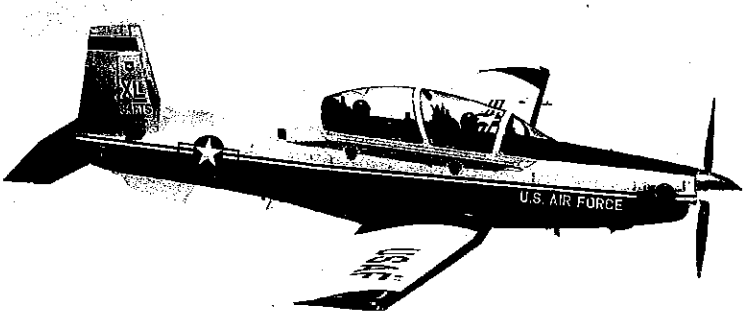
UNITED STATES AIR FORCE
AIRCRAFT ACCIDENT INVESTIGATION
BOARD REPORT

T-6A, TEXAN II, T/N 08-3925

84TH FLYING TRAINING SQUADRON
47TH FLYING TRAINING WING
LAUGHLIN AIR FORCE BASE, TEXAS



ACCIDENT LOCATION: LAUGHLIN AIR FORCE BASE, TEXAS

DATE OF ACCIDENT: 24 SEPTEMBER 2010

BOARD PRESIDENT: COLONEL BRADLEY K. MCCOY

Conducted IAW Air Force Instruction 51-503

EXECUTIVE SUMMARY

AIRCRAFT ACCIDENT INVESTIGATION

T-6A TEXAN II, T/N 08-3925
LAUGHLIN AIR FORCE BASE, TEXAS
24 SEPTEMBER 2010

On 24 September 2010, a T-6A, Tail Number 08-3925, assigned to the 84th Flying Training Squadron, 47th Flying Training Wing, Laughlin Air Force Base (LAFB) Texas, crashed after the engine suffered severe damage during an airstart attempt. The crash occurred at 1115 local Central Daylight Time on a ranch 20 miles east of LAFB. The mishap aircraft (MA) was destroyed following aircrew ejection. The Mishap Student Pilot (MSP) suffered a significant back injury as well as minor injuries and the Mishap Instructor Pilot (MIP) suffered minor injuries.

The mishap occurred during a Joint Specialized Undergraduate Pilot Training formation sortie for the MSP who occupied the front cockpit. Upon return to base, approximately 57 minutes into the sortie and 4,900 feet above ground level (AGL), the MSP executed a straight-ahead rejoin with too much speed. The MIP assumed control of the aircraft, inadvertently raised the engine cut-off gate handle, and pulled the [throttle] Power Control Lever (PCL) into the OFF position. The MIP immediately pushed the PCL above IDLE where the engine recovered to normal operation. However, due to misperception of engine status, the MIP shut down the functioning engine again. The MIP did not correctly execute appropriate restart procedures, which led to an unsuccessful airstart. Following engine shutdown for the third time, the MIP applied the correct Immediate Airstart procedures until he incorrectly advanced the PCL above IDLE while the engine was still in a sub-idle condition. This forced excessive fuel to the engine, which led to an extreme heat condition severely damaging the engine and rendering it unrecoverable. The following five airstart attempts were unsuccessful due to this engine damage. The mishap crew (MC) missed the opportunity to make a forced landing at a suitable airfield, and the MIP initiated ejection at 580 feet AGL. The MA was destroyed resulting in a mishap cost of $5,011,287.84. The MA impacted a field, causing incidental damage to a barbed wire fence on private property. A local rancher, flying a helicopter nearby, was on scene within minutes to offer assistance.

The Accident Investigation Board President (AIBP) found by clear and convincing evidence, the cause of this mishap was pilot error. The MIP induced severe engine damage due to inadvertent shutdown of a normal engine followed by procedural errors to restart the engine. In addition, the MC missed the opportunity to attempt a forced landing at a suitable airfield. The AIBP also found by a preponderance of the evidence that the mishap crew's channelized attention on the engine, delayed the decision to reach a suitable airfield.

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
T-6A TEXAN II, T/N 08-3925
24 SEPTEMBER 2010

TABLE OF CONTENTS

COMMONLY USED ACRONYMS AND ABBREVIATIONS

°	Degree
1Lt	First Lieutenant
19 AF	19th Air Force
2 Lt	Second Lieutenant
47 FTW	47th Flying Training Wing
47 OG	47th Operations Group
84 FTS	84th Flying Training Squadron
AETC	Air Education and Training Command
AF	Air Force
AFB	Air Force Base
AFE	Aircrew Flight Equipment
AFI	Air Force Instruction
AFIP	Air Force Institute of Pathology
AFTO	Air Force Technical Order
AGL	Above Ground Level
AIB	Accident Investigation Board
AIBP	Accident Investigation Board President
ATIS	Automatic Terminal Information Service
BINGO	Minimum Fuel Required to Head Home
BIP	Buddy Instructor Pilot/Program
BPO/PR	Basic Post or Pre-Flight Inspection
C	Celsius
Capt	Captain
CFS	Canopy Fracture System
Col	Colonel
COMMS	Communications
CDT	Central Daylight Time
CST	Central Standard Time
DE	Dental Examination
DME	Distance Measuring Equipment
EP	Emergency Procedures
ET	Extended Trail
FCIF	Flight Crew Information Files
FTW	Flying Training Wing
G	Force of Gravity
GLOC	Gravity Induced Loss of Consciousness
GPS	Global Positioning System
HPO	Hourly Post Flight Inspection
IAW	In Accordance With
IDARS	Integrated Data Acquisition Recording System
ICS	Intercommunication Systems
IFE	Inflight Emergency
IMC	Instrument Meteorological Conditions
IMDS	Integrated Maintenance Data System
IP(s)	Instructor Pilot(s)
ISB	Interim Safety Board
ITT	Inlet/Interstage Turbine Temperature
JSUPT	Joint Specialized Undergraduate Pilot Training
KIAS	Knots Indicated Air Speed
L	Local
LPU	Life Preserver Unit
Lt Col	Lieutenant Colonel
MA	Mishap Aircraft
Maj	Major
MC	Mishap Crew
ME	Mishap Engine
MOA	Military Operating Area
MOC	Maintenance Operations Control
MIP	Mishap Instructor Pilot
MQT	Mission Qualification Training
MSgt	Master Sergeant
MSL	Mean Sea Level
MSP	Mishap Student Pilot
N_1	Gas generator speed
Nav	Navigation
NM	Nautical Miles
NOTAMS	Notices to Airmen
Np	Propeller Speed
OBOGS	On Board Oxygen Generating System
OG	Operations Group
Ops	Operations
Overtemp	Over Temperature
PCL	Power Control Lever
PHA	Periodic Health Assessment
PIT	Pilot Instructor Training
PLF	Parachute Landing Fall
PMU	Power Management Unit
RAPCON	Radar Approach Control
RPM	Revolutions Per Minute
RTB	Return to Base
SA	Situational Awareness
SAR	Search and Rescue
SIMS	Simulations
SM	Statute Miles
SOF	Supervisor of Flying
Sortie	Flight
SP	Student Pilot
SUP	T-6 Supervisor
T.C.T.O.	Time Compliance Technical Order
T/N	Tail Number
T.O.	Technical Order
TSgt	Technical Sergeant
UHF	Ultra High Frequency
U.S.	United States
USAF	United States Air Force
USAFA	United States Air Force Academy
VFR	Visual Flight Rules

VHF or Victor Frequency	Very High Frequency	VORTAC	VHF Omnidirectional Range/Tactical Aircraft Control
VMC	Visual Meteorological Conditions		

