

RAS 5859

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USNRC



## EXECUTIVE SUMMARY

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### AIRCRAFT ACCIDENT INVESTIGATION REPORT

F-16DG, SERIAL NUMBER 88-0154  
310 FS, LUKE AIR FORCE BASE (AFB), AZ  
7 JANUARY 1999

OFFICE OF THE SECRETARY  
RULEMAKING AND  
ADJUDICATIONS STAFF

1. The mishap pilot (MP) and mishap instructor pilot (MIP) departed Luke AFB, AZ at approximately 1252 p.m. on 7 January 1999 in a single F-16D on an Air Strike Control-2 syllabus training sortie (Tabs N-3, V-5-7). Both pilots were current and qualified for the mission (Tab V-7-1). Shortly after takeoff, the mishap aircraft (MA) suffered an internal failure of its F-100PW-220E engine resulting in severe vibrations and loss of thrust (Tabs V-5-11, 15; J-16). The MP jettisoned the external stores and zoomed the aircraft. The MIP determined that the aircraft could not maintain level flight and commanded an ejection (Tab V-5-21). The MA was subsequently destroyed by ground impact (Tab Z-5). The MP and MIP executed a simultaneous ejection, resulting in severe entanglement of the MIP with the MP's parachute (Tab V-9-1). Both pilots descended under the MP's parachute (Tab J-51). Neither pilot was seriously injured (Tabs V-5-23, V-6-36). Luke AFB medical personnel returned both pilots to Luke AFB (Tabs V-5-26, V-6-35).
2. Clear and convincing evidence shows the most likely cause of the internal engine failure was the 3<sup>rd</sup> stage turbine fan blade tip curled which caused the turbine blade(s) to come in contact with the turbine shroud (Tabs J-14, J-16). This caused an imbalance resulting in one or more turbine blades breaking free (Tabs J-13, J-14). The loss of 3<sup>rd</sup> stage turbine blades caused significant damage to 4<sup>th</sup> stage blades (Tab J-14). The loss of turbine blades caused engine vibrations, compressor stalls, and loss of thrust (Tab J-16). The mishap aircrew responded properly during the mishap.
3. Under 10 U.S.C. 2254 (d), any opinion of accident investigations 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 an aircraft accident, nor may such information be considered admission of liability by the United States or by any person referred to in these conclusions or statements.

#### NUCLEAR REGULATORY COMMISSION

Docket No. 13 Official Edn. No. 13  
In the matter of PFS  
Staff ✓ IDENTIFIED ✓  
Applicant ✓ RECEIVED ✓  
Intervenor ✓ REJECTED ✓  
Other Joint WITHDRAWN ✓  
DATE 4-11-02 Witness ✓  
Clerk L. Shindurling

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SECY-02

## SUMMARY OF FACTS

### 1. AUTHORITY, PURPOSE, AND CIRCUMSTANCES

**AUTHORITY:** In a memorandum dated 27 January 1999, General Lloyd W. Newton, Commander, Air Education and Training Command (AETC), appointed Colonel Jeffrey L. Patton, 325 FW/IG, to serve as President, and conduct an investigation pursuant to Air Force Instruction 51-503, *Aircraft, Missile, Nuclear, and Space Accident Investigations*, into the circumstances surrounding an aircraft mishap on 7 January 1999 involving an F-16DG (SN 88-0154), assigned to the 310th Fighter Squadron at Luke AFB, AZ. He also appointed Lieutenant Colonel John G. Hurd, HQ AETC/LGMA, to serve as Maintenance Advisor; Major Howard R. Russell, AETC/JA, to serve as Legal Advisor; Major Ronald K. Roberts, 21st Fighter Squadron, to serve as Pilot Technical Advisor (Tab Y-1). Major John J. Privette, 21st Fighter Squadron, was also appointed to serve as Pilot Technical Advisor (Tab Y-3).

**PURPOSE:** To determine the relevant facts, circumstances, and causes surrounding the mishap that occurred on 7 January 1999. The accident investigation is intended primarily to gather and preserve evidence for claims, litigation, disciplinary and administrative action, and for all other purposes deemed appropriate by competent authority.

**CIRCUMSTANCES:** Captain Julian M. Chestnutt, Mishap Pilot (MP), and Captain Brian L. Egger, Mishap Instructor Pilot (MIP), were scheduled for an F-16 single ship Forward Air Control (airborne) Training Course syllabus upgrade sortie. Mission planning and briefing were uneventful. MP and MIP ground aborted the primary aircraft due to a flight control problem and proceeded to a spare, SN 88-0154, the Mishap Aircraft (MA). Preflight, start, taxi and line up checks for the MA were uneventful. During an afterburner takeoff, the MA experienced an engine malfunction shortly after gear retraction. The MA zoomed and started a left turn. The MP jettisoned the external fuel tanks that hit near an intersection off base causing minor injuries to a civilian and damaging his truck. The MA rolled wings level and both the MP and MIP accomplished a successful ejection. The MA impacted the ground 2.0 nautical miles north of Luke AFB on a private farm. The MA was destroyed. The debris struck no people, animals, or buildings.

### 2. ACCIDENT SUMMARY:

- a. On 7 January 1999, at 1252 Arizona Time (Universal Coordinated Time minus seven hours with no Daylight Savings Time adjustment), an F-16DG from the 310<sup>th</sup> Fighter Squadron at Luke AFB, Arizona, departed runway 03 right on an ASC-2 mission (Tabs N-3, V-5-7, V-6-5). Approximately 50 seconds after beginning the takeoff and shortly after gear retraction, the mishap crew experienced severe vibrations and loss of engine thrust (Tabs V-5-11,15; V-6-18). The MP jettisoned the external stores on the MA and turned north of the field (Tab V-6-20, 22). Approximately 30 seconds after the beginning of the vibrations and with the aircraft losing altitude, the mishap crew ejected (Tabs V-5-15, V-6-23). The MA impacted the ground and was destroyed. The MP's and MIP's parachutes became entangled during deployment, resulting in

both pilots descending under one parachute canopy (Tab V-5-22). Neither pilot was seriously injured (Tabs J-33, J-51, V-5-23, V-6-36).

b. The main crash site is located on the Justice Brothers Farm approximately 2 miles north of Luke AFB at N 3334.808 and W 11222.703 (Tab R-2). Additional wreckage was spread onto property belonging to Fairway Farms, located approximately 300 feet north of the main impact site (Tab P-3). The two 370 gallon fuel tanks and rocket pod impacted on land belonging to Mr. Robert McKee at N 3333.977 and W 11221.559, approximately 1 mile north of Luke AFB (Tab R-2). Portions of the external tanks hit a civilian Ford pickup truck on a public highway and caused damage to the truck and injury to the driver (Tab J-33). The driver's civilian attorney claims the driver suffered cuts and bruises to his head and may be suffering cervical vertigo (Tab P-2). To date, no civil claims have been presented to the government. The damage cost to Air Force property is \$22,776,045.50 (Tab M-2).

c. Initial media interest was high. The 56 FW public affairs office handled 125-150 media inquiries in the 48 hours following the mishap. Most of these inquiries were from Phoenix metropolitan news agencies (Tab V-23-1). Media interest has dropped considerably since the mishap (Tab V-23-1).

