10s were upgraded to the precision engagement A-10C. In 2008 and 2009 respectively, the 75th and 74th Fighter Squadrons deployed to Afghanistan in support of Operation ENDURING FREEDOM (OEF), flying their newly upgraded A-10C aircraft. While providing close air support to ground forces and engaging Taliban and insurgents, the squadrons logged over 23,000 combined combat hours (Tab CC-7 to Tab CC-8).

d. A-10C Thunderbolt II

The A-10C Thunderbolt II is the first Air Force aircraft specifically designed for close air support of ground forces and has been digitally upgraded with the latest precision-guided weaponry and communications. It has excellent maneuverability at low air speeds and altitude and is a highly accurate weapons-delivery platform. The wide combat radius and short takeoff and landing capability permit operations in and out of locations near front lines. The Thunderbolt II can employ a wide variety of conventional munitions, including general purpose bombs, cluster bomb units, laser guided bombs, joint direct attack munitions (JDAM), wind corrected munitions dispenser (WCMD), AGM-65 Maverick and AIM-9 Sidewinder missiles, rockets, illumination flares, and the GAU-8/A 30mm cannon which is capable of firing 3,900

rounds per minute to defeat a wide variety of targets including tanks. The aircraft has participated in OPERATIONS DESERT STORM, SOUTHERN WATCH, PROVIDE COMFORT, DESERT FOX, NOBLE ANVIL, DENY FLIGHT, DELIBERATE GUARD, ALLIED FORCE, ENDURING FREEDOM, and IRAQI FREEDOM (Tab CC-9 to Tab CC-10).

4. SEQUENCE OF EVENTS

a. Mission

The mishap mission was planned and briefed as two separate sorties with hot pit refueling accomplished between the two sorties. The first sortie was planned as a CAS mission to Grand Bay range in support of Joint Tactical Air Controller (JTAC) training, followed by Maverick missile training in Moody Military Operating Area (MOA) 2 North (Tab V-1.5 and Tab V-2.4). CAS training involves employing simulated or practice weapons against targets in proximity to friendly forces while under the control of JTACs or other qualified ground parties. Following the first sortie, the flight planned to hot pit refuel, a procedure in which the pilot taxis the aircraft to a designated area and the aircraft is refueled with engines running.

The second sortie was planned as a Basic Fighter Maneuvers (BFM) mission to Moody MOA 2 South with Low Altitude Tactical Navigation (LATN) accomplished en route (Tab V-1.5 and Tab V-2.4). BFM training consists of one fighter aircraft attacking (or being attacked by) another fighter aircraft within visual range of each other at pre-determined parameters of airspeed, altitude and distance between the aircraft.

The two-ship flight was composed of the mishap flight lead (MFL), call sign “EASY 01,” and the MP, “EASY 02.” The 75 FS Operations Supervisor (Ops Sup) authorized the mission (Tab T-3 to Tab T-4).

b. Planning

The MFL planned the mission as continuation training practicing CAS and BFM. The MP conducted wingman mission planning responsibilities in accordance with the 23 FG standards to include obtaining weather information, calculating takeoff and landing data (TOLD), and other tasks as directed by the MFL (Tab V-1.6 and Tab V-2.4). Mishap flight (MF) members accomplished Operational Risk Management (ORM) worksheets resulting in both flight members rated as “Low Risk” (Tab V-1.5 to V-1.6, Tab V-2.5, and Tab K-34 to Tab K-37). The Ops Sup conducted a mass briefing for all pilots flying that afternoon which covered weather, Notices to Airman (NOTAMS), an intelligence briefing, and an emergency procedure (EP) discussion (Tab V-1.5 and Tab V-2.4). The MFL conducted the individual mission briefing; all required items were thoroughly briefed and understood by all flight members (Tab V-1.6 and Tab V-2.6).

c. Preflight

The MF members met at the operations desk for a final update briefing on weather, NOTAMS and other pertinent safety-of-flight information prior to stepping to their aircraft (Tab V-1.6 and

Tab V-2.6). During the launch, both aircraft required minor maintenance action to rekey the Enhanced Position Location Reporting System (EPLRS) (Tab K-33, Tab V-1.7, and Tab V-2.7). Other than the EPLRS rekey, aircraft engine start, ground operations, and taxi to the end of runway (EOR) arming area were uneventful (Tab V-2.7).

In EOR, the arming crew informed the MP that the aircraft Turbine Engine Monitoring System (TEMS) had malfunctioned (Tab V-1.7 and Tab V-2.7). Maintenance was unable to resolve the issue causing the MP to taxi back to the parking space and shut down the aircraft (Tab V-1.7 and Tab V-2.7). Due to time constraints, the MFL and MP determined that the MP would not step to a spare aircraft for the first sortie. Instead, the MP would rejoin the flight in a spare aircraft after the MFL completed refueling between sorties (Tab V-1.7 and Tab V-2.7). The MFL took off single ship and executed the first sortie as planned (Tab V-2.7). The MP returned to the squadron operations building to wait for the next sortie (Tab V-1.7).

Forty-five minutes later, the MP stepped to the mishap aircraft (MA). Engine start and system checks were normal with no discrepancies noted (Tab V-1.7 and Tab V-11.5). Due to an unrelated in-flight emergency (IFE), the MP remained in chocks an additional 20-25 minutes waiting for the MFL to start hot pit refueling (Tab V-1.8 and Tab V-2.7). Once the MFL began refueling, the MP taxied to EOR and the arming crew armed the MA (Tab V-1.8 and Tab V-2.7). The MFL completed refueling, taxied to rejoin the flight, and got armed in EOR (Tab V-2.8).

d. Summary of Accident

The MF taxied into position to hold on Runway 18L (Tab V-1.8 and Tab V-7.4). Runway 18L is 9300 feet long (Tab Z-12). At 1653:27L Moody Tower cleared the MF for takeoff (Tab N-5). The briefed takeoff was a 20 second interval takeoff. The MF ran their engines up to 90% rpm, standing up the throttles to a vertical position, and completed final pre-takeoff checks (Tab V-1.8 and Tab V-2.8). The MFL released brakes and executed a normal single ship takeoff (Tab V-2.8). As the MFL released brakes, the MP started a timer in his cockpit to execute the planned 20 second interval takeoff (Tab V-1.8). At that time, the MP realized that he was not wearing his prescription glasses (Tab V-1.8). The MP grabbed the glasses case out of the saddlebag located on the MA's glare shield, pulled the glasses out of the case, put them on, and returned the case to the saddlebag (Tab V-1.8). As the MP put the glasses on, he noticed the timer reach 19 seconds (Tab V-1.8). The MP released brakes at 20 seconds as briefed, finished putting the glasses on, lowered the visor on his helmet, and placed his hands back on the throttles and stick (Tab V-1.8). As the MP placed his hand back on the throttles, approximately 250-500 feet into the takeoff roll, he realized that he had not, per normal procedures, pushed the throttles to maximum (max) power after brake release (Tab V-1.8 to Tab V-1.9, Tab V-2.5). The MP pushed the throttles to max and continued the takeoff roll (Tab V-1.9).