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 15 October 2010, Lieutenant General Douglas H. Owens, Vice Commander, Air Education and Training Command (AETC), appointed Colonel Bradley K. McCoy to convene an aircraft accident investigation under Air Force Instruction (AFI) 51-503 of the 24 September 2010 crash of a T-6A aircraft, tail number (T/N) 08-3925, near Laughlin Air Force Base (LAFB), Texas (TX). The investigation was conducted at LAFB, TX from 25 October 2010 to 9 November 2010. Technical advisors were Lieutenant Colonel (Lt Col) Anthony Waldroup, Medical Member (MM), Captain (Capt) Nicholas Carter, Legal Advisor (LA), First Lieutenant (1Lt) Christopher Brown, Pilot Member (PM), Mister (Mr.) Bill Pyle, Maintenance Member (MXM), Master Sergeant (MSgt) Brian Cawvey, Court Reporter (CR), Technical Sergeant (TSgt) Andrea Evans, Recorder (REC), Mister (Mr.) Ross Mills, Engine Functional Area Expert (EFAE), and Mr. Mike Lo Bue, Life Support Functional Area Expert (LSFAE). (Tab Y-3 thru Y-17)

b. Purpose

This is a legal investigation convened to inquire into the facts surrounding the aircraft or aerospace accident, to prepare a publicly-releasable report, and to gather and preserve all available evidence for use in litigation, claims, disciplinary actions, administrative proceedings, and for other purposes.

2. ACCIDENT SUMMARY

On 24 September 2010, the Mishap Aircraft (MA), a T-6A, Tail Number (T/N) 08-3925, was destroyed as the Mishap Instructor Pilot (MIP), Capt Nicholas Brumgard, and the Mishap Student Pilot (MSP), Second Lieutenant (2Lt) Joseph Eastman ejected from the MA near LAFB. (Tab H-11) The MIP sustained minor injuries and the MSP suffered a significant back injury and minor injuries. The MA, MIP, and MSP were assigned to the 47th Flying Training Wing (47 FTW) at LAFB. (Tab B-3) The MIP and MSP were flying a formation training mission designed to introduce the MSP to formation fundamentals in the T-6. (Tab BB-6) The MA was destroyed resulting in a mishap cost of $5,011,287.84. (Tab P-1) The MA impacted a field causing incidental damage to a barbed wire fence on private property. (Tab P-2)

3. BACKGROUND

a. Air Education and Training Command (AETC)

AETC is one of nine major commands in the USAF. AETC, with headquarters at Randolph AFB near San Antonio, TX, provides basic military training, initial and advanced technical training, flying training, and professional military and degree-granting professional education. AETC's role makes it the first command to touch the life of almost every Air Force member. AETC's mission is to develop America's Airmen today...for tomorrow. (Tab CC-3 thru CC-8)

b. 19th Air Force (19 AF)

19 AF is responsible for managing all flying training within AETC. It ensures compliance with AETC's policies and instructions through clear, concise execution guidance to subordinate units. 19 AF also conducts annual air crew Standardization and Evaluation visits to its units to assess the effectiveness of its training programs. 19 AF includes 25 active duty training units and has operational oversight over three Air National Guard units. It commands more than 31,000 personnel and operates over 1,800 aircraft of 21 different models flying more than 580,000 hours annually. (Tab CC-9 thru CC-12)

c. 47th Flying Training Wing (47 FTW)

47 FTW commands a flying operation which exceeds 105,000 flying hours and 90,000 sorties per year. It is composed of more than 1,300 military personnel, 1,124 civilian employees and a total base community exceeding 4,200 people. (Tab CC-13)

d. 47th Operations Group (47 OG)

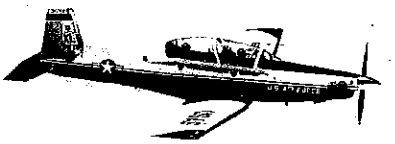
47 OG is responsible for training U.S. Air Force and allied nation pilots under the Joint Specialized Undergraduate Pilot Training Program (JSUPT). The group provides management, control and standardization/evaluation of all aspects of flying training operations and airfield management at LAFB. The group consists of five flying squadrons and a support squadron. (Tab CC-15 thru CC-16)

e. 84th Flying Training Squadron (84 FTS)

The 84 FTS together with the 85 FTS fly the T-6A Texan II to provide student pilots the fundamentals of aircraft handling, instrument, formation, low-level, navigation and night flying. The training provided by these instructors forms the basic flight skills crucial to a student's flying career. Following primary training in the T-6A, students are selected for either the airlift/tanker track flying the T-1A Jayhawk, the fighter-bomber track flying the T-38C Talon, the turboprop aircraft track flying the T-44 King Air at Naval air Station Corpus Christi, TX, or the helicopter track flying the UH-1 Huey at Fort Rucker, Alabama. (Tab CC-17)

f. T-6A Texan II

The T-6A Texan II was a single-engine, two-seat primary trainer designed to train JSUPT students in basic flying skills common to U.S. Air Force and Navy pilots. The T-6A is used to teach JSUPT students the basic skills necessary to progress to one of four training tracks: the Air Force bomber-fighter or the Navy strike track, the Air Force airlift-tanker or Navy maritime track, the Air Force or Navy turboprop track and the Air Force-Navy helicopter track. The T-6A Texan II is produced by Hawker Beechcraft Corporation. Stepped-tandem seating in the single cockpit places one crewmember in front of the other, with the student and instructor positions being interchangeable. A pilot may also fly the aircraft alone from the front seat. Pilots enter the T-6A cockpit through a side-opening, one-piece canopy that has demonstrated resistance to bird strikes at speeds up to 270 knots. (Tab CC-19 thru CC-20)



The T-6A has a Pratt & Whitney Canada PT6A-68 turbo-prop engine that delivers 1,100 horsepower. Because of its excellent thrust-to-weight ratio, the aircraft can perform an initial climb of 3,100 feet (ft) (944.8 meters) per minute and can reach 18,000 ft (5,486.4 meters) in less than six minutes. The aircraft is fully aerobatic and features a pressurized cockpit with an anti-G system, ejection seat and an advanced avionics package with sunlight-readable liquid crystal displays.

4. SEQUENCE OF EVENTS

a. Mission

The mishap crew (MC), consisting of the MIP in the rear cockpit and the MSP in the front cockpit, was performing a basic formation sortie. (Tab V-6.3 thru V-6.4) The objective of this sortie was to introduce and practice formation procedures and maneuvers in the T-6A. (Tab BB-6) The MC was scheduled to fly mission F4002, in accordance with (IAW) the JSUPT syllabus. (Tab V-6.3, Tab BB-6) The planned mission tasks for the MC included leading a

normal wing takeoff, departure, and Military Operations Area (MOA) maneuvers. The planned MOA maneuvers were: pitchout to a G-awareness exercise, wing work, close trail, crossunder, echelon turn, turning rejoin, straight-ahead rejoin, and extended trail (ET) level I. (Tab K-16, Tab V-1.6, V-2.4, V-5.8, V-6.7) All maneuvers except for the G-awareness exercise were accomplished as both lead and wing. The MA planned to return to LAFB in the wing position. (Tab K-16)

b. Planning

The mission planning was conducted IAW AFI 11-2T-6V3, *84th/85th Flying Training Squadron Standard Operating Procedures*, and the LAFB *T-6A Inflight Guide*. (Tab BB-6, BB-9 thru BB-20, BB-21, BB-23 thru BB-29) The MIP arrived to work at approximately 0800 local (L). (Tab V-6.3) The MSP arrived at the squadron at approximately 0830L. (Tab V-5.3) The MSP attended the daily morning formal brief; the MIP did not attend the formal brief, however, the MIP attended the formation brief. (Tab V-5.4, V-6.3) Attendance of the formal brief is not required of attached instructors. (Tab BB-4) The formal brief consisted of: a student pilot briefing, local procedures, Notices to Airmen (NOTAMs), current and forecasted weather and winds, wind analysis for patterns and landings, status of the airfield, duty day times, flight crew information files, and an emergency procedure (EP). (Tab V-2.3) Following the formal brief, the MC and wingmen met and briefed their formation sortie IAW the locally developed LAFB T-6A Inflight Guide. (Tab BB-21) The MSP briefed the overview of the formation sortie to include: weather, flying status, departure, area maneuvers, training rules, and recovery. (Tab V-1.3, V-2.4, V-5.4, V-6.3 thru V-6.6) The MIP briefed crew coordination and the abnormal procedures including: EPs, weather, formation procedures, and operational risk management. (Tab K-26 thru K-27, Tab V-5.4, V-6.3 thru V-6.6) The briefing concluded at step time. (Tab V-1.5, V-5.5, V-6.6) The mission was thoroughly briefed and understood by all formation members.