### **3. BACKGROUND:**

a. The mishap aircrew (MAC), and the MA were assigned to fly with the 310<sup>th</sup> Fighter Squadron, part of the 56<sup>th</sup> Fighter Wing (FW) at Luke AFB, AZ (Tabs A-2, V-6-4). The mission of the 56 FW is to train US and Allied pilots in various models of the F-16 aircraft. The number and type of missions flown by pilots training in the F-16 at Luke is determined by their experience level and the mission of the operational unit the upgrading pilot will fly with. For pilots in the experience category and the follow-on operational mission of the MP, the course of instruction is named after the syllabus outlining their training. In this case, it is the AETC Syllabus F16C0FACPL *USAF Forward Air Control (Airborne) Training F-16C/D*, dated August 1998, commonly called FAC-A. The FAC-A syllabus is designed for a 2-ship flight lead qualified operational F-16 pilot who has his squadron commander's approval (Tab BB-6). The FAC-A syllabus has an optional night upgrade for upgrading pilots who are qualified to fly with night vision goggles as MP was. The syllabus calls for 25 hours of academic training, 2 hours of simulator training and 12 sorties of flying training (Tab BB-7). At the time of the mishap, MP had completed 1.5 hours of simulator training and 2 sorties of flying training (Tab AA-12).

b. The upgrading pilots are always under the direct supervision of an instructor pilot during their training. This supervision can either be from the rear cockpit of an F-16 D or as the flight lead or chase airplane in another F-16 (Tabs BB 26 through BB-37). During the mishap, the responsibility for supervising MP was assigned to the MIP who occupied the rear cockpit (Tab BB-28).

### **4. SEQUENCE OF EVENTS:**

a. MISSION: The mishap sortie was a formal training unit (FTU) single ship F-16CG aircraft from the 310<sup>th</sup> Fighter Squadron at Luke Air Force Base. The mission was flown in support of syllabus flight training in the AETC syllabus F16C0FACPL USAF *Forward Air Control (Airborne) Training F-16C/D* dated August 1998 (Tabs BB-1 through BB-37). The syllabus training sortie was an ASC-2 mission, requiring an instructor in the rear cockpit as well as supporting fighter aircraft. Two A-10s deployed from Barksdale AFB, LA were the supporting aircraft in this case (Tabs K-2, V-6-9). The training objective was to practice low threat air strike control (Tabs V-6-6, BB-28). Additional training objectives were to introduce artillery coordination and deconfliction in a limited communications-jamming environment, as well as buddy lasing communication and communication (Tabs V-6-6, BB-28). This was the third sortie in the syllabus training. Flight authority was designated on USAF Order 99-060 by Major George Stillman, 310<sup>th</sup> Fighter Squadron Assistant Operations Officer (Tab K-2).

b. PLANNING: The MP completed most of the pre-mission planning (Tab V-5-7). The briefing started 10 minutes later than standard (2 hours 20 minutes prior to the scheduled takeoff time) with the MAC and the supporting flight of A-10 pilots, Capt Ehrenberger and Lt Col Vogel, present and prepared (Tabs V-6-8 through V-6-9). The MP briefed the fighter coordination with the two A-10s pilots who were providing fighter support using the 56<sup>th</sup> Fighter Wing CAS Pack (Tabs V-5-6, V-6-9,11; BB-113 through BB-115). The MIP completed all remaining required portions of the briefing referencing the 310<sup>th</sup> squadron briefing guides (Tabs V-5-6, V-6-10). Standard emergency procedures were adequately discussed including engine failure on take off and ejection (Tabs V-5-9, V-6-13). The briefing was completed about 13 minutes prior to planned step time and was clearly understood by the MP (Tab V-6-10).

c. PREFLIGHT: Facilities NOTAMS (Notice to Airmen) were discussed during the flight briefing. There were no facility limitations that would have affected the MA on 7 January 1999 (Tabs K-6, V-6-16). The MA (call sign Stein 1) was filed on a Busco-Buggs standard instrument departure (SID) and standard Luke stereo flight profile (Tab K-2). The scheduled working area was R-2304 (the tactical bombing range known as ETAC) (Tab K-2). The MAC was dressed in their life support equipment and stepped to the aircraft between 1 and 5 minutes later than their planned step time (Tabs V-5-8, V-6-12). The MAC started one aircraft but ground aborted it due to a flight control problem (Tabs V-5-9, V-6-14). Following this ground abort, they went to the MA where the MIP completed the preflight walk around inspection and examined the aircraft maintenance forms as the MP got in the cockpit and prepared for engine start (Tabs V-5-9,10; V-6-14). After-engine start checks were slightly rushed, but otherwise normal, as the MP speeded up his ground operations in an attempt to make it to the bombing range on time (Tab V-6-15).

d. SUMMARY OF ACCIDENT:

(1). The MA taxied approximately 10 minutes later than planned (Tab V-6-15). End of runway checks were completed and the MP completed his coordination with the simulated close air support controlling agencies while holding short of the runway (Tab V-6-15). The MP took the runway for departure and completed the standard runup checks and noted no abnormal engine indications (Tab V-6-17). The MA was cleared for takeoff on Luke Air Force Base's runway 03R at 1251:06 local time. The MAC acknowledged the clearance and subsequently switched their radio to the Luke Departure frequency (Tab N-3). The current weather

observation was 20 miles visibility, few clouds at 12,000', broken clouds at 20,000', temperature 18°C, and winds from 010° at 5 knots (Tab CC-33).