At 1000 feet down the runway, the MP looked at the airspeed indicator to verify that the MA had met the required acceleration check speed (Tab V-1.9). Providing the throttles are advanced to max at brake release, acceleration check speed is a minimum speed for a given distance during takeoff which validates that the engines are producing the expected thrust. For the A-10C, if the acceleration check speed is not met at 1000 feet, a system malfunction is indicated and the takeoff should be aborted (Tab BB-4). The acceleration check speed indicated on the MF's line-

up card was 80 KIAS (Tab K-3). When the MP checked at 1000 feet down the runway, he noted the airspeed indicated between 50-60 KIAS (Tab V-1.9). However, due to the late push of the throttles to max power, the MP elected to continue the takeoff and check the airspeed again further down the runway (Tab V-1.9).

Between 1500-2000 feet down the runway, the MP rechecked the airspeed indicator and noted 60-70 KIAS (Tab V-1.9). The MP looked in the head up display (HUD) to verify the airspeed, but for an undetermined reason he did not see the digital airspeed readout (Tab V-1.9). At this point, the MP suspected a pitot-static system failure (Tab V-1.9). The pitot-static system takes air pressure readings from different areas on the aircraft to determine and display the airspeed. The MP believed the aircraft was traveling "a lot faster" than indicated and chose to continue the takeoff roll with the intent of rotating just past the predicted takeoff distance and rejoin with the MFL rather than attempt a high speed abort "and have hot brakes and possibly do some damage to the airplane" (Tab V-1.10). During this decision making process, the MP either stood the throttles up or pulled them to idle for "a second or less" to start an abort, but pushed them back to max once the decision to continue was made (Tab V-1.10).

Approaching the takeoff distance, approximately 4000-4500 feet down the runway, the MP checked the airspeed indicator again and saw a reading of 90-100 KIAS (Tab V-1.10). The MP expected the airspeed to remain at 60-70 KIAS throughout the takeoff due to the pitot-static failure (Tab V-1.10). Despite the indicated airspeed rise, at the same time, the MP had a contradictory visual perception that the MA was no longer accelerating. The MP concluded that the airspeed indicator was working properly and for an unknown reason the MA was unable to attain takeoff speed (Tab V-1.10). At this point, with 3000-4000 feet of runway remaining and a perceived 100 KIAS, the MP decided to abort the aircraft (Tab V-1.10). Air Traffic Controllers (ATC) and the Supervisor of Flying (SOF) who witnessed the mishap stated that the MA abort started with 3000-4000 feet remaining, but that the aircraft was "carrying a lot of speed" and "looked as if he could still probably lift off" (Tab V-3.5, Tab V-4.4, Tab V-6.3, and Tab V-7.7). An airfield surveillance camera captured the second half of the MF's takeoff/abort sequence. Analysis of the video shows the MA traveling on the runway at approximately the same speed as the MFL when reaching approximately 3000-3500 feet runway remaining (Tab S-12 and Tab AA-5). Using airfield references on the video, visual comparison of MFL and MP, and simulator modeling of the MFL's speeds after liftoff, the MA's groundspeed at the beginning of the abort was calculated at approximately 160-170 KIAS (Tab AA-3 to Tab AA-4).

The MP applied the abort procedure for the perceived airspeed of 100 KIAS, bringing the throttles to idle, extending the speed brakes fully, and applying wheel brakes for 3-4 seconds (Tab V-1.10). The MP felt "good deceleration" and came off the brakes for 1-2 seconds to avoid overheating them (Tab V-1.11). If the MA was actually travelling at 100 KIAS then these procedures would have been enough to bring the aircraft under control and stopped within the remaining runway with minimal braking required (Tab V-9.5).

If maximum braking is deemed required, minimum stopping distance is achieved with speed brakes open, throttles at idle, and wheel brakes applied with a firm continuous force sufficient to feel anti-skid cycling (Tab BB-3). With a speed of 160-170 knots, the MA, utilizing maximum braking procedures, required 2540–2790 feet to stop (Tab AA–9). Maximum braking would

have stopped the MA 800-1000 feet' short of the end of the Runway 18L, without use of the 1000 foot overrun.

The MP reapplied the wheel brakes with 1500-2000 feet remaining on the runway, but did not feel the deceleration he expected (Tab V-1.10 to Tab V-1.11). Despite maintaining brake pressure throughout the remainder of the abort roll, the MP never applied enough force to feel the anti-skid cycle and in fact indicated that "…I was wanting to let off the brakes because I didn't want it to get to that cycling" (Tab V-1.11 and Tab V-1.14).

Approaching 500 feet of runway remaining, the MP determined that the MA would not come to a stop prior to the end of the runway (Tab V-1.11). While maintaining brake pressure, the MP attempted a ninety-degree right turn using nose wheel steering in an effort to utilize the additional prepared surface of Taxiway Alpha and the Alpha Pad. Taxiway A is the perpendicular taxiway at the end of the runway and Alpha Pad its accompanying aircraft parking area (Tab S-3 and Tab V-1.11). About 30 degrees through the turn, the MP realized that the MA ground speed was too fast to successfully complete the turn (Tab V-1.11). The MP centered the nose wheel steering and evened out the brake pressure as the MA departed the runway (Tab S-3 and Tab V-1.11). As the MA left the prepared surface, the MP ejected from the aircraft (Tab V-1.11 and Tab V-8.4). The MA continued traveling over soft uneven grassland until the nose gear collapsed and the right main landing gear and MA nose became lodged into the ground (Tab H-4, Tab J-5, and Tab J-8). The lateral forces applied to the aircraft during the abrupt stop caused a catastrophic fuselage failure just forward of the right wing's leading edge (Tab J-5). The MA stopped approximately 500 feet into the grassland at a 45 degree angle off the end of the runway (Tab H-4, Tab S-3, and Tab S-9). Within minutes, the MA was engulfed in fire due to the ruptured forward main fuel tank and was destroyed (Tab J-8 and Tab V-12.3 to V-12.4).

e. Impact

All wreckage from the fire and subsequent clean-up was contained on Moody AFB, GA (Tab S-10). There was no evidence of damage to civilian property.

f. Life Support Equipment, Egress and Survival

The MP ejected from the aircraft as it departed the prepared surface at the end of the runway. The estimated MA parameters at the time of ejection placed the ejection within the MA's Advanced Concept Ejection Seat (ACES) II envelope for Mode I ejection (Tab H-6). In Mode I, the seat drogue shoot does not deploy, reducing the time required for the personnel recovery shoot to deploy and inflate (Tab H-4). The ACES II ejection sequence performed as designed (Tab H-6 and Tab V-1.11).