c. Preflight

At approximately 0933L the MC gathered their life support equipment including helmet, oxygen-mask, CRU-60/P (oxygen connector), torso-harness, G-suit, and gloves. (Tab H-17, Tab K-16, Tab V-1.5, V-2.5, V-5.5, V-6.6) Once dressed for the sortie, the MC proceeded to the supervisor's desk to receive the step brief. (Tab V-6.6) The step brief is normally given by a senior instructor pilot, specifically qualified as a squadron supervisor (SUP), to ensure crews are qualified and properly briefed. The step brief consisted of current runway, weather updates, local NOTAM changes, and any operations or supervisory concerns. The SUP also reviewed each pilots flying currencies, qualifications, and relayed all pertinent administrative information. (Tab K-17 thru K-18) The MC was assigned aircraft T/N 08-3925. (Tab K-5)

The MC arrived at the MA approximately 0945L. (Tab V-1.5) After arriving at the MA, both pilots checked the maintenance forms and performed the Before Exterior Inspection checking the condition of the cockpit, ejection seat, and confirming the fuel load. The MSP climbed into the front cockpit of the MA and performed the Interior Inspection while the MIP accomplished the Exterior Inspection of the MA. (Tab R-2) The Interior Inspection is a cockpit check of aircraft components before the engine is started. The Exterior Inspection is a visual inspection of the

exterior components of the aircraft checking the general condition of the airframe, landing gear, engine, and flight controls. Once the Exterior Inspection was completed the MIP climbed into the rear cockpit of the MA and assisted with finishing the Interior Inspection. (Tab R-2) Engine start and taxi were uneventful. The MA took off 15 minutes late. (Tab DD-7)

d. Summary of Accident

The MSP contacted Laughlin Tower and was cleared for takeoff at 1018L on Runway 13R at LAFB. (Tab V-2.5, V-2.7, V-6.6 thru V-6.7, Tab DD-7)

The MSP performed a formation takeoff in the lead position and departed via the QUAIL departure for local MOA 4 Low. (Tab V-1.5, V-5.6, V-6.7) On departure to the MOA, the MA maneuvered slightly to avoid Instrument Meteorological Conditions (IMC), otherwise the departure was uneventful and executed according to the preflight briefing. (Tab V-6.7) Once in the MOA the MA accomplished the lead portion of the formation profile, executed a lead change, and repeated the profile as the wing aircraft. (Tab V-1.6 thru V-1.7, V-2.6 thru V-2.7, V-5.7 thru V-5.8) The MOA profile was uneventful and as briefed. (Tab R-2, Tab V-1.7, V-5.8 thru V-5.9, V-6.7 thru V-6.8)

The MA departed the MOA on the wing in the fighting wing position. (Tab V-1.7, V-2.8, V-6.9) The flight was cleared the Rio-One Procedure and was instructed to cross the OTULE waypoint at 6,000 ft mean sea level (MSL). (Tab V-5.9, V-6.9) The lead aircraft initiated a descent to 6,000 ft MSL and directed the MA to take spacing for a straight-ahead rejoin on a 120° heading. (Tab O-19, Tab V-2.8, V-5.9 thru V-5.10, V-6.9, Tab Z-3) On the first rejoin attempt, the MSP failed to recognize the rapidly closing range between the two aircraft, causing the MIP to take control of the aircraft and dissipate the excess closure. (Tab V-5.10, V-6.9 thru V-6.10) The MIP repositioned the MA to lead's six o'clock position. After a brief discussion on proper rejoin procedures and recognition of closure rates, the MIP transferred aircraft control back to the MSP for a second rejoin attempt. Level at 6,000 ft MSL, the MSP executed the second straight-ahead rejoin as the MIP placed his left hand and right elbow on the respective canopy rail. (Tab V-6.14, V-9.1 thru V-9.2) The MSP again gained excessive closure during the rejoin and was slow to correct. (Tab V-6.9 thru V-6.10) As the MIP assumed control of the MA, he lowered his left hand from the canopy rail to the [throttle] power control lever (PCL). The MIP placed his palm on the top of the PCL and his hand continued moving down. The MIP inadvertently pulled up on the engine cut-off gate handle with his fingers as his hand was pulling back. The PCL moved through the cut-off gate to the OFF position, thus shutting down a functioning engine. (Tab V-5.11, V-5.14, V-6.10, V-6.14)

It is typical for an instructor to fly with hands in what is described as a "defensive position," particularly during critical phases of flight. Examples of critical phases of flight include, but are not limited to, rejoins, close formation, takeoffs, and landings. The defensive position refers to the instructor positioning his hands just behind or shadowing the stick and PCL in case of a dangerous situation developing. (Tab V-4.11, V-10.1) The MIP did not have his hands in a defensive position just prior to assuming control of the MA. (Tab V-6.14, V-9.1 thru V-9.2)

The MC felt a deceleration of the MA and the MSP noted the propeller slowing down. (Tab V-5.11 thru V-5.12, V-6.10) The MIP immediately recognized the PCL was back farther than the normal IDLE position and reactively pushed the PCL back up through IDLE. (Tab O-19, Tab V-4.2 thru V-4.3, V-5.11 thru V-5.12, V-6.10, V-6.15, Tab Z-3) Integrated Data Acquisition Recording System (IDARS) shows engine instruments recovered when the PCL was pushed up above the IDLE position. (Tab O-19, Tab V-4.3, Tab Z-3) The MIP failed to recognize the recovered engine and subsequently brought the PCL back to the OFF position. (Tab V-4.3, V-5.14, V-6.10, Tab Z-3)

During the mishap, there were eight times that the PCL was moved to OFF and back to IDLE or above. (Tab O-19, Tab Z-3) For the purposes of this report, each of these instances are referred to as an airstart attempt regardless of whether appropriate procedures were applied or not.