(2). The MA's takeoff roll was normal and the engine indications were normal for the first portion of the flight up to the landing gear retraction (Tab V-6-17). At 1252:00 a control tower person noted "Hey, he just flamed out" (Tab N-3). Multiple fireballs came out the back of the MA's tailpipe (Tab V-4-1). Premed 1, an F-16 in the Luke traffic pattern, transmitted on Luke Tower's frequency "Tower, you've got an aircraft...uh...at the end of the runway...flames shot out the back end" (Tab N-3). The MA was still over the northern end of Luke's runway 03R at approximately 200-500 feet above the ground and 200 knots (Tabs V-4-1, V-5-11, V-6-18). The MAC noticed severe vibrations and the MP began to execute the first step of the critical action procedures (CAPs) for engine failure on takeoff by zooming the aircraft (Tabs V-5-13, V-6-20). The severe vibrations went away for a few seconds and the MAC perceived the aircraft to be accelerating (Tabs V-5-12, V-6-22). The vibrations quickly returned and the MAC sensed a loss of thrust (Tab V-6-22). The MP initiated a momentary right turn but he was quickly advised and assisted on the control stick by the MIP, to turn left toward the relatively unpopulated area northwest of Luke (Tabs V-5-12,14; V-6-20). The MP waited for a few seconds to jettison the stores because he wanted to find an unpopulated area (Tab V-6-21). Initially, the MIP thought it might be possible to turn back toward Luke Air Force Base and land the MA on runway 21R and he attempted to transmit these intentions to the Luke control tower (Tab N-4). The radio in the MA was still tuned to the Luke Departure Control frequency (Tab V-5-20). Shortly thereafter, the lack of thrust, decaying airspeed and rapidly sinking altitude made the MAC realize the runway was too far away to reach and that there was an immediate need for ejection (Tabs V-5-21, V-6-23). The MIP notified air traffic control of the impending ejection at 1252:43 (Tab N-4) and the MAC initiated the ejection sequence (Tab N-4).

e. IMPACT:

(1). MA takeoff configuration (Tab J-33):

Station 1-LAU-129 missile launcher

Station 2-empty

Station 3-weapons pylon, TER-9 with 3 BDU-33s

Station 4-370 gallon fuel tank and fuel tank pylon

Station 5A-inlet hardpoint, LANTIRN Nav Pod

Station 5-empty

Station 5B-inlet hardpoint, LANTIRN Targeting Pod

Station 6-370 gallon fuel tank and fuel tank pylon

Station 7-weapons pylon, TER-9 with LAU-131 launcher and 7-2.75 inch rockets

Station 8-empty

Station 9-16S210 missile launcher and captive AIM-9L/M training missile

Ammo drum-338 rounds of 20mm TP Ammo

Flares-30 Mk 206 flares

Fuel-estimated 10000 lbs. (full tanks minus 1000 lbs. for start and taxi)

(2). The MP jettisoned the following external stores and they impacted near the

intersection of Litchfield road and Olive Avenue, coordinates N33 33.9777720, W112 21.5592083 (Tab R-2):

- (a). 2-370 gallon fuel tanks with an unknown quantity of fuel
- (b). TER-9 with LAU-131 Rocket Pod and 7-2.75 inch rockets

(3). The fuel tanks struck the ground near a 1983 Ford F150 pickup truck occupied by a male civilian . There was damage to the truck and the truck driver has claimed personnel injury (Tab P-2)

(4). MA impact configuration (Tab J-34):

Station 1-LAU-129 missile launcher

Station 2-empty

Station 3- weapons pylon, TER-9 with 3 BDU-33s

Station 4-fuel tank pylon

Station 5A-inlet hardpoint, LANTIRN Nav Pod

Station 5-empty

Station 5B-inlet hardpoint, LANTIRN Targeting Pod

Station 6-fuel tank pylon

Station 7-weapons pylon

Station 8-empty

Station 9-16S210 missile launcher and captive AIM-9L/M training missile

Ammo drum-338 rounds of 20mm TP Ammo

Flares-30 Mk 206 flares

Fuel-estimated 5900lbs. (full internal)

(5). The MA's main wreckage impacted 2 miles northwest of Luke AFB, AZ near the intersection of Peoria Avenue and Bullard Avenue, coordinates N 33 34.8078630 W 112 22.7029350 (Tab R-2). Time of the crash was approximately 1253 Arizona time, 7 January 1999 (Tab A-2). The scatter pattern of the wreckage indicated the aircraft struck the ground in an upright, wings level attitude, slightly nose low on level desert terrain (Tab J-34).

(6). The MA impacted approximately 100 feet south of Peoria Avenue (Tab R-3). Some of the wreckage scattered across Peoria road. The nose landing gear was found approximately 600 feet northwest of the main wreckage (Tab R-3). The canopy was located approximately 350 feet east of the main wreckage (Tab R-3). Some of the wreckage knocked down some power poles and power lines (Tab P-3). Although the wreckage impacted on private property near a house. No structures, animals, or people were actually hit (Tabs R-2, R-3).

f. LIFE SUPPORT EQUIPMENT, EGRESS and SURVIVAL:

(1). The MAC simultaneously initiated ejection by pulling the seat mounted ejection handles of their Advanced Concept Ejection System (ACES II) seats between 500-700' above the ground in a wings level attitude and approximately 15-20° nose low over relatively flat terrain (Tabs V-5-16, V-6-23). The ejection airspeed was around 170 knots (Tabs V-5-16, V-6-

23). The MIP had failed to select "AFT" on the ejection mode selector handle (it was discovered to have been in "SOLO") so the automatic proper firing sequence was inhibited (Tabs J-57, V-5-17, V-9-1).

(2). Because the ejections were nearly simultaneous and not properly sequenced, the two parachutes became entangled, with the MP getting a full parachute and the MIP's parachute not inflating properly (Tabs J-57, V-5-16, V-6-24). As the MAC descended, the MIP's parachute lines caught on the MP's parachute risers (Tabs J-58, V-5-16, V-6-24). Both crewmembers then descended beneath the MP's parachute (Tabs J-58, V-5-16, V-6-24). Analysis of the seats, individual survival kits and life support equipment showed all inspections current (Tab J-58). During the parachute rescue and descent, the emergency locator transmitter (ELT) beacon transmitted briefly before it fell silent (Tab V-9-1). The cause of the premature failure of the beacon is believed to have been due to the high impact speed caused by two crewmembers descending on one parachute (Tab V-9-1).

g. SEARCH AND RECOVERY (SAR):

(1) The mishap occurred at 1252 Arizona time. The first distress call was made by the MA shortly after takeoff on Luke departure control frequency that "Stein 1's emergency turn to the left we've got a motor knocking on us bad, clear the runway" (Tab N-4). 41 seconds later, the MIP made the following transmission, "Stein 1 emergency, we're going to be getting out of the airplane on a northeast heading. We're down to about seven..." (Tab N-4). Followed by an emergency locator transmitter broadcast (Tab N-4). The first call on the base crash net alerting rescue forces was at 1258 (Tab CC-1). Due to differences in timekeeping, the actual time the crash net was activated was probably 1253 (Tab V-4-1). The SOF testified the tower personnel witnessed the crash and activated the crash net immediately (Tab V-4-1).