After ejection, the MP's parachute opened as expected with no malfunctions (Tab V-1.11). Due to the low altitude ejection, the MP was unable to complete the post ejection procedures and attain a proper parachute landing fall (PLF) position. This resulted in a hard impact of his tailbone and head with the ground (Tab V-1.11).

All egress and life support equipment appeared to function normally. All the life support equipment inspections were current at the time of the mishap (Tab H-8, Tab H-11 to Tab H-13, and Tab DD-3).

g. Search and Rescue (SAR)

Search and Rescue were not employed due to the nature of the mishap. The MP evacuated the mishap site to the north and was quickly picked up by the base wildlife biologist north of Taxiway Alpha (Tab V-1.12 and Tab V-8.5).

5. MAINTENANCE

a. Forms Documentation

The 23rd Maintenance Group, 23rd Aircraft Maintenance Squadron (AMXS), Moody AFB, Georgia, maintained the aircraft forms for the MA. Maintenance is documented on Air Force Technical Order (AFTO) 781 series forms and in the Integrated Maintenance Data System (IMDS). AFTO 781 series forms are hard copy forms used to document various maintenance actions. They are maintained in a binder that is 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 airworthiness up to the point of the mishap (Tab D-5 to Tab D-6, Tab D-17 to Tab D-18). At the time of the mishap, the MA total aircraft time was 11,598.1 hours.

A thorough review of active and historical AFTO Form 781 series aircraft maintenance forms revealed minor documentation discrepancies (Tab D-5 to Tab D-26 and Tab R-65). The detailed review of the active AFTO 781 series forms and AFTO 781 historical records revealed no evidence of mechanical, structural or electrical failure in the previous 90 days (Tab D-5 to Tab D-26). The MA flew a total of 31 sorties for 66.4 flight hours in the 30 days prior to the mishap. There were 12 discrepancies in the active AFTO 781 series forms and eight delayed discrepancies at the time of the mishap (Tab D-8 to Tab D-10, Tab D-12, Tab D-14 to Tab D-16, Tab D-26). There is no evidence that aircraft forms and documentation were relevant to this mishap.

b. Inspections

Three days prior to the mishap (7 May 2010 at 1850L) the MA had a combined Basic Post Flight/Preflight (BPO/PR) inspection accomplished (Tab D-5). The BPO is required at the end of the flying period. The PR is current for 72 hours prior to the next flight. The BPO/PR was current at the time of the mishap. A production superintendant signed an exceptional release (ER), which serves as a certification that the active forms were reviewed ensuring the aircraft is safe for flight (Tab D-5). A 30 day documents review was in-progress at the time of the mishap (D-15). Mid-shift accomplished servicing on the MA in the early morning on the day of the mishap (Tab D-6 to D-7, Tab D-11, and Tab D-15). There were no Time Compliance Technical Order (TCTO) inspections or overdue scheduled inspections (Tab D-26). The MA has flown 126.5 flight hours since the last phased inspection. A phase inspection is scheduled maintenance

regularly performed on Air Force aircraft at specific flying hour intervals. The A-10C phase inspection cycle consist of 1000 flight hours divided into two 500 flight hour phase intervals. The phase inspection was last accomplished starting on 21 January 2010 and completed on 5 February 2010 at 11,471.6 airframe hours.

c. Maintenance Procedures

Review of the MA's AFTO 781 series forms and IMDS revealed all required maintenance actions were in compliance with standard operating procedures (Tab D-5 to Tab D-6 and Tab D-17 to Tab D-18).

Protective covers are installed to protect the aircraft from potential damages by the environment, the effects of adverse weather, and foreign object ingestion. These covers are commonly referred to as -21 equipment in reference to the applicable technical order, 1A-10C-21, Chapter 1, Maintenance Safety and Protection Equipment (MSPE). There is differing testimony as to standard procedures and practices in regards to A-10C -21 cover usage prior to the mishap (Tab R-34, Tab R-64 to Tab R-65, Tab V-10.5, and Tab V-11.4). For the MA, maintenance records show that the -21 covers were installed on the same day post the MA's last flight (Tab D-10). Maintenance records also show that the MA's -21 covers were removed three days later, on the day of the mishap as the aircraft was being prepared for flight (Tab R-34). There is no evidence that maintenance procedures to the MA were relevant to the mishap.

d. Maintenance Personnel and Supervision

The training records for applicable 23 AMXS maintenance personnel were reviewed and revealed no discrepancies. All personnel had adequate training and experience (Tab R-64).

e. Fuel, Hydraulic and Oil Inspection Analysis

Analysis of the fuel and hydraulic fluid sampling indicated only trace contaminants were present (Tab U-3 to Tab U-4, and Tab U-25) Joint Oil Analysis Program (JOAP) records indicate both engines were code Alpha, a designation given when there is no adverse negative trending analysis evident that would halt continued flying operations (Tab U-7 to Tab U-25). There is no evidence to indicate that fluids were relevant to the mishap.

f. Unscheduled Maintenance

Review of AFTO 781 series forms and IMDS revealed eight unscheduled maintenance discrepancies, none of which were sufficiently urgent or dangerous to warrant its grounding or discontinued use. There is no evidence that any unscheduled maintenance task was relevant to the mishap (Tab D-8 to Tab D-9, Tab D-12, and Tab D-14).

6. AIRFRAME SYSTEMS

Overall, the aircraft suffered extensive fire damage aft of the cockpit to the front of the horizontal stabilizers. The nose gear was folded aft and the fuselage was fractured just forward of the leading edge of the right wing. The fuselage forward of the break was rotated thirty

degrees counter-clockwise away from the rest of the fuselage, as looking down at the aircraft, such that the nose of the aircraft was closer to the left wing (Tab J-4 to Tab J-7).