The MIP initiated a shallow climb to the left to maneuver away from the lead aircraft. (Tab V-1.8, V-2.9) Upon seeing this, the lead aircraft attempted to establish communication with the MA. The lead aircraft received no response, noted the MA's propeller slowed, and began to reposition to follow the MA. (Tab V-1.9, V-2.9) The chase aircraft (previously the lead aircraft) attempted to establish contact with the MA several times during the mishap, none of which received a response. (Tab V-1.8, V-2.10) At 1110:11L, the chase aircraft declared an inflight emergency (IFE) for the MA with radar approach control (RAPCON). (Tab V-2.10, Tab DD-5)

Slowing through 150 Knots Indicated Airspeed (KIAS), the MIP attempted a second airstart by initiating the Immediate Airstart (PMU Norm) BOLDFACE procedure as the engine decelerated through 27% N_1. N_1 is the speed of the gas generator section of the engine, expressed as a percentage with 104% representing maximum rated speed. However, the MIP incorrectly applied the BOLDFACE procedure by failing to activate the starter switch resulting in an unsuccessful airstart. (Tab O-19, Tab V-4.3 thru V-4.4, Tab Z-3)

The MIP directed the MSP to find the closest airfield. (Tab V-5.12) The MSP found the nearest airfield in the GPS, then the MIP directed the MSP to find Wizard (LAFB auxiliary field). (Tab V-5.13) The MSP had to scroll through at least two closer airfields on the GPS to find Wizard. The MIP assumed control of the aircraft to find Wizard and then transferred aircraft control back to the MSP and focused on airstarts. (Tab V-5.12 thru V-5.13) The MIP recalled making a left 90° turn toward Wizard (the start of a 280° turn), yet Wizard was in the opposite direction. (Tab V-6.11) No mention or attempt to reach the two closer airfields was made for the remainder of the mishap. (Tab V-6.20)

Approximately 47 seconds after the PCL was inadvertently placed in OFF, the MIP attempted the third airstart. The MIP applied the BOLDFACE procedure at 120 KIAS. (Tab O-19, Tab V-4.4) T-6 procedural guidance states the airstart envelope is 125 to 200 KIAS from sea level to 15,000 ft. While airstarts may be attempted at any airspeed and altitude, airstart attempts outside of the airstart envelope may be unsuccessful or result in engine overtemperature. (Tab V-4.6, Tab BB-36)

All engine airstart indications appeared normal, however passing 37% N_1, the MIP incorrectly advanced the PCL past the mid range position in an attempt to expedite the airstart resulting in

excessive fuel flow to the engine. (Tab O-19, Tab V-4.5, V-6.11, Tab Z-3) The checklist for Immediate Airstart (PMU Norm) states that if an airstart is successful: PCL – As required after N_1 reaches IDLE RPM (approximately 67% N_1). (Tab V-4.13, Tab BB-36)

This increase of fuel flow, from 80 pounds per hour (PPH) to 260 PPH, overtemped the engine as Interstage Turbine Temperature (ITT) climbed through 1200° Celsius (C). (Tab O-19, Tab V-4.5, V-5.12, V-5.17, V-6.19) The ITT remained off the scale for the remainder of the mishap. (Tab O-19, Tab Z-3) The increase in temperature in the compressor turbine section resulted in catastrophic engine damage. (Tab J-13) N_1 continued to climb to a peak of 47% during this airstart where it began to decrease as the compressor turbine section of the engine failed. (Tab O-19, Tab V-4.5, Tab Z-3) As the airstart progressed, the MA slowed to 103 KIAS. The MSP notified the MIP of the slow airspeed. The MIP noted the propeller beginning to slow and engine instruments winding back. The MIP placed the PCL to the OFF position and lowered the MA's nose to accelerate. (Tab O-19, Tab V-5.15, V-6.11, Tab Z-3) The MIP transferred aircraft control of the stick and rudder to the MSP while the MIP maintained control of the PCL and starter switch to continue airstart attempts. (Tab V-5.13, V-6.11)

The MA proceeded on a 150° heading at 6,000 ft MSL (4,900 ft AGL) with two emergency airfields in front of the aircraft. (Tab DD-15 thru DD-16) Anacancho, a 6,000 ft runway, was approximately eight miles away. (Tab V-2.15, Tab DD-15 thru DD-16) Spofford/Frontier, a 4,200 ft runway, was slightly farther. (Tab DD-15 thru DD-16) In the MA's configuration at 125 KIAS, the MA can glide two nautical miles (nm) for every 1,000 ft AGL with no wind and without attempting airstarts. (Tab BB-32) At 5,000 ft AGL and 125 KIAS the T-6A can glide ten miles. This put both airfields within gliding range if the MIP had attempted to reach an emergency airfield. (Tab V-2.15) Following the third airstart, the MA began a left 280° turn effectively taking the MA off profile for an emergency airfield, thus eliminating the possibility of successfully recovering the aircraft if the engine did not restart. (Tab Z-3, Tab DD-9)

As the MA began the left 280° turn at 115 KIAS, the MSP accelerated to 125 KIAS. (Tab DD-9, Tab Z-3) The MIP attempted a fourth airstart by applying the proper procedures. During the airstart, N_1 climbed to a peak of approximately 27% and then stagnated while airspeed varied from 120-135 KIAS. (Tab O-19, Tab Z-3) With no increase of N_1 for approximately 20 seconds the MIP terminated the airstart by placing the PCL in the OFF position. (Tab O-19, Tab Z-3)

The fifth airstart was initiated at 130 KIAS and airspeed varied from 120 to 130 KIAS during the airstart. (Tab O-19, Tab Z-3) After starter switch activation and as N_1 passed 15%, the MIP incorrectly advanced the PCL past the IDLE position. The PCL varied from approximately 30% to MAX during the airstart. (Tab O-19, Tab V-4.7, Tab Z-3) Once N_1 reached 26% it stagnated and after no upward trend for six seconds, the MIP terminated the airstart. (Tab O-19, Tab Z-3) The MSP notified the MIP the MA was descending through 3,000 ft MSL (1,900 ft AGL) which is 100 ft below the recommended controlled ejection altitude. (Tab V-5.13, V-5.20) The MA rolled out of the left 280° turn on a heading of approximately 195°. (Tab Z-3)

Descending through 2,600 ft MSL (1,500 ft AGL), at 126 KIAS, and 1 minute and 50 seconds into the emergency, the MIP pulsed the PCL past mid range and back to the OFF position in an incorrectly executed sixth airstart attempt. (Tab O-19, Tab V-4.7, Tab Z-3) No changes in engine performance occurred as well as no indication the starter switch was activated. The MSP notified the MIP of the need to eject. The MIP acknowledged and stated his intention of another airstart. The MSP confirmed this would be the last attempt, which the MIP affirmed. (Tab V-5.13, V-5.20, V-6.11)

The MIP attempted the seventh airstart by applying the correct BOLDFACE procedures as the MA descended through 2,400 ft MSL (1,300 ft AGL). (Tab V-4.7 thru V-4.8, Tab Z-3) N_1 stagnated at 23-24% for 16 seconds at which point the MIP terminated the airstart. Airspeed during the seventh airstart attempt varied from 124 to 130 KIAS. (Tab Z-3)

The MIP notified the MSP to prepare for ejection, as the MIP attempted the eighth and final airstart descending through approximately 1,800 ft MSL (700 ft AGL). (Tab V-5.13, V-6.11, Tab Z-3)

The MIP activated the starter switch and placed the PCL to IDLE where it remained through ground impact. (Tab O-19, Tab Z-3) Upon confirmation the MSP was ready for ejection, and as the MA reached 1,680 ft MSL (580 ft AGL), the MIP gave the command to eject and pulled the ejection handle. (Tab H-11, Tab V-6.11, Tab Z-3) This initiated the ejection sequence for the MC, with the MA at approximately 115 KIAS, on a 180° heading, approximately wings level, and in a slight climb. (Tab H-11)

e. Impact

Upon ejection, the MA continued straight ahead in a clean glide until impacting a field approximately three miles east of Bracketville, and 1.8 miles south of Hwy 90, destroying the aircraft. (Tab DD-3) The impact damaged a barbed wire fence, four mesquite bushes, and other minor damage to private property. (Tab P-3)

f. Egress and Aircrew Flight Equipment

All required life support and survival equipment inspections were current, with the exception of the MIP's G-suit inspection records which were missing. (Tab H-18) This had no bearing on the mishap. The MC was wearing the appropriate life support equipment for the mission. All aircrew flight equipment functioned properly. (Tab H-5 thru H-12, H-16) The ejection took place within the ejection envelope, however, it was initiated 1,420 ft below the minimum recommended controlled ejection altitude of 2,000 ft AGL. (Tab Z-3, Tab BB-35)