(2) The first SAR asset on the scene was an F-16 (Howler 3) that was in the Luke AFB traffic pattern and observed the impact of MA (Tab N-3). He orbited the site at 3500 feet and radioed the SOF that he observed people assisting the pilot and relayed the coordinates of the crash site to the SOF (Tab V-4-1). Almost simultaneous with the arrival of Howler 3 on scene was an ambulance from Luke AFB hospital and an F-16 pilot in his privately owned vehicle rendering assistance (Tab V-5-23). In quick succession, other emergency vehicles, to include fire fighting, police, and medical, responded from Phoenix, Peoria, and Surprise, Arizona (Tab V-8-1). Due to a large number of eyewitnesses on and near the base and the availability of cellular telephones, the most likely cause of the rapid civilian response was due to 911 calls (Tab V-8-1). Both the external stores and MA impact sites were cordoned off by civil law enforcement agencies (Tab V-8-1). Luke AFB medical personnel transported both pilots back to the Luke hospital for observation and treatment (Tabs V-5-24, V-6-35, CC-9).

(3) There were no undue delays in responding to the mishap (Tab V-8-1). The coordination between the two On-Scene Commanders and civil authorities was good. Due to the proximity of the mishap to the base, there was minimal time elapsed from the MAC's ejection to rescue personnel on scene. The owner of the property the MA landed upon did not arrive on scene any earlier than the first rescue forces (Tab V-22-1). Overall, there were no difficulties experienced

in the rescue effort such as weather, time of day, topography, or civilians at the scene (Tab V-8-1).

h. RECOVERY OF REMAINS: Not applicable.

## 5. MAINTENANCE:

### a. FORMS DOCUMENTATION

(1). The 781 Series aircraft information provided was summarized from the MA forms and verified with a Consolidated Aircraft Maintenance System (CAMS) historical snapshot. The history of the 781A in-flight discrepancies preceding the mishap encompass fourteen days of forms (Tabs U-1 through U-115). The MA completed number 2 Phase inspection on 3 December 1998 (Tab H-3). This was accomplished at aircraft time 2799.7 hours (Tab H-3). 186.1 hours remained on the MA until the next scheduled phase inspection (Tab H-3). The MA had an engine change started on 11 June 1998 and completed on 12 July 1998 (Tab H-3).

(2). Replacement of 3<sup>rd</sup> Stage Turbine Blades and replacement of 4<sup>th</sup> Stage Turbine Blades were performed in conjunction with the engine removal on 4 Dec 1997 (Tab J-13). The turbine blades were replaced to prevent a known problem; third stage turbine blade tip curl (Tab J-13). IAW the applicable TCTO's both the 3<sup>rd</sup> and 4<sup>th</sup> stage turbine blades were replaced. The Fan Drive Turbine Module, which contains the 3<sup>rd</sup> and 4<sup>th</sup> stage turbine blades had 260.35 hours since previously overhauled, (Tab J-13) but had no specific time change criteria. A borescope inspection every 10 hours had been performed on the mishap engine 6.6 hours prior to the mishap, on 1 Dec 98 (Tab U-23).

There were two pilot-reported discrepancies since 1 January 1999 as noted below:

<u>DATE DISCOVERED</u>	<u>SYMBOL</u>	<u>DISCREPANCY</u>	<u>CORRECTIVE ACTION</u>
5/1/99	Red X	Aft Wiggins fitting by fuel Master Switch leaking- Ground Abort	Replace seals on aft fuel flow transmitter (Tabs U-4, H-3)
6/1/99	Red /	Flight data recorder maintenance fault listing codes 003, 020, 024 and 028	Performed Aircraft Structural Integrity Program Download (Tabs U-4, H-3)

(3). The following is a record of open write ups in the AFM 781 A's for the MA at the time of the mishap.

<u>DATE</u>			
<u>DISCOVERED</u>	<u>SYMBOL</u>	<u>DISCREPANCY</u>	
22/10/98	Info	Main fuel shut-off valve safetied to the open position IAW OTI J336017 (Tabs U-13, H-3)	
22/10/98	Info	Fuel Inert and Halon Heater circuit breaker pulled and collared to prevent halon from discharging IAW AETC OTI J436002 (Tabs U-13, H-3)	
22/10/98	Info	Halon bottle empty IAW AETC OTI J436002 (Tabs U-13, H-3)	
22/10/98	Info	Both Front Cockpit and rear cockpit anti-G hose dust covers removed (Tabs U-13, H-3)	
22/10/98	Info	Left and right speed brakes blended within limits (Tabs U-13, H-3)	
22/10/98	Info	Intake foreign object inspection due at Crew Show (Tabs U-13, H-3)	
5/12/98	Info	512 rounds of TP ammo, 15x Flare installed (Tabs U-15, H-3)	
6/1/99	Info	FCR 236 MFL (Tabs U-16, H-3)	

(4). The following is a record of open write-ups in the AFTO Form 781 K's.

<u>DATE</u>			
<u>DISCOVERED</u>	<u>SYMBOL</u>	<u>DISCREPANCY</u>	<u>STATUS</u>
7/10/98	Red /	ASHM Too dim to see anything	AWP (Tabs U-21, H-3)
16/10/98	Red /	Forward cockpit, left kick panel badly cracked	AWP (Tabs U-21, H-3)
30/11/98	Red /	Tab and screw missing from JFS fuel control c/p housing	AWP (Tabs U-22, H-3)

(5). Excerpts from AFTO Form 781 A's for the period of 6-7 January, 1999 demonstrate that the operational checks for the MA were completed in preparation for flight (Tabs U-14 through U-17). The information write-up for the "Intake F.O. Inspection due at crew show" was not signed off (Tab U-13). The crew chief that launched the MA said that he accomplished the inspection (Tab V-14-1) but did not document this in the AFTO Form 781 A (Tab V-14-1). Also included is the 781 A entry releasing the MA for flight (Tabs U-11, U-17). TCTOs that were not complied with did not relate to this mishap (Tabs U-20, U-21).

b. INSPECTIONS: F. O. Inspection at crew show was not accomplished IAW LAFB Instruction 21-107, Pg 6 Paragraph 4.4.2 (Tab BB-43). All other scheduled inspections were complied with in a timely manner (Tabs U-20, U-21, U-23).