The components and accessories of the systems submitted for testing and tear down analysis:

a. Brake System

Both sets of brake housings were found intact and were able to be tested as a whole. There was evidence of heat build-up, but because the brakes were preserved in the mud, there was no damage to them in the post mishap fire (Tab J-9 to Tab J-10).

Cockpit Brake Assembly:
The brake rudder pedal frame and linkage were intact within the cockpit area which allowed application of a deflection force check. No binding of the pedals was noted during the check. The brake out force results would not prevent full deflection of brake pedals (Tab J-12 to Tab J-13).

Left MLG brake: The Sustainment Program Office (SPO) (OO-ALC, Hill AFB) performed tests on the left MLG brake. The brake stack compressed and released normally, no leakage of hydraulic fluid was observed (Tab J-10 to Tab J-13). Ferrous iron was discovered imbedded throughout stators indicative of hot brakes since the last brake inspection (Tab J-25 to Tab J-26). Hydraulic lines were found intact (Tab J-10).

Left MLG wheel and tire assembly: The left MLG tire had serviceable tread, no bald spots, and minimal tread separation (Tab J-9). Observation of surface scratches present on the left MLG tread indicated a sideways component to the normal direction of rotation and likely established during the final segment of ground roll on the prepared surface (Tab J-9). Runway evidence shows tire maintained pressure until it left the prepared surface (Tab J-9). One fusible plug melted due to exposure to extreme heat from fire, thereby releasing nitrogen pressure from tire (Tab J-9 to Tab J-10).

Right MLG brake: The SPO performed tests on the right MLG brake. The brake stack compressed and released normally, no leakage of hydraulic fluid was observed (Tab J-10 to Tab J-13). Ferrous iron was discovered imbedded throughout stators indicative of hot brakes since the last brake inspection (Tab J-25 to Tab J-26). Hydraulic lines were found intact (Tab J-10).

Right MLG wheel and tire assembly: The right MLG tire had serviceable tread, no bald spots, and minimal tread separation (Tab J-9). Observation of surface scratches present on the right MLG tread indicated a sideways component to the normal direction of rotation and likely established during the final segment of ground roll on the prepared surface (Tab J-9). Runway evidence shows tire maintained pressure until it left the prepared surface (Tab J-9). No fusible plugs melted (Tab J-9 to Tab J-10). It is plausible that the cooling effect of the wet mud surrounding the assembly dissipated heat rapidly enough to prevent melting of these plugs (Tab J-9).

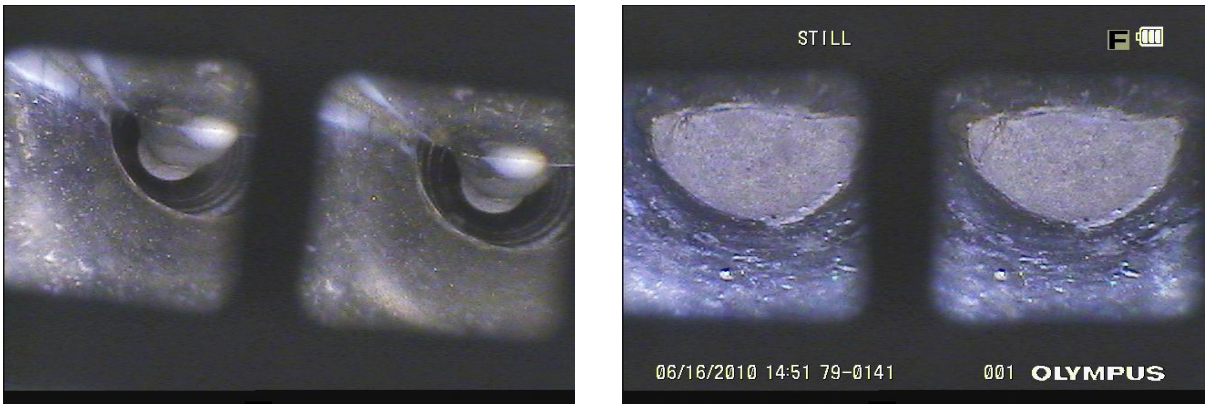
MLG wheel speed transducers: Both MLG wheel speed transducers were removed and tested for accuracy of their electrical resistance properties and determined to be within limitations (Tab J-10 to Tab J-12, Tab J-26 to Tab J-27).

b. Pitot-Static Probe

The Pitot-Static Probe is located at the tip of a four foot boom on the right wing. Its purpose is to provide pitot and static pressures for airspeed, altimeter, and vertical velocity indicators, central air data computer (CADC), altitude and air speed switches, alpha mach computer, and differential pressure switches (Tab J-17). The probe was found intact and appeared to be in normal condition. The boom was removed from the aircraft at the wing. The probe was then removed from the boom by cutting the boom from the probe. Low pressure air was applied to the pressure port and confirmed a blockage (Tab J-17 and Tab J-19). A borescope inspection was performed which validated foreign object intrusion four inches from the port opening (Tab Z-9). The inspection revealed the foreign object to be comprised of a light brown, granular composition resembling soil (Tab Z-9 to Tab Z-10).

Exterior view of pitot probe from MA.

Borescope inspection being accomplished.



New pitot tube (left) compared with blocked pitot tube from MA (right).

If the foreign object allows absolutely zero air to pass through the pitot port on the probe, then the air speed indications would not move from the baseline. If the blockage has some fraction of

permeability, then the pressure from the aft side of the blockage will eventually equalize and an airspeed will be indicated (Tab AA-7).

The MA returned from Nellis AFB on Friday, 7 May 2010. Aircraft covers (-21) were installed on 7 May 2010 (Tab D-10). The Sunday mid-shift supervisor testimony states that the pitot tube cover was already in place when his shift began (Tab V-10.1). The -21 covers were removed while servicing the aircraft during mid-shift prior to the mishap (Tab R-34). The launch crew chief came in on day-shift on the day of the mishap. When he arrived at the mishap aircraft the pitot tube cover had already been removed (Tab V-11.1).