The post-ejection trajectories of the MSP and MIP resulted in their parachutes opening in extremely close proximity. From approximately wings level and 115 knots, the MIP initiated ejection and both seats ejected with the proper sequencing. (Tab H-11) However, once the MSP (front cockpit) exited the aircraft, the seat rotated slightly forward, then flipped backward 180 degrees so the MSP's head was pointing down and his feet were pointing up at man/seat separation. (Tab V-5.21) At the opening shock of the parachutes, the MIP looked up to check

his canopy and discovered the MSP's boots and legs were touching the MIP's parachute canopy. They maneuvered away from each other and executed their parachute landing fall. (Tab V-6.11 thru V-6.12)

g. Search and Rescue (SAR)

At 1110:11L, the MA's wingman declared an IFE via radio. (Tab DD-5) The LAFB Crash Network, a base-wide emergency response notification system, was activated for the IFE at 1114L. (Tab DD-11, DD-13) The MA impacted the ground at approximately 1115L. As part of the crash network, the 47th Medical Group at LAFB was also notified. (Tab DD-11, DD-13) The LAFB Fire Department initiated their IFE procedures at the time of the call. At 1135L the Fire Department sent Chief 1 to the crash site with two personnel. (Tab DD-3 thru DD-4)

At 1115:24L, the MA's wingman notified RAPCON, the SUP, and the SOF of the ejection and crash of the MA. The wingman assumed on scene commander duties and set up an orbit around the MC IAW the LAFB *T-6 In-Flight Guide*. (Tab DD-5)

The MC landed in a field southeast of Bracketville approximately 20-30 yards from each other. (Tab R-3) The ejection seats impacted the ground approximately 760 ft south of the ejection point with the crash site 0.60 miles to the south-southeast of the ejection seats. (Tab H-5, H-14) Upon landing, the MC checked each other for injuries. The MIP used his cell phone to notify command post of the ejection. (Tab V-6.12) A civilian helicopter, which happened to be in the area, landed near the MC within minutes. (Tab V-6.11) A person exited the helicopter, checked on the condition of the MC, and notified Kinney County Emergency Medical Services (EMS) and Fire Department (FD). (Tab R-7) Upon obtaining GPS coordinates of the MC, the helicopter took off, hovered over the mishap site, and relayed information to RAPCON. (Tab V-6.11) The MC began noticing injuries and then laid on the ground to await EMS. (Tab V-6.12)

Kinney County EMS arrived at the mishap site and extracted the MC approximately 1122L. (Tab V-6.24, Tab DD-3) Due to terrain the ambulance was unable to reach the location of the MC. The MC were therefore transported via all-terrain vehicles to the ambulance, and transported to Val Verde Regional Medical Center at 1221L. (Tab V-6.2, Tab DD-3 thru DD-4) Kinney County FD sprayed foam on the aircraft as a preventative measure. (Tab DD-4)

Security Forces personnel arrived to setup a cordon around the MA and established an entry control point at 1220L. (Tab DD-11) A second convoy of Security Forces personnel arrived on scene at 1520L. (Tab DD-11) The emergency response was terminated at 1544L. (Tab DD-4)

h. Recovery of Remains

Not applicable.

5. MAINTENANCE

a. Forms Documentation

(1) Summary: The MA Air Force Technical Order (AFTO) Form 781s, 95 series forms, and PT-6A Engine Logbook data were summarized and verified with the Integrated Maintenance Data System (IMDS). (Tabs U-3 thru U-4, D4 thru D54) Historical records and IMDS maintenance documentation were properly documented and complete. There is no evidence compliance with AFTOs, Time Compliance Technical Orders (TCTO), or maintenance historical records were a factor in this mishap. (Tab D-18 thru D-19, D-21 thru D-22, D-40 thru D-41)

(2) Major Maintenance: 47th Maintenance Directorate LAFB, TX performed the following major maintenance on the MA in the 30 days preceding the mishap:

(a) The first 400 hour engine Hourly Post-Flight Inspection (HPO) was accomplished on 20 September 2010. (Tab D-26)

(b) No corrective/additional maintenance actions were required after the 400 hour HPO.

Major maintenance actions were not a factor in the mishap.

(3) Recurring Maintenance Problems: None. Review of IMDS revealed no related pilot or maintenance reported discrepancies with the MA. The recurring maintenance discrepancies were not a factor in the mishap.

(4) Open Write-ups: None. The MA AFTO Form 781A was reviewed and all maintenance actions were current.

(5) AFTO 781K Write-ups: None. The MA AFTO Form 781K was reviewed and all maintenance actions were current.

(6) Pre-flight Operational Checks: None. The MA AFTO Form 781A was reviewed and all maintenance actions were current. All preflight servicing checks were completed prior to flight on 24 September 2010. (Tab D-23) Fuel quantity was verified and documented on AFTO Form 781H as 1100 pounds of JP-8+100 (jet fuel) onboard the MA. (Tab D-5)

b. Inspections

(1) Aircraft: The MA accumulated 397.6 flight hours prior to the mishap sortie. (Tab D-4 thru D-5) The T-6 400 hour HPO was completed at 394.9 hours. The next 100 hour inspection was scheduled at 494.9 hours. The last minor MA inspection was a combined Basic Postflight/Preflight (BPO/PR) inspection completed 23 September 2010. (Tab D-4)

(2) Engine: The mishap engine (ME), PT0006A-68, serial number PWV-RA0579, was

installed on the MA on 02 September 2009. (Tab U-3 thru U-4) The engine had never been used on any other aircraft except the MA. The MA was accepted as new by LAFB, TX on 16 September 2009. (Tab U-3 thru U-4) All scheduled engine inspections were current at the time of installation and at the time of the mishap. There were no completed maintenance actions identified or documented in IMDS for the ME.

(3) Egress and Life Support: A review of life support and egress inspection records revealed no overdue inspections. A review of these maintenance records indicated all physiological, ejection, escape, and survival systems were in serviceable condition at the time of the mishap.

c. Maintenance Procedures

Maintenance procedures on the MA were conducted IAW applicable Technical Orders (TO). On 23 September 2010, the BPO/PR inspection and exceptional release were accomplished. (Tab D-4)

d. Maintenance Personnel and Supervision

Maintenance for the MA was performed by Civil Service employees. Maintenance training records were reviewed and revealed no training deficiencies contributed to this mishap. All personnel involved in servicing or inspecting the MA were qualified and proficient in the performance of their duties.

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 fuel, oil lubricants, and hydraulic fluid samples met material test requirements. (Tabs D-56 thru D-64) However, particulates were found in the MA hydraulic fluid analysis. These particulates are most likely a result of impact. (Tab D-57)

f. Unscheduled Maintenance

No unscheduled maintenance was performed on the MA the night prior to the mishap or prior to the BPO/PR inspection.