c. MAINTENANCE PROCEDURES:

(1) Maintenance documentation; See Item 14, paragraph 1(b) and 1 (e) 2, 3, 4, 5 and 6.

d. MAINTENANCE PERSONNEL AND SUPERVISION: Personnel involved in the preflight servicing (filling of liquid oxygen, nitrogen, oil, and hydraulic reservoirs and containers) were found to be qualified. Pre-flight servicing was accomplished under qualified supervision (Tabs U-118 through U-124).

e. FUEL, HYDRAULIC OIL INSPECTION ANALYSIS: Pre-flight and post-flight analysis of oil, oil carts, hydraulic carts, and fuel trucks were within technical limits (Tab J-21 through J-27). Pre-flight and post-flight analysis of F-100-PW-220E Number PWOE105107's engine fluids from the MA was performed and found to be within technical limits (Tab D-2).

f. UNSCHEDULED MAINTENANCE: Unscheduled maintenance since last inspection was reviewed and had no bearing on the mishap (Tab U-1 through U-115).

**6. AIRCRAFT AND AIRFRAME, MISSILE OR SPACE VEHICLE SYSTEMS (MA):**

a. The MA was functioning properly at engine start, through taxi and end of runway (EOR) checks and immediately prior to takeoff (Tabs V-5-11, V-6-18). On takeoff, shortly after becoming airborne, MA experienced engine anomalies (Tabs V-5-11, V-6-18).

b. MA impacted the ground approximately 2.2 miles north of Luke AFB. Ground impact and post impact fire caused damage to all aircraft parts (Tab A-2). Prior to impact with the ground the MA experienced severe vibrations and significant loss of thrust (Tabs V-5-11, V-6-18). After loss of thrust, the MP jettisoned the external stores (Tab V-5-14). The external wing tanks and rocket pod landed on private property approximately  $\frac{1}{2}$  mile south of the aircraft (Tabs R-2 through R-6). The canopy was found, along with parachutes for both aircrew, approximately 250 feet E/SE of the main impact site (Tab R-3). The engine anomalies experienced by the MA resulted in an unserviceable aircraft and subsequent ejection of MAC (Tabs V-5-15, V-6-18). MA was destroyed by impact and post-impact fire (Tab A-2).

c. The Crash Survivable Memory Unit (CSMU) was analyzed by Lockheed Martin. No data from any segments of flight for the MA was recovered (Tab J-38). Some fragmentary data from ground operations prior to takeoff for MA was recovered but was not of significant value (Tab J-38).

d. Post-mishap engine analysis found all 68 blades of the 3<sup>rd</sup> stage heavily damaged (Tabs J-13,14, S-4). Subsequent damage to 4<sup>th</sup> stage turbine showed extreme damage (Tabs J-13,14, S-5). Additional damage to the engine resulted from impact and post impact fire (Tabs J-13,14).

## 7. WEATHER:

a. **FORECAST WEATHER**: Automated Weather Information & Distribution System (AWIDS) terminal forecast for Luke AFB was for a ceiling of broken clouds at 25,000 feet (Tab K-3). Surface wind was forecast to be from the northeast at 7 knots with visibility of at least 20 miles (Tab K-3). Barometric pressure was forecast to be 30.09 inches of mercury (Tab K-3).

b. **OBSERVED WEATHER**: A Luke AFB local weather observation was taken at 1955Z (1255 Arizona time) for few clouds at 12,000 feet, and a ceiling of broken clouds at 25,000 feet (Tab C-33). The wind was from a true bearing of 010° at a velocity of 5 knots (Tab C-33). Visibility was 20 miles (Tab C-33). Barometric pressure was 30.04 inches of mercury (Tab C-33). Temperature was 18° Celsius with a dewpoint of -3° Celsius (Tab C-33).

c. **SPACE ENVIRONMENT**: Not Applicable.

d. **CONCLUSIONS**: The MA departed Luke AFB on an IFR (Instrument Flight Rules) clearance utilizing the Busco-Buggs stereo instrument departure procedures (Tabs K-2, BB-109). The mishap sequence occurred in visual meteorological conditions (VMC) with clear visibility (Tab C-33). Weather was not a factor in this mishap.

## 8. CREW QUALIFICATIONS:

a. **Captain Julian Chesnutt (MP)**

RPI 1, ASC-1A, Senior pilot rating, DAFSC O11F3H  
30/60/90-day history shows 14.9/32.7/71.0 flight hours  
Assigned to the 555<sup>th</sup> Fighter Squadron, 31<sup>st</sup> Fighter Wing  
Temporarily assigned to the 310<sup>th</sup> Fighter Squadron, 56<sup>th</sup> Fighter wing  
383.7 total F-16 hours as of 7 January 1999  
Initial pilot training instrument qualification (T-38) - 30 August 1990  
Initial F-16 instrument/qualification rating - 16 January 1997  
Current F-16 instrument/qualification - 20 May 98  
Current critical action procedures (CAPs) - 4 January 1999  
Current flight crew information file (FCIF) - current  
Current situational emergency procedures training (SEPT)  
Current standardization and evaluation periodic testing  
Certified as a 2-ship flight lead in the 555<sup>th</sup> Fighter Squadron - 24 June 1998

Egress training current – 180 day refresher accomplished – 30 December 1998

b. The MP met all course requirements of the Forward Air Controller-Airborne F16C0FACPL (Tabs V-2-1, BB-6). All course prerequisites had been accomplished and training standards met or exceeded prior to the mishap sortie (Tabs V-2-1, BB-16). The MP was current and qualified to perform all tasks assigned to him on 7 January 1999 (Tabs G-2 through G-4, V-2-1).

c. Captain Brian L. Egger (MIP)

RPI 6, ASC-1A, Senior pilot rating, DAFSC WO11F3H  
30/60/90-day history shows 8.1/23.7/39.8 flight hours  
Attached to fly with the 310<sup>th</sup> Fighter Squadron, 56<sup>th</sup> Fighter Wing  
Assigned to the 56<sup>th</sup> Training Squadron, 56<sup>th</sup> Fighter Wing  
1900.0 total F-16 hours as of 7 January 1999  
Initial pilot training instrument qualification (T-38) – 7 November 1989  
Initial F-16 instrument/qualification rating – 5 June 1990  
Initial F-16 instructor qualification – 14 April 1994  
F-16 formal training unit (FTU) instructor qualification – 11 March 1997  
Current F-16 instrument/qualification – 17 August 1998  
Current critical action procedures (CAPs) – 4 January 1999  
Current flight crew information file (FCIF) - current  
Current situational emergency procedures training (SEPT)  
Current standardization and evaluation periodic testing  
Certified as an instructor in the 310<sup>th</sup> Fighter Squadron – 14 March 1997  
Egress training current – 180 day refresher accomplished – 6 January 1999

d. MIP was current and qualified to perform all tasks assigned to him on 7 January 1999 (Tabs G-5 through G-6, V-3-1).