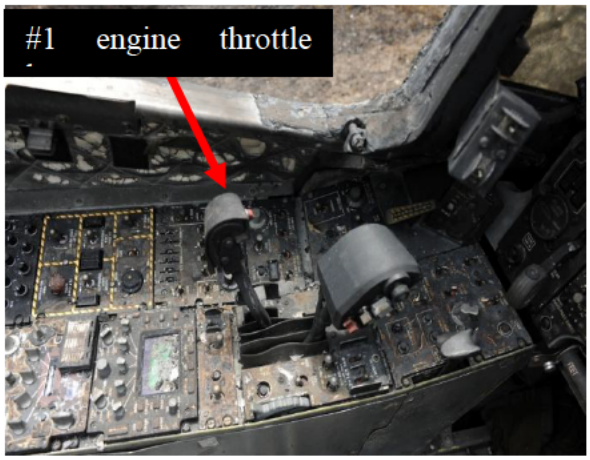
c. Mishap Engines

The MA is powered by two high-bypass turbofan General Electric TF34-GE-100A engines mounted in individual nacelles located on the aft fuselage. Each engine is capable of producing approximately 8,900 lbs of thrust. The number one engine (left engine) serial number 205635 had 10,641.6 hours total engine operating time. The number two engine (right engine) serial number 206246 had 7,879.6 hours total engine operating time (Tab D-23).

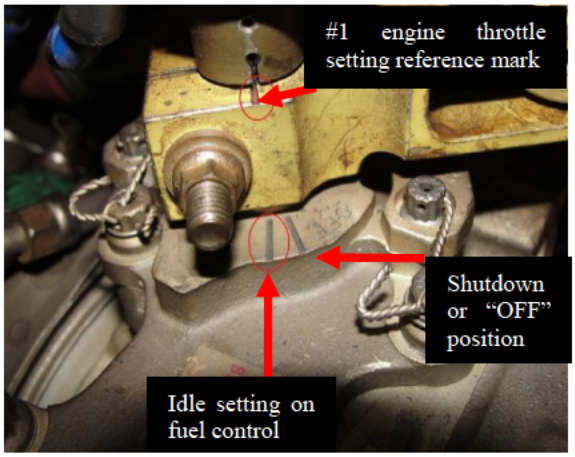
#1 Engine post-mishap findings: Physical evidence and witness testimony confirms the #1 engine continued to run after the MA came to rest (Tab V-8.6). A white swirling effect coupled with bluing on the engine's fan blades is indicative of having ingested extreme heat after the MA caught on fire (Tab J-14). A borescope inspection found similar excess heat indicators on variable inlet guide vanes (VG's) and compressor section which is comprised of a compressor stator, compressor rotor, and a variable vane system. There were heavy soot deposits noted inside the engine cowlings (Tab J-6). The borescope inspection found heavy soot deposits caked onto internal components. An eye-witness from the Fire Department detailed how the engine was intermittently thrusting and he heard a distinctive "woomp, woomp" sound suggesting the ingestion of fuel vapors into the running engine (Tab V-13.1). There was no Foreign Object Damage (FOD) to fan blades or internal components (Tab Z-10 to Tab Z-11). Post-mishap the #1 engine throttle in the cockpit was examined and found to be in the "idle" position (Tab J-13). The Power Lever Angle (PLA) linkage on the engine fuel control also confirms the engine setting was at "idle."

White swirling and bluing on fan blades.

Heavy soot evident inside engine cowlings.



#1 engine throttle positioning.

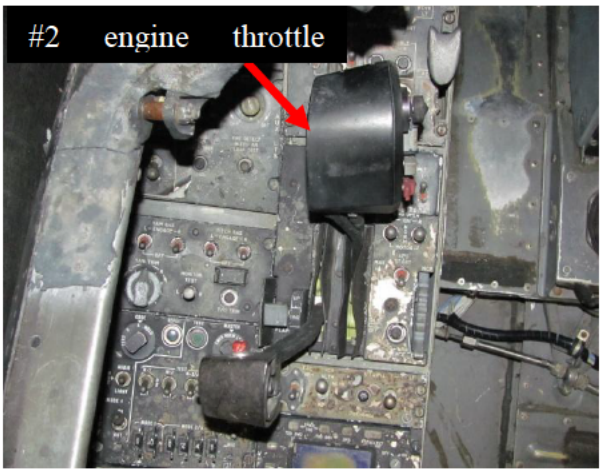


#1 engine PLA throttle linkage in idle position.

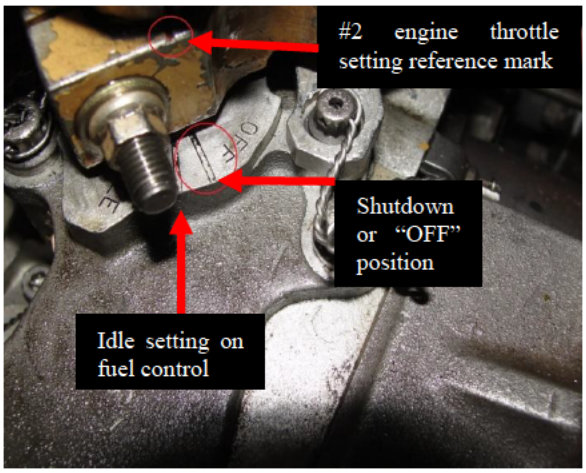
#2 Engine post-mishap findings: Physical evidence and eye-witness testimony confirm the #2 engine shutdown prior to the post mishap fire (Tab V-13.3 to Tab V-13.4). The shutdown occurred due to right side fuselage separation, subsequently stretching the throttle cable until eventual failure (Tab J-13). This failure likely forced the PLA linkage on the fuel control to "cutoff" which immediately stopped fuel flow to the engine (Tab J-14). The stretching of the throttle cable during the fuselage separation accounts for the #2 engine throttle being found in the "max" position (Tab J-13). A borescope inspection was accomplished on VG's and compressor section. This examination revealed light soot deposits on internal components (Tab Z-10 to Tab Z-11). There was no foreign object damage to fan blades or internal components (Tab Z-10 to Tab Z-11). The inspection found light soot deposits on fan blades, engine cowlings, and almost no soot deposits on upper areas of the cowlings (Tab J-6). There were no swirling effects or bluing on fan blades (Tab J-14).

No swirling or bluing, light soot on fan blades.

#2 engine cowlings with light soot residue.



#2 engine throttle positioning.



#2 engine PLA throttle linkage at cut-off.