6. AIRFRAME, MISSILE, OR SPACE VEHICLE SYSTEMS

a. Condition of Systems

(1) MA Fuselage and Control Surfaces: The MA's fuselage remained mostly intact. The wing separated from the fuselage, with all electrical, mechanical, and hydraulic connections separated. The forward fuselage was deformed with major impact damage to the engine compartment. The horizontal and vertical stabilizers remained

attached, with both the left and right stabilizer tips sustaining impact damage. The upper portion of the vertical stabilizer suffered leading edge deformation. The left wingtip was deformed aft and downward. The left wing sustained dents and abrasions along the entire leading edge. Both wing navigation light assemblies were separated. The left main landing gear strut, gear wheel, and gear door side strut remained attached to the wing. The right wing sustained upward and aft deformation. The right wing sustained dents and abrasions along the entire leading edge. The right main landing gear strut, gear wheel, and gear door side strut remained attached to the wing. (Tab J-5 thru J-6)

(2) Engine

(a) ME Pre-Impact Thermal Findings: The ME suffered pre-impact thermal turbine failure due to excess fuel and resultant excess temperature within the combustor turbine during an airstart. Due to the extreme temperature, the turbine experienced: turbine performance loss, loss of thrust, and turbine stagnation. Sustainable thrust was lost due to high heat erosion of the blade heat coatings, blade tips, and trailing edge airfoil. Stagnation occurred due to excessive heat resulting in reduced air flow across the blades and stators, which led to extreme ITT. Downstream effects were one of two igniter plugs melted, molten metal spray erosion from the turbine blades, melted ITT sensors, and deposited metal spray throughout the remainder of the turbo machinery of the engine. Based on these findings, the ME turbine was destroyed and rendered incapable of any engine recovery or airstart. (Tab J-11 thru J-14)

(b) ME Post-Impact Component Observations: Inspection of the gas generator case aft of the air inlet revealed minimal crushing damage due to ground impact. (Tab J-8 Photo #6) The compressor bleed off valve was visually inspected with no obvious sign of distress or failure. (Tab J-9 Photo #9, J-10 Photo #10) The combustion chamber within the gas generator case was the separation point of the forward section of the engine. (Tab J-10 Photo #11) Inspection of the combustion chamber did not yield evidence of heat distress. The turbine vane ring exhibited a severe damage fracture at the outer diameter of the vane ring caused from the impact. (Tab J-15 Photo #20) The compressor turbine shroud and ITT probes exhibited high heat bluing and metal spray build up on the shroud segments. (Tab J-19 Photo #19) Both igniter plugs showed high heat distress, the left igniter plug was burned in half, the right plug showed metal spray and heat distress. (Tab J-18 Photo #27) All 43 turbine compressor blades exhibited evidence of material loss through overtemperature. (Tabs J-11 thru J-14) All blades were similar in height and appearance. (Tabs J-13 Photo #17, J-14 Photo #18) The compressor turbine shroud segments exhibited a metal spray build up. The upstream face of the disc exhibited localized tinting from excessive heat, and the blade retention rivets exhibited evidence of light rub. (Tab J-11)

(c) MA Post-Impact Propeller Assembly: The propeller interface unit fractured at the mounting flange and separated from the wreckage. The reduction gearbox front housing fractured at the "A" flange; the housing was still attached to the propeller assembly. Review of the 1st and 2nd stage reduction gear assembly revealed the three planetary gears were visible with no obvious signs of distress. The ring gear was not capable of rotation. (Tab J-17 Photo #25, J-18 Photo #26) The reduction gearbox chip detector showed no presence of magnetic material.

7. WEATHER

a. Forecast Weather

At brief time, weather for takeoff at LAFB was forecast to have a scattered cloud layer at 3,000 ft AGL, skies clear with wind out of the east-southeast at 9 knots. (Tab F-2) At the time of the mishap, a temporary condition forecasted a 2,000 ft AGL broken layer and a 3,000 ft AGL overcast layer with similar winds. (Tab F-2)

b. Observed Weather

The MA took off from LAFB at 1018L. (Tab DD-7) The MA's emergency began at approximately 1110L and impacted the ground at approximately 1115L. (Tab DD-5 thru DD-6) Surface weather observations were recorded at 1001L (17 minutes prior to takeoff), 1055L (15 minutes prior to initial emergency), and 1111L (one minute after initial emergency). (Tab F-10) At takeoff time a scattered cloud layer was observed at 1,400 ft and 2,000 ft AGL, winds out of the east-southeast at 11 knots, and 10 statute miles (SM) inflight visibility. Surface temperature was observed at 79° Fahrenheit. (Tab F-10) At 1055L, an overcast cloud layer was observed at 2,100 ft AGL, winds were out of the southeast at nine knots. (Tab F-10) At 1111L, a scattered cloud layer was observed at 2,200 ft AGL. (Tab F-10) Broken cloud layers were observed at 2,800 and 3,500 ft AGL. An overcast cloud layer was observed at 4,400 ft AGL. Winds were out of the southeast at 10 knots with 10 SM inflight visibility. (Tab F-10)

The MSP reported a broken or scattered cloud layer at approximately 3,000 ft MSL on departure and during the mishap. (Tab V-5.6) The MA's wingman IP reported weather on departure to be a broken cloud layer from 2,000-2,100 ft MSL to 6,000 ft MSL. (Tab V-2.6) The MA's wingman student pilot (SP) reported a scattered cloud layer from 6,000 ft MSL to 7,500-8,000 ft MSL. (Tab V-1.6)

At 1103:10L (approximately seven minutes before the mishap) a pilot departing LAFB reported to RAPCON the base of the clouds at 3,100 ft (pilot does not specify whether AGL or MSL) and seven SM visibility. (Tab N-4)

c. Space Environment

Not applicable.

d. Operations.

Operations were being conducted IAW applicable directives.

8. CREW QUALIFICATIONS

a. Mishap Student Pilot

The MSP was a current student pilot with 62.8 total flying hours in the T-6A. (Tab T-6) The MSP began JSUPT on 22 April 2010 and was on the second of 17 sorties in the formation phase of T-6A training. (Tab T-7)

The MSP met all currency and training requirements prior to the mishap sortie. (Tab G-25 thru G-27)

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

	Hours	Sorties
30 Days	24.9	16
60 Days	45.6	33
90 Days	54.6	40

(Tab T-7 thru T-10)

b. Mishap Instructor Pilot

The MIP was a current and qualified inexperienced instructor pilot with 260 hours in the T-6A and 1,313.8 total flying hours. (Tab G-6 thru G-7) The MIP graduated Pilot Instructor Training (PIT) for the T-6A on 24 February 2010. (Tab G-44) The MIP completed local Mission Qualification Training on 21 April 2010. (Tab G-3) The MIP successfully completed his latest instrument/qualification checkride on 2 November 2009. (Tab G-22)

The MIP met all currency and training requirements prior to the mishap sortie. (Tab G-11 thru G-13)

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

	Hours	Sorties
30 Days	35.1	24
60 Days	56.9	42
90 Days	73.5	56

(Tab G-6)

9. MEDICAL

a. Qualifications

The AIB reviewed the medical, dental and physiologic training records of the MC. Both pilots were medically and physiologically qualified to perform flight duty on the day of the mishap. (Tab X-6, X-7, X-10 thru X-11)

To note, the MSP sustained a head injury with concussion at the United States Air Force Academy (USAFA) on 26 August 2005 which required an aeromedical wavier for flight duty. Although this waiver was not accomplished he received a USAF Flying Class I medical certification 19 April 2007 while at the USAFA. His need for an aeromedical waiver for head injury was not addressed at his "entry into pilot training" physical exam at LAFB, TX on 23 April 2010. The waiver was accomplished after the mishap on 8 October 2010. (Tab X-3 thru X-4)

b. Health

The AIB reviewed the medical and dental records of the MC. There are no mental health or family advocacy records on file to review.

The MIP sustained minor injuries as a result of his egress and landing. (Tab X-3) He was being treated for chronic intermittent low back pain stemming from an injury sustained while playing soccer in 1997. There is no evidence that his pre-existing chronic low back pain contributed to the mishap. Additionally, the MIP had a current aeromedical waiver and there is no evidence that his waivered condition contributed to the mishap.