9. MEDICAL:

a. HEALTH: The MP and MIP were medically cleared and qualified for flying duties at the time of the mishap (Tabs AA-4, AA-26). There is no evidence in the medical records of medical/psychological factors which would have caused or contributed to the mishap (Tabs V-21-1, X-1, X-2).

b. PATHOLOGY: Post-mishap examinations were conducted on the MAC. In addition, toxicological tests were conducted on the MAC as well as all ground personnel involved in launching the MA. There is no evidence to indicate either of the MAC experienced a medical or physical condition that interfered with his ability to safely operate the aircraft (Tabs X-1, X-2). Neither is there any evidence, which indicates any of the ground personnel involved with launching the MA were under the influence of illegal substances (Tabs X-1, X-2).

c. LIFESTYLE: There were no indications of unusual habits, behavior or stress that would have contributed to this mishap (Tabs V-5-5,6; V-6-6, V-21-1).

d. **CREW REST AND CREW DUTY TIME:** The MP arrived at work at about 0800 on the day of the mishap (Tab V-6-6). The MIP arrived at work between 0800 and 0900 on the day of the mishap (Tab V-5-5). The MAC complied with all crew rest requirements (Tabs V-5-5, V-6-6). The mishap occurred about five hours into their duty day (Tab A-2).

## **10. OPERATIONS AND SUPERVISION:**

a. **OPERATIONS:** The operations tempo of the 310 FS was high, but not so high as to characterize the squadron personnel as being overworked (Tabs V-1-1, V-16-1). The 310<sup>th</sup> FS permanent party of pilots are all instructors with a high level of experience. The students are all pilots who have been previously qualified in the F-16 or another fighter (Tab V-7-2). The maintenance personnel are qualified but there is a shortage of fully trained personnel (5 and 7 levels) as compared to not fully qualified personnel (3 levels) (Tab V-1-1). The operations tempo is above average and experience level about average for the wing (Tabs V-7-1,2).

b. **SUPERVISION:** The MP was under the direct inflight supervision of MIP (Tab V-6-20) and under the day to day supervision of Capt Kelly (Tab V-2-1). Capt. Kelly did not have any derogatory comments concerning the MP's flying abilities (Tab V-2-1). The MIP's day-to-day supervisor was Maj Brown (Tab V-3-1). Both he and the squadron commander extolled the above average flying skills of the MIP (Tabs V-1-1, V-3-1). The mission was scheduled and briefed as an Air Strike Control - 2 mission under the F-16 Training Syllabus (Tab V-5-7) AETC Syllabus F16COFACPL (*USAF Forward Air Control (Airborne) Training F-16C/D*). Authorization for the flight was on a USAF Order 99-060, signed by Maj George Stillman, 310 FS/ADO (Tab K-2).

**11. HUMAN FACTORS ANALYSIS:** There was no evidence of any complacency, overconfidence, undermotivation to succeed, distraction, disruption, pressure, channelized attention, or other degradations that may have led to the accident. (Tabs V-1-1,2; V-16-1). The required engine intake inspection due on aircrew arrival was apparently not performed. Neither the MAC nor the assistant helping launch the MA recall seeing the engine intake inspection performed (Tabs V-5-19, V-10-1, V-15-1). The crew chief testified he performed the inspection but did not annotate the aircraft maintenance forms as required (Tab V-14-1). This was an uncharacteristic mistake by this particular crew chief (Tabs V-14-1, V-16-1).

## **12. GOVERNING DIRECTIVES AND PUBLICATIONS:**

The following directives and publications were applicable to the mishap mission (Tab BB-1 through BB-73, BB-108 through BB-115. BB-74 through BB-107 not used):

AETC Syllabus F16COFACPL – *USAF Forward Air Control (Airborne) Training F-16C/D* – August 1998

Luke AFB Instruction 21-107, 24 November 1998 - *Preventing Foreign Object Damage to Aircraft*

**MA Operating Instruction 21-38, 10 April 1998 - F100-220/220E Engine Documentation**

**MA Operating Instruction 36-3, 11 February 1998 - Training requirements for qualification, certification, and recertification on engine borescope operations**

**56<sup>th</sup> Fighter Wing Falcon Facts, Change 1, November 1998**

**56<sup>th</sup> Fighter Wing CAS Pack, June 98**

**13. NEWS MEDIA INVOLVEMENT:**

a. The aircraft mishap created high media interest on the day of the mishap. The mishap was the lead story on the local news broadcasts (Tabs V-23-1, CC-31). A couple of the local television stations interrupted their regular programming to cover the mishap (Tabs V-23-1, CC-31). Shortly after the mishap, local news aircraft were in the vicinity providing coverage of the aircraft mishap (Tab V-23-1). The lead stories included footage of the mishap site, interviews with several civilian witnesses to the mishap, and footage of a press briefing conducted by Brigadier General Barry, 56 FW/CC (Tabs V-23-1, CC-31). Coverage also indicated this was the third mishap involving an F-16 since October 1998, that the mishap occurred while on a routine training mission and identified the two mishap pilots (Tab CC-31). Subsequent news coverage discussed the issue of new housing developments encroaching upon Luke AFB (Tab CC-31). One of the local news channels also conducted an interview with a civilian who suffered personal injuries from debris from the mishap (Tab CC-31).

b. Several news articles appeared in Phoenix metropolitan area newspapers immediately after the 7 January 1999 mishap (Tabs CC-16 through CC-26). The articles indicated a civilian had been injured, that fuel had been spilled on farmland, and this was the third aircraft mishap since October 1998 (Tabs CC-16, CC-19). The news articles also included interviews with civilian witnesses to the mishap (Tabs CC-17, CC-19, 20; CC-24 through 26). Further coverage addressed concerns from members of the Arizona congressional delegation (Tabs CC-22, 23).

c. 56 FW/PA issued two press releases on 7 January 1999, acknowledging a two-seat F-16 aircraft had crashed 1 ½ miles north of Luke AFB during takeoff for a routine training mission. (Tabs CC-27, CC-28). The release indicated the MP and MIP ejected safely and were transported to the hospital for examination and appeared to be in good condition (Tabs CC-27, CC-28). Both press releases stated a board of officers would be assigned to investigate the mishap (Tabs CC-27, CC-28). The second press release identified the two pilots, their flying hours, and indicated that one was an instructor pilot and the other was a student. The release also stated the F-16 had 25 pound practice bombs, flares and white phosphorus rockets on board at the time of the mishap (Tab CC-28). 56 FW/PA handled between 125 to 150 media inquiries in the first 48 hours following the mishap (Tab V-23-1).