7. WEATHER

a. Forecast Weather

The 23 OSS weather flight provided the mission execution forecast (MEF) for Moody AFB, on 10 May 2010. Winds were expected to be from 120 degrees (approximately SE) at ten knots with a temperature of 28° C (82° F). Anticipated visibility was 7 statute miles with clear skies (Tab F-6 to F-7).

b. Observed Weather

Following the mishap, the 23 OSS recorded the observed weather for Moody AFB, on 10 May 2010, at 1709L. Winds were from 110 degrees at ten knots with few clouds at 7,000 feet and 10 statute miles visibility. The term "few" refers to cloud layers that cover less than 25% of the sky. The temperature measured 29° C with a dew point of 13° C and air density pressure of 30.14 inches of mercury (Tab F-13).

c. Space Environment

Not applicable.

d. Operations

Weather was within operational parameters.

8. CREW QUALIFICATIONS

a. Training

The MP is a fully qualified A-10C Instructor Pilot (IP) (Tab G-3). All necessary flight currencies were up-to-date and all required training for the planned mission was current in-accordance with AFI 11-2A-OA-10, Volume 1, *Flying Operations, A/OA-10 Aircrew Training*,

dated 31 August 2006 (Tab G-7 to Tab G-18). On 19 March 2009, the MP performed his most recent instrument qualification in the A-10C and completed his mission qualification on 6 October 2009 (Tab G-50 to Tab G-51).

b. Experience

The MP is a Command Pilot with 3637.2 hours of military flying time prior to the mishap. Of this total, the MP had 2680.3 hours of primary A-10 time, with 788.5 hours as an A-10 IP, and 122.1 hours as an A-10 Evaluator Pilot (Tab G-19 to Tab G-20). The MP is an experienced combat pilot, logging 111.5 combat hours, and is a graduate of the A-10 Weapons Instructor Course (WIC) (Tab G-19 and Tab V-1.2).

The MP had flown five sorties in the two weeks prior to the mishap (Tab G-22). The MP flew his latest sortie on 7 May 2010, three days prior to the mishap (Tab G-22).

The MP's flight time during the 90 days before the mishap is as follows:

	Hours	Sorties
Last 30 Days	16.3	9
Last 60 Days	16.3	9
Last 90 Days	28.6	17

(Tab G-6 and Tab G-22)

9. MEDICAL

a. Qualifications

The MP was medically qualified to perform A-10C flying duties at the time of the mishap. The MP's annual Preventative Health Assessment (PHA) was current and review of the Aeromedical Information and Medical Waiver Tracking System (AIMWTS) database showed one approved and current medical waiver. Furthermore, the MP had no physical or medical restrictions and was worldwide qualified prior to the mishap.

b. Health

The MP medical records, both hard copy and the electronic system Armed Forces Health Longitudinal Technology Application (AHLTA 3.0), were reviewed. According to the PHA on 18 May 2009, the MP was medically cleared for continued flying duties with glasses. Of note, the MP's most current PHA performed about one month after the mishap revealed a mild change in near vision requiring bifocals. This new prescription however, does not appear to be a factor in the mishap.

c. Toxicology

Immediately following the mishap, toxicology testing was conducted by the Interim Safety Board (ISB) for all persons involved including the MP, MFL, SOF, Air Crew Flight Equipment (AFE) personnel, and 28 maintainers. The blood and urine samples were submitted to the Armed Forces Institute of Pathology for toxicology analysis of carbon monoxide and ethanol levels in the blood and to detect for any traces of drugs in the urine to include amphetamines, barbiturates, benzodiazepines, cannabinoids, cocaine, opiates, and phencyclidine.

The toxicology samples arrived at the Armed Forces Institute of Pathology in good condition. The results were universally negative for all members tested to include the MP.

d. Lifestyle

The MP's lifestyle had no indication of unusual stresses, behaviors, or habits (Tab V-1.3, Tab V-2.6, and Tab V-9.3). Of note, the MP was scheduled to change duty stations in the following month to Hickam AFB, Hawaii. There is no indication that the moving process contributed to an increase in stress level of any significance.

e. Crew Rest and Crew Duty Time

All aircrew are required to have proper crew rest prior to performing flying duties as outlined in AFI 11-202 Vol 3. Proper crew rest is defined as a minimum of 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 8 hours of uninterrupted sleep. The MP met crew requirements. Although only 5-6 hours of sleep occurred the night prior to the mishap, a "well rested" state was recalled. Furthermore, 5-6.5 hours of sleep appears to be a normal amount of sleep for the MP (Tab V-1.4).

10. OPERATIONS AND SUPERVISION

a. Operations

Three days prior to the mishap, the 75 FS had returned from Nellis AFB, Nevada after a month long deployment supporting the USAF WIC training syllabus. The mishap occurred during the first fly period after the unit redeployment. The overall operations tempo was fairly robust but considered typical of an A-10C squadron (Tab V-1.3, Tab V-2.3, Tab V-7.3, Tab V-9.2, Tab V-10.3, and Tab V-11.3). The 72 hour and 14 day histories from the 28 maintainers support a manageable workload. In the six months prior to the mishap, the MP functioned as the Deputy Maintenance Group Commander (23 MXG/CD). In that capacity the MP was not assigned within the 75 FS but flew as an "attached" flyer. The workload of the 23 MXG/CD was considered reasonable for an experienced operational aircrew member. (Tab V-1.3)

b. Supervision

Operations supervision at the squadron, group, and wing level were fully engaged (Tab V-1.3, Tab V-2.3, and Tab V-9.2). The 75 FS has an active Operational Risk Management (ORM) program (Tab K-34 to Tab K-37, Tab V-1.5 to Tab V-1.6, and Tab V-2.5). Prior to each flight brief, pilots assess their risk factors (ORM) for the mission to be flown. Both the MFL and MP self-assessed their participation in this mission as "Low Risk." Additionally, just prior to the pilots stepping to the aircraft, the Ops Sup (on-duty squadron supervisor overseeing all daily missions) reviewed and validated the MF's individual and overall mission assessment (Tab K-34 to Tab K-37).

Testimony reveals that Ops/Maintenance relationship was strong and that no undue pressure existed from Ops to launch aircraft. (Tab V-10.3, Tab V-10.5 to Tab V-10.6, and Tab V-11.3). With respect to the flight line, within maintenance, there is differing testimony as to standard procedures and practices in regards to A-10C -21 cover usage prior to the mishap (Tab R-34, Tab R-64 to Tab R-65, Tab V-10.5, and Tab V-11.4). For the MA, maintenance records show that the -21 covers were installed on the same day post the MA's last flight (Tab D-10). Maintenance records also show that the MA's -21 covers were removed three days later, on the day of the mishap as the aircraft was being prepared for flight (Tab R-34).