The MSP sustained significant back injury during ejection and suffered minor injuries as a result of his egress and landing. (Tab X-3) The MSP had a previous head injury in 2005 for which an aeromedical waiver was required. There is no evidence that the past head injury with concussion contributed to the mishap.

c. Pathology

Blood and urine samples were collected and submitted to the Armed Forces Institute of Pathology for toxicological analysis. The MC's blood samples were negative for elevated carbon monoxide levels or ethanol. The urine drug screening tests were negative for amphetamine, barbiturates, benzodiazepines, cannabinoids, cocaine, opiates or phencyclidine. (Tab X-5 and X-9)

d. Lifestyle

Witness testimony and medical record reviews for the MC did not reveal any significant or unusual habits, behaviors or stressors. There were no lifestyle factors identified as causal or substantially contributory in this mishap. (Tab V-5.4, V-6.4, Tab X-3)

e. Crew Rest and Crew Duty Time

The MC's testimonies indicated all crew rest and duty day requirements were met. (Tab V-5.3, V-6.3)

10. OPERATIONS AND SUPERVISION

a. Operations

Although the 84 FTS and 85 FTS are separate squadrons, they share the same life support, aircraft, building, flying supervisor, and mission. On the day of the mishap the MC, attached to the 85 FTS, was flying an 84 FTS aircraft. The 85 FTS had a normal operations tempo for a primary FTS. (Tab V-10.1) There was no other tasking, outside of training SPs that would have increased the workload or operations tempo for the squadron IPs or SPs. (Tab V-10.1) The 85 FTS letter of qualifications listed 83% of IPs as experienced. (Tab T-3 thru T-4)

b. Supervision

The mission profile and all mission objectives were IAW the JSUPT T-6A Syllabus. (Tab K-16, Tab BB-5 thru BB-6) The MIP and MSP planned the mission IAW all governing directives. (Tab Tabs V-1.3 thru V-1.4, V-2.3 thru V-2.4, V-5.4 thru V-5.5, V-6.3 thru V-6.6) The MIP and MSP each briefed applicable sections of the mission brief IAW all governing directives. (Tab V-1.3 thru V-1.4, V-2.3 thru V-2.4, V-5.4 thru V-5.5, V-6.3 thru V-6.6) The MIP and MSP each understood the mission briefing and the planned maneuvers to be performed that day. (Tab V-1.3 thru V-1.4, V-2.3 thru V-2.4, V-5.4 thru V-5.5, V-6.3 thru V-6.6) The flight was authorized by the SUP. (Tab K-5) The supervision of all 85 FTS flying operations on the day of the mishap, including the mishap sortie, was normal.

11. HUMAN FACTORS ANALYSIS

The Department of Defense Human Factors Analysis and Classifications Systems is comprised of a list of potential human factors that can be contributory or causal to a mishap. A total of nine human factors were identified and described below for this mishap.

a. Causal

(1) Acts - Inadvertent Operation (AE101): Inadvertent operation is a factor when an individual's movements inadvertently activate or deactivate equipment, controls or switches when there is no intent to operate the control or device. This action may be noticed or unnoticed by the individual.

Departing the area on the second rejoin, the MIP inadvertently operated the engine cut-off gate handle during flight and pulled the PCL past the cut-off gate to the OFF position. (Tab V-5.11, V-5.14, V-6.10, V-6.14) This initial inadvertent switch actuation was noticed by the individual, and began the IFE that eventually led to the

MC ejection, and loss of the aircraft.

(2) **Acts - Checklist Error (AE102) and Procedural Error (AE103):** Checklist Error is a factor when the individual, either through an act of commission or omission makes a checklist error or fails to run an appropriate checklist and this failure results in an unsafe situation. 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.

The MIP made multiple Checklist and Procedural Errors during the course of the mishap. The MIP failed to execute the Immediate Airstart (PMU Norm) BOLDFACE checklist correctly by not actuating the starter switch on the second airstart attempt which resulted in a "no start." (Tab O-19, V-4.3 thru V-4.4)

Procedurally, during an airstart attempt the PCL may be advanced out of IDLE upon reaching 67% N_1. On the third airstart, the MIP incorrectly advanced the PCL out of IDLE passing 37% N_1. This action resulted in excessive fuel flow to the engine and an excessive heat condition which produced irrevocable damage within the engine. (Tab O-19, Tab V-4.5, V-5.12, V-17, V-6.11, V-6.19)

(3) **Acts - Necessary Action – Rushed (AE203):** Necessary action – Rushed is a factor when the individual takes the necessary action as dictated by the situation but performs these actions too quickly and the rush in taking action leads to an unsafe situation.

The MIP advanced the PCL out of IDLE during the third airstart before N_1 reached idle RPM (approximately 67% N_1) in a rushed attempt to generate usable thrust. This action resulted in excessive fuel flow to the engine and an excessive heat condition which produced irrevocable damage within the engine. (Tab O-19, V-4.5, V-5.12, V-5.17, V-6.11, V-6.19)

(4) **Acts - Error due to Misperception (AE301):** Error due to Misperception is a factor when an individual acts or fails to act based on an illusion; misperception or disorientation state and this act or failure to act creates an unsafe situation.

On the first airstart attempt, the MIP inadvertently moved the PCL to the OFF position and then immediately moved the PCL above mid range. The engine recovered, but the MIP perceived the engine was decelerating and moved the PCL to the OFF position. (Tab V-4.3, V-5.14 and V-6.10) This action resulted in shutting down a functioning engine.

(5) **Acts - 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.

The MIP failed to identify the nearest suitable airfield and instead chose an unreachable airfield. (Tab V-5.12, V-5.13, V-6.10 and 6.19) The MC had two suitable airfields within gliding distance, for which they failed to get on profile. He instead made a delayed attempt to reach an airfield further away.

(6) Preconditions- Task Delegation (PP103): Task Delegation is a factor when the crew or team members failed to actively manage the distribution of mission tasks to prevent the overloading of any crewmember.

The MIP delegated to the MSP the task of obtaining the bearing to Wizard and at one point maintaining aircraft control. However, the following tasks were not delegated due to channelized attention: referencing appropriate checklists, locating the nearest suitable airfield, and communicating within the flight or controlling agency. (Tab V-6.10)

b. Contributing

Acts - Channelized Attention (PC102): Channelized Attention is a factor when the individual is focusing all conscious attention on a limited number of environmental cues to the exclusion of others of a subjectively equal or higher or more immediate priority, leading to an unsafe situation and may be described as a tight focus of attention that leads to the exclusion of comprehensive situational information.