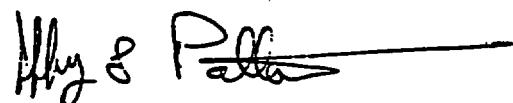
**14. ADDITIONAL AREAS OF CONCERN:** In reviewing the facts of the mishap, the accident investigation board did not uncover any deficiencies in navigation aids, airfield facilities, visual or instrument flight rule procedures or electromagnetic environmental effects

(E3). The board did notice several maintenance and operations practices that, while not directly contributing to the mishap, indicate areas of concern:

- a) The Crash Survivable Flight Data Recorder (CSFDR) operated, but did not record data on this sortie (Tab J-38). This board also investigated the 22 October 1998 mishap from this same squadron and noted that the CSFDR did not operate on either of the two aircraft involved with that mishap (Tab J-17, 22 Oct 1998 AIB Report).
- b) The intake inspection required when the MAC initially arrived at MA was not accomplished. No witnesses reported seeing the inspection accomplished and it was not annotated as being completed in the MA's maintenance record (Tabs U-13, V-14-1).
- c) The crew coordination briefing between the MP and the MIP was perfunctory (Tab V-6-13). The MIP failed to put the ejection mode selection handle in the AFT position as required in the "Top Hat Standards" (Tabs V-3-1, V-5-17, V-9-1).
- d) The MIP bumping the stick once the engine malfunctioned caused doubt in the mind of the MP as to who was flying the MA. There was never any change of aircraft control between the MP and the MIP (Tab V-5-12).
- e) There were numerous documentation errors in the mishap aircraft's maintenance record (AFTO 781) (Tab U-1 through U-114). These errors indicated lack of attention to detail in regards to proper documentation. Sample errors are listed below:
  - (1) Info write-up for 512 rounds TP ammo and 15 flares installed (Tab U-15). Previous write-ups in forms of 6 January 1999 showed 30 flares installed (Tab U-31). The write-up referred to on 5-12-98 shows 30 flares installed (Tab U-116). The weapons flight kept a log that showed 388 rounds were loaded vice forms documentation (Tab V-20-1). 383 rounds were subsequently recovered (Tab CC-3-6).
  - (2) The discrepancy written up on 6-1-99, Pg. 4 of AFTO Forms 781 Block 1 is informational in nature, the "when discovered by" block is signed only by a "Capt." (Tab U-16). This write-up was not transferred correctly (Tab U-35 Pg. 7 of 10, Block 1). Additionally this was a Pilot Reported Deficiency (PRD) and not shown on the PRD log as required by wing leadership (Tab V-11-2).
  - (3) It appears that installation of flares is being accomplished and annotated via the Info write-up for the gun (Tabs U-15, U-31, U-60, U-72, U-96) and added to an existing write-up. When rounds were expended, the write-up was crossed out (Tabs U-31, U-60, U-72, U-96).
  - (4) The CSFDR was downloaded on 6 January 1999 to correct a PRD (Tab U-34). The aircraft time of the download, 2823.6 (Tab D-2) was not subtracted from the resulting CSFDR 150-hour download (Tab H-14), resulting in a projected CSFDR download at the 3079.9 point (Tab H-14), a difference of 256.3 hours vice the 150 hours required between downloads (Tab U-19).

(5) The aircraft was flying with an unapproved external stores configuration (Tab J-34).

(6) The aircraft forms contained optional 380 CAMS screen runs. These forms showed the aircraft flying on an open Red X (Tab U-7).



JEFFREY L. PATTON, Col, USAF  
President, Accident Investigation Board

## GLOSSARY

**3<sup>rd</sup> Stage** – A stage of the engine behind the core compressor, part of the high speed turbine section.

**370 tanks** – 370 gallon external fuel tanks carried by the F-16 to extend its range. The tanks can be jettisoned by the pilot in emergencies.

**4<sup>th</sup> Stage** – A stage of the engine behind the 3<sup>rd</sup> stage, part of the high speed turbine section.

**781's** – Aircraft forms that provide information about the aircraft, ie. fuel loads, armament, aircraft problems, etc.

**A-10** – Twin engine, single piloted, close air support aircraft.

**AB** – Afterburner. A mode of engine operation that provides maximum thrust, characterized by a conical flame extending from the rear of the aircraft.

**ACES-2** – Advance Cockpit Ejection System. The name used for the F-16 ejection seat.

**Anti-G** – Term referring to a system that helps the aircrew during maneuvers that subject their bodies to gravity at an accelerated rate.

**Augmented** – Refers to an engine that has additional thrust provided by an afterburner, increases thrust to maximum extent possible.

**AWP** – Awaiting Parts. An aircraft status that refers to a discrepancy that is not grounding, that is awaiting parts (previously ordered) to repair.

**BDU** – Bomb Dummy Unit. An inert practice bomb. Usually contains a small smoke charge so the range personnel and aircrew can tell where it impacts.

**Borescope** – An instrument and a procedure by which a flexible camera and a light are inserted into engine components to inspect for damage.

**BPO** – Basic Post Flight. An inspection of the aircraft after a flight to determine if there are any problems. This can be combined with a thruflight in order to not duplicate work.

**Break Down the Aircraft** – A term that is used to signify taking off the covers from the engines and various components of an aircraft in preparation for flight.

**C/P** – Cannon Plug. A device that fits together, normally two parts, a male and female portion that contain pins for the transfer of electrical/electronic data.

ATTCH 1-1

**CAPs – Critical Action Procedures.** A set of memorized procedures pilots are taught to execute during time critical emergencies.

**CAMS - Consolidated Aircraft Maintenance System.** An automated system that contains aircraft and personal status for maintenance personnel.

**Crew rest –** By regulation, pilots are required to be away from work for 12 hours before they can fly again. In addition, during that 12 hours, they must have 8 hours of uninterrupted (work related interruptions) time for sleep.

**CSFDR – Crash Survivable Flight Data Recorder** (also called CSMU). See CSMU for definition.

**CSMU – Crash Survivable Memory Unit.** A unit in the back portion of the aircraft that documents flight information periodically during aircraft missions.