11. HUMAN FACTORS

The Department of Defense Human Factors Analysis and Classification System (DoD-HFACS) is comprised of a list of potential human factors that can be contributory or causal to a mishap. A total of five human factors were identified and described below for this mishap: decision-making during operation, misperception of operational conditions, task misprioritization, distraction, and procedural error.

a. Decision-Making During Operation (AE206)

Decision-Making During Operation is a factor when the individual, through faulty logic, selects the wrong course of action in a time-constrained environment.

(1) Decision to continue takeoff without acceleration check speed met

The MF's line-up card shows that 80 KIAS was the calculated speed necessary to achieve as the aircraft arrives at 1000 feet down the runway (Tab K-3). If the check speed is not met, the procedure is to abort the takeoff (Tab V-7.10 and BB-4). The MP noted that, "At 1000 feet I checked the airspeed which is the procedure where you check our acceleration speed. The airspeed indicator indicated between 50 and 60 knots. I thought to myself, ok, this is because you failed to push the throttles all the way to max at first. Check it again when you get down a little bit further" (Tab V-1.9). The decision to continue the takeoff roll with a new non-standard check speed distance is not in accordance with established procedure (Tab V-7.10 and BB-4).

(2) Decision to continue takeoff with suspected pitot-static failure

The MP suspected pitot-static failure 2000-3500 feet down the runway. At this point, the MP rationalized that he would rather not abort and "…have hot brakes and possibly do some damage

to the airplane" (Tab V-1.10). With this perception, the MP continued with the takeoff. During his decision making process, the MP either stood the throttles up or pulled them to idle for "a second or less" to start an abort, but pushed them back to max once the decision to continue was made (Tab V-1.10). This decision to continue ultimately resulted in the MA traveling down the runway at an estimated 160-170 knots without the MP having definitive airspeed data available to him (Tab AA-5).

b. Misperception of Operational Conditions (PC504)

Misperception of Operational Conditions is a factor when an individual misperceives or misjudges altitude, separation, speed, closure rate, road/sea conditions, aircraft/vehicle location within the performance envelope or other operational conditions and this leads to an unsafe situation.

Approaching the takeoff distance, about 4000 feet down the runway, the MP rechecked the airspeed indicator and saw a reading of 90-100 KIAS (Tab V1.9 to Tab V-1.10). Despite the indicated airspeed rise, at the same time, the MP had a contradictory visual perception that the MA was no longer accelerating. The MP concluded that the airspeed indicator was working properly and for an unknown reason the MA was unable to attain takeoff speed (Tab V-1.10). With 3000-4000 feet of runway remaining and a perceived 100 KIAS, the MP decided to abort the aircraft (Tab V-1.10). As noted previously, the MA's actual speed at this time was approximately 160-170 knots. The MP's underestimation of the MA's actual airspeed led to the MP applying insufficient braking for the actual conditions.

c. Task Misprioritization (AE202)

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

The briefed takeoff interval was 20 seconds. The MP realized that he forgot to don his glasses after the MFL initiated his takeoff roll. By the time the MP retrieved his glasses from the saddlebag he noticed the time was 19 seconds. The MP then misprioritized the need to proceed with his brake release precisely at 20 seconds instead of taking additional time to fully complete the immediate task of putting on his glasses. In retrospect, the MP stated, "In my mind, if I had my glasses on when they should have been on this never would have happened. I would have realized at 1000 feet that I didn't have the airspeed indicator and I would have aborted right there" (Tab V-1.15).

d. Distraction (PC106)

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

The MP's task of donning his glasses at an atypical time in the pre-takeoff routine contributed to the MP's inappropriate redirection of attention from the required task of advancing the throttles to max at brake release (Tab V-1.8 and V-1.15).

e. Procedural Error (AE103)

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.

In accordance with A-10C procedure, if maximum braking is required during an abort, minimum stopping distance can be achieved in a three-point attitude, throttles idle, speed brakes full open, and wheel brakes applied with a firm continuous force sufficient to feel anti-skid cycling (Tab BB-3).

According to MP testimony, with 1500-2000 feet runway remaining he felt that the MA braking action was insufficient and that stopping distance was critical. He stated that "as I got back on the brakes. I didn't feel a good deceleration like I had before. In fact I felt very minimal to none if any at all." Approaching 500 feet remaining the MP realized that, "…I'm not going to get it stopped even by the end of the overrun" (Tab V-1.11).

When the MP was asked about whether he recalled feeling anti-skid cycling during the abort he stated, "No, I did not" (Tab V-1.11). When asked what gave the MP the impression that the anti-skid had not cycled he further elaborated, "I felt it cycle before on other aborts, not necessarily a high speed abort, but I have had to abort on takeoff rolls before and I felt it cycle. I used to be a functional check flight pilot, FCF pilot, and I've felt that before. I don't recall feeling it cycling on this. Since I was doing the abort, I was feeling that and I was wanting to let off the brakes because I didn't want it to get to that cycling" (Tab V-1.14).

12. GOVERNING DIRECTIVES AND PUBLICATIONS

a. Primary Operations Directives and Publications

1. Air Force Instruction (AFI) 11-2A/OA-10, Volume (Vol) 1, A/OA-10—*Aircrew Training*, 31 August 2006
2. AFI 11-2A/OA-10, Vol 2, A/OA-10—*Aircrew Evaluation Criteria*, 16 November 2005
3. AFI 11-2A/OA-10, Vol 3, A/OA-10—*Operations Procedures*, 11 February 2002, and 23 FG Supplement dated 23 August 2007
4. AFI 11-202, Vol 3, *General Flight Rules*, 5 April 2006
5. AFI 51-503, *Aerospace Accident Investigations*, 26 May 2010
6. T.O. 1A-10C-1SS-11, *Flight Manual, USAF Series A-10C Aircraft*, 10 March 2010

b. Maintenance Directives and Publications

1. AFI 21-101, *Aircraft and Equipment Maintenance Management*, 12 April 2010
2. T.O. 1A-10C-2-1-1, *General Equipment Manual*, 1 May 2010
3. T.O. 1A-10C-21, *Aircraft Inventory Record Master Guide*, 1 May 2010
4. T.O. 00-20-1, CAF SUP 1, *Aerospace Equipment Maintenance Inspection, Policies, and Documentation Procedures*, 14 November 2007

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

c. Known or Suspected Deviations from Directives or Publications

No known or suspected deviations occurred which contributed to this aircraft accident.

13. ADDITIONAL AREAS OF CONCERN

No additional areas of concern contributed to this aircraft accident.