After inadvertent inflight engine shutdown, the MIP became channelized on restarting the engine. The focused attention on restarting the engine resulted in the MC not identifying the nearest suitable airfield nor placing the MA on profile for an airfield in a timely manner. The delayed decision resulted in a controlled ejection. (Tab V-6.11)

12. GOVERNING DIRECTIVES AND PUBLICATIONS

a. Primary Operations Directives and Publications

1) AFI 11-2T-6V3, *T-6 Operations Procedures*
2) LAFB *T-6 In-Flight Guide*
3) AIR FORCE TO 1T-6A-1, *Flight Manual, USAF/USN Series T-6A Aircraft*), dated 24 January 2006, change 5, 15 June 2010
4) Squadron Standard Operating Procedures, *T-6 Procedures and Guidance,* dated 12 March 2010
5) AFMAN 11-248, *T-6 Primary Flying,* dated 10 October 2008
6) AFI 11-202V3, *General Flight Rules,* dated 5 April 2006
7) AETCI 36-2205 Volume 4, *Formal Flying Training Administration and Management – T-1, T-6, T-38, T-43, and UH/TH-1H,* dated 31 August 2010

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) 1T-6A-2, *Maintenance Manual,* dated 01 September 2010
4) 1T-6A-6, *Scheduled Inspection and Maintenance,* dated 1 September 2010
5) 1T-6A-6WC-1, *Inspection Workcards, Preflight,* dated 1 June 2009
6) 1T-6A-2-12CL-60-1, Technical Manual, Organizational Maintenance, dated 7 December 2007

13. ADDITIONAL AREAS OF CONCERN

There are three additional areas of concern.

a. Ejection

The post-ejection trajectories of the MSP and MIP resulted in their parachutes opening in extremely close proximity. From approximately wings level and 115 knots, the MIP initiated ejection and both seats ejected with the proper sequencing. However, once the MSP (front cockpit) exited the aircraft, the seat rotated slightly forward, and then flipped backward 180 degrees so the MSP's head was pointing down and his feet were pointing up at man/seat separation. (Tab V-5.21) At the opening shock of the parachutes, the MIP looked up to check his canopy and noticed the MSP's boots and legs were touching the MIP's parachute canopy. They maneuvered away from each other and executed their parachute landing fall. (Tab V-6.11 thru V-6.12) This finding had no impact on the cause of the mishap and did not contribute to any injuries.

b. Simulator

The simulator responds as it is programmed versus the reality of how the aircraft responds. Currently in the simulator, if the PCL is moved to the OFF position and immediately back above IDLE, the engine will continue to shut down. Through testimony, it was discovered pilots have moved the PCL OFF and immediately back above IDLE at least three times at LAFB (including this mishap) and all three times the engine recovered to a normal condition. (Tab V-4.9) In addition, on an Immediate Airstart, the simulator allows the PCL to move above IDLE in a sub-idle condition without repercussions. The evidence from this mishap shows if the PCL is moved to mid-range with the engine at 37% N_1, the engine can be severely damaged due to extreme heat generated by excess fuel. (Tab DD-15 thru DD-16) According to testimony, the simulator programming had no impact on this mishap.

c. Checklist

The Immediate Airstart checklist does not address multiple airstart attempts. It states if the airstart is unsuccessful, then execute a forced landing or eject. The preponderance of evidence shows the MA would have started normally on the second and/or third attempt if the Immediate Airstart checklist (PMU Norm) had been executed correctly. According to testimony, the checklist was not physically referenced during this mishap. (Tab V-6.22)

9 November 2010

BRADLEY K. MCCOY, Colonel, USAF
President, Accident Investigation Board

STATEMENT OF OPINION

T-6A Texan II, T/N 08-3925 ACCIDENT
24 SEPTEMBER 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 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 cause of this mishap was pilot error. The mishap instructor pilot (MIP) generated an emergency by inadvertently shutting down a functioning engine, executed procedural errors on airstarts, and missed a forced landing opportunity. Evidence for this opinion included witness testimony, expert analysis of the Integrated Data Acquisition Recording System (IDARS), T-6A simulation, T-6A publications, and post-mishap engine analysis. The MIP initiated an emergency by shutting down a functioning engine while executing a flight maneuver to rejoin the formation. Immediately recognizing the error, the MIP quickly placed the power control lever (PCL) above IDLE and the engine recovered. The MIP did not recognize the engine recovery and shut down the functioning engine for a second time. From this engine off condition, the MIP made two procedural errors in attempting to restart the engine. The first was incorrectly executing the Immediate Airstart BOLDFACE when the MIP selected IDLE before moving the starter switch to AUTO/RESET, which led to a "no start." The second and most significant procedural error occurred during the third airstart, when the MIP prematurely moved the PCL above IDLE while the engine was in a sub-idle condition. This forced excessive fuel into the engine causing extreme heat, severe engine damage, and an unrecoverable condition.

In my opinion, the MIP had multiple opportunities to recover the engine to a normal state until the extreme heat condition occurred, which rendered the mishap aircraft (MA) unrecoverable. Additionally, the MA was within parameters to execute a forced landing at a suitable airfield during the first three airstarts, yet the MC failed to establish a forced landing profile in a timely manner.

2. DISCUSSION OF OPINION

a. Cause

The cause of this mishap was pilot error. The MIP induced severe engine damage due to inadvertent shutdown of a normal engine followed by procedural errors to restart the engine. In addition, the mishap crew (MC) missed the opportunity to execute a forced landing at a suitable airfield.

On the second rejoin after departing the military operating area, the MIP perceived excessive closure and assumed control of the aircraft. As the MIP lowered his left hand from the canopy rail to the PCL he placed his palm on the top of the PCL and inadvertently pulled up on the engine cut-off gate handle with his fingers as his hand was pulling back. The PCL moved through the cut-off gate to the OFF position, thus shutting down a functioning engine. The MIP, immediately realizing the error, moved the PCL back above IDLE and the engine recovered. However, the MIP did not recognize the engine recovery and intentionally pulled the PCL to the OFF position again. In my opinion, the first airstart would have been successful if the MIP left the PCL above IDLE. As the engine was decelerating, the MIP did not actuate the starter switch before moving the PCL to IDLE, which introduced fuel to the engine with no ignition source and therefore a "no start" condition. In my opinion, the second airstart would have been successful if the MIP would have executed the airstart procedures correctly.

The MIP moved the PCL to OFF for a third time. On the third airstart attempt, the MIP completed the Immediate Airstart BOLDFACE correctly and the engine was reacting normally until the N_1 RPM reached 37%. At this point, the MIP moved the PCL from IDLE to well above IDLE, in an attempt to get the engine to start faster. However, T-6A procedural guidance states the PCL can move as required once the engine reaches idle RPM (approximately 67% N_1 RPM). As the PCL moved forward, the fuel flow increased forcing more fuel than the engine could process. The excess fuel led to an extreme heat condition that destroyed the engine, including melting portions of the compressor turbine blades, one of the two igniter plugs, and the interstage turbine temperature probes thus terminating the attempted airstart before idle N_1 RPM. The engine was incapable of starting on the following five airstart attempts due to this damage. In my opinion, the third airstart would have been successful if the PCL remained in IDLE until idle N_1 RPM was achieved.

Through the first three airstart attempts (approximately 66 seconds), the MA was within the parameters to reach a suitable airfield for a forced landing. However, the weather precluded visually seeing the airfield and the mishap crew was late to seek the information, which made a forced landing impossible. In my opinion, the MA could have reached an alternate landing runway directly on the initial flight path if the mishap crew referenced the closest airfield on the Global Positioning System (GPS) in a timely manner.

b. Contributing Factors

The MIP's channelized attention on restarting the engine was a contributing factor in missing the opportunity for a forced landing. The initial steps for a T-6A engine emergency are turn, climb, clean, and check. "Turn" refers to turning toward the nearest suitable airfield, which can be accessed through the GPS. The "climb" provides altitude to maximize the glide distance for landing. "Clean" refers to ensuring the landing gear and flaps are up and "check" refers to analyzing the engine instruments. In my opinion, if the MIP had accomplished these steps prior to attempting airstarts, then a forced landing at a suitable airfield would have been achievable.

3. CONCLUSION

Clear and convincing evidence shows the cause of this mishap was pilot error. The MIP inadvertently placed the PCL to OFF and immediately back above IDLE which recovered the engine. The MIP then induced an emergency condition by shutting down a functioning engine and compounded the problem through procedural errors in the Immediate Airstart checklist, which ultimately led to the severe engine damage and an unrecoverable condition. The MC failed to set up a profile for a forced landing at a suitable airfield in a timely manner.

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