28 June 2010

BRYAN K. TURNER, Colonel, USAF
President, Accident Investigation Board

STATEMENT OF OPINION
A-10C, T/N 79-0141 ACCIDENT
10 MAY 2010

Under 10 U.S.C. 2254(d), any opinion of the accident investigators 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 10 May 2010 at 1655 local time, A-10C tail number 79-0141, call sign EASY 02, departed the right edge of runway 18L when the MP did not successfully stop the aircraft during an aborted takeoff. As the MA departed the runway, the MP ejected and sustained only minor injuries. The MA continued traveling 500 feet over soft uneven grassland until the nose gear collapsed and the right main landing gear and MA nose became lodged into the ground. This caused a catastrophic fuselage failure just forward of the right wing's leading edge. Within minutes, the MA was engulfed in fire due to the ruptured forward main fuel tank.

After extensive interviews, video evidence, simulator modeling, and the expertise, experience and opinion of the AIB members, I found clear and convincing evidence that the cause of the mishap was human factor error. Specifically, the MP's initial decision not to abort the takeoff, and then once the decision to abort was made, the MP applying an inappropriate braking procedure that was based on his perception of being at a lower airspeed. Additionally, I found by a preponderance of the evidence, that the pitot-static system blockage, task misprioritization, distraction, and procedural error were substantially contributing factors to the mishap.

The MF's crew rest, mission planning, briefings and step to the aircraft were uneventful. Due to a TEMS malfunction, the MP was forced to ground abort at EOR and return to the chocks with his first aircraft. The MFL (EASY 01) opted to takeoff single ship with the plan of joining up with the MP after returning from the first sortie. The MP returned to the 75 FS Operations building for 45 minutes before stepping out to the MA. MA ground operations were unremarkable and the MF rejoined in the arming area just prior to takeoff. At 1651:49L, Moody Tower cleared EASY 01 flight to cross Runway 18R and taxi into position and hold on Runway 18L. At 1653:27L, EASY 01 flight was cleared for takeoff. After engine run-up, the MFL released brakes and performed an uneventful takeoff.

The MP decided early in his takeoff roll to continue takeoff without meeting acceleration check speed and with indications of pitot-static system failure. These factors directly contributed to the MP's underestimation of the MA's actual speed when the MP started the abort with only 3500 feet of runway remaining.

2. DISCUSSION OF OPINION

a. Cause

1. Decision-Making During Operations

As indicated in MP testimony, there were two major decision points at which the MP had the opportunity to recognize the pitot-static system malfunction and abort the takeoff. The first being a procedural decision point at 1000 feet down the runway. After not meeting acceleration check speed at 1000 feet, the MP decided to move the acceleration check speed procedure to a non-standard distance further down the runway. The MP based this decision on his late push of throttles to max upon brake release. Although seemingly a low-risk decision, this led to the MP checking the airspeed at, or past, the point where he felt comfortable to abort the MA despite recognition of the pitot-static failure.

Second, when the MP rechecked his airspeed at his modified acceleration checkpoint (1500-2000 feet down the runway) he correctly surmised a pitot-static system failure. The MP based this conclusion on the grounds that there was no significant increase in speed from the first check and that perceptually he thought he was traveling at a much faster speed. The MP's apprehension to abort and "…have hot brakes and possibly do some damage to the airplane" led him to decide to continue his takeoff run. Witness testimony and simulator profiles indicate that an abort at speeds up to takeoff speed, with the runway distance remaining at that time (approximately 6000 feet), can be completed with minimal wheel braking required.

The decision to continue the takeoff without acceleration check speed met and with a suspected pitot-static system failure put the MP in the position where he neither had the ability to assess takeoff airspeed nor had the means to validate a required takeoff distance. I find by clear and convincing evidence that had the MP aborted at either of these critical decision points, the mishap would have been averted.

2. Misperception of Operational Conditions

Approaching takeoff distance, approximately 4000 feet down the runway, the MP rechecked the airspeed indicator and saw a reading of 90-100 KIAS. Despite the indicated airspeed rise, at the same time, the MP had a contradictory visual perception that the MA was no longer accelerating. The MP concluded that the airspeed indicator was working properly and for an unknown reason the MA was unable to attain takeoff speed. With 3000-4000 feet of runway remaining and a perceived 100 KIAS, the MP decided to abort the aircraft.

Eyewitness testimony states that the MA was traveling at takeoff speed or greater at the point of the abort. Video evidence supports that at the MP's abort decision (3500 feet of runway remaining) the MA was traveling at approximately 160-170 knots. Even at these airspeeds, the brakes were within their normal limits to stop the MA within the remaining runway. I find by clear and convincing evidence that this misperception ultimately led the MP to apply insufficient braking for the actual conditions which caused the mishap.

b. Contributing Factors

I find by a preponderance of evidence that each of the following four human factors substantially contributed to the mishap: pitot-static system blockage, task misprioritization, distraction, and procedural error.

(1) Pitot-Static System Blockage

The pitot-static system blockage directly contributed to the MP's decision-making process and misperception of airspeed at the time of the abort. In particular, the unexpected airspeed rise between the decision to continue the takeoff and the decision to abort weighed heavily into his perception that the airspeed indicator was correct.

(2) Task Misprioritization (AE202)

The MP misprioritized the need to proceed with his brake release precisely at 20 seconds instead of taking additional time to fully complete the immediate task of putting on his glasses. This led to the MP's late push of throttles to max power and resulted in the decision to proceed past the normal acceleration check speed point. This decision invalidated acceleration check speed which is when the MP would have had the first opportunity to recognize an engine thrust deficiency and/or a pitot-static system anomaly.

(3) Distraction (PC106)

The MP's task of donning his glasses at an atypical time in the pre-takeoff routine contributed to the MP's inappropriate redirection of attention from the required task of advancing the throttles to max at brake release.

(4) Procedural Error (AE103)

In the last 1500-2000 feet of the abort the MP became keenly aware that the MA was not decelerating as expected. In my opinion, based on the MP testimony and braking distance analysis, the MP either did not apply sufficient brake pressure to reach the anti-skid cycle or was releasing brake pressure if he felt the anti-skid begin to cycle. Without precise MA airspeed data during the last 2000 feet of the abort, it cannot be determined whether the maximum braking procedure would have stopped the MA on the prepared surface. However, it is logical to deduce that not reaching the anti-skid cycle during braking would have increased the MA required stopping distance.

28 June 2010

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