**DCC – Dedicated Crew Chief.** An individual who is primarily responsible for a specific aircraft. Assigned to a given aircraft but can work others if required.

**DEEC – Digital Electronic Engine Control.** Digital computer that aids in the controlling of specific portions and operations of the engine.

**Depot –** A place where aircraft and sub components are sent to perform heavy maintenance and/or work that the field is unable to perform.

**ELT – Emergency Locator Transmitter.** A radio that transmits a warbling tone on a preselected emergency frequency. The ELT is contained in the ejection seat and is activated upon ejection.

**EOR – End of Runway.** Where the “last chance” inspections are performed and aircraft armed for the mission, or where aircraft are de-armed and made safe after the mission. Arm/de-arm are at opposite ends of the airfield.

**ER – Exceptional Release.** An inspection of the aircraft by a senior member of the maintenance organization that certifies the aircraft is safe for flight. This includes checking the forms for proper documentation as well as a walk-around of the aircraft using a specific training guide.

**F-16 – Single engine fighter aircraft manufactured by Lockheed Martin.** Two seat versions are called “D models”, single seat versions are called “C models”.

**FAC-A – Forward Air Controller Airborne.** A pilot who is trained to coordinate with fighter aircraft and ground forces while directing airstrikes near friendly forces.

ATTCH 1-2

**F.O.** – Foreign Objects. Objects that are not part of the aircraft. This normally refers to items ingested by the aircraft engine. Damage from F.O. can be severe resulting in engine changes, or minor depending on size and type of F.O.

**FCR** – Flight Control Recorder. Records various aspects of flight.

**Front Cockpit** – In a D model aircraft with two cockpits, the front portion where the pilot sits and flies the aircraft.

**FTIT** – Fan Turbine Inlet Temperature. Temperature on specific component of the engine.

**FTU** – Formal Training Unit. The school that teaches upgrading pilots. The 56<sup>th</sup> Fighter Wing at Luke AFB, AZ is the USAF's active duty F-16 FTU.

**GE** – General Electric. Company that produces a motor that is used in a different model of the F-16.

**Ground Abort** – A write-up that causes an aircraft to miss its mission due to problems with the aircraft.

**HPT** – High Pressure Turbine. Modular part of the engine behind the combustion section.

**IAW** – In Accordance With. A term used to show compliance with a specific item, ie. a regulation.

**IP** – Instructor Pilot. A highly experienced pilot who is responsible for teaching the upgrading pilot.

**JFS** – Jet Fuel Starter. Starts the aircraft engine.

**LAU 131** – A rocket launcher that can hold up to seven 2.75 inch folding fin aerial rockets.

**LPT** – Low Pressure Turbine. An engine component (module) that contains the 3<sup>rd</sup> stage and 4<sup>th</sup> stage. Focus of the investigation.

**MA** – Mishap Aircraft. The aircraft involved in the mishap.

**MAC** – Mishap Air Crew. In this mishap, the MAC consisted of the mishap pilot and mishap instructor pilot.

**MIP** - Mishap instructor pilot. In this mishap the MIP occupied the rear cockpit of the mishap aircraft.

ATTCH 1-3

**MP** – Mishap pilot. In this mishap, the mishap pilot was an upgrading pilot and occupied the front cockpit.

**MFL** – Maintenance Fault Listing. A listing that shows what specific codes are as shown by the computers. Aids in determining aircraft problems.

**Mx** – Abbreviation for the word maintenance.

**NOTAMs** – Notice to Airmen. A printed list distributed to pilots which identifies any airfield or navigation facilities which are out of order.

**PFL** – Pilot Fault Listing. Listing on a computer that shows errors in the system and allows maintenance to correct the problem.

**Phase Inspection** – A timed approach to inspecting various items on an aircraft from the primary airframe to the engine.

**PRD** - Pilot Reported Discrepancies A write-up/discrepancy as reported during an after flight/ground operations. Depending on severity, they can ground an aircraft or result in non-working portions of the airplane.

**Pre-flight** – An inspection of the aircraft that insures it is ready for flight. This includes the filling of certain liquids, air pressures and a thorough check of systems that would be used by the aircrew for flight.

**Production Supervisor** – The senior person on the flightline charged with insuring the production of aircraft for the daily flying schedule.

**Rear Cockpit** – In a D Model aircraft with two cockpits, the back portion where the pilot sits and flies the aircraft.

**Red X Symbol** – A symbol that when entered in aircraft forms means the aircraft is not safe to fly.

**RPM** – Revolutions Per Minute. The amount of times an object turns 360 degrees in a minute.

**SEC** – Secondary Engine Control. A mode of operating the engine as an alternate method when the primary method is not working or unavailable.

**SEPT** – Situational Emergencies Procedures Training. A monthly discussion between pilots which reviews recent accidents and the proper procedures to follow if the same situation should occur again.

ATTCH 1-4

**SID**- Standard Instrument Procedure. A ground track with prescribed altitudes that pilots fly to leave an airport. The SID can be flown in the weather and will keep the aircraft clear of obstacles and other aircraft.

**SOF** – Supervisor of Flying. A senior instructor pilot located in the Air Traffic Control tower. Charged with overseeing the wings flying operations and assisting pilots with emergencies.

**Speed Brake** – A rectangular piece of the aircraft that can be extended at various times of the flight to aid in slowing the aircraft down through aerodynamic forces.

**Stake** – An aircraft appendage, fin, that extends below the right or left side of the front of the aircraft.

**Stein 1** – The radio callsign of the mishap aircraft.

**Stores** – The external load carried by an aircraft such as fuel tanks, armament, and suspension equipment. Can be jettisoned in an emergency.

**TER** – Triple Ejection Rack. Suspension equipment used to hold multiple types of munitions on an aircraft, depending on the type of mission to be flown.

**Thruflight** – An inspection of the aircraft between flights to insure nothing has gone wrong with the aircraft and it is ready to fly again.

**TCTO** - Time Compliance Technical Order. A written order that has a specific time in which it must be completed to avoid possible grounding of the aircraft, or a waiver would be required to fly the aircraft.

**TO** – Technical Order. A book(s) that have the technical requirements for flying and maintaining an aircraft.

**TP** – Target Practice. Refers to practice ammunition. It contains primers for firing and propellant but the bullet portion is inert.

**Transient Alert** – An organization/part of an organization that services aircraft that stop by a unit, but are not assigned to the base.

**Turbine Blade** – A metal blade that is part of the engine and rotates around a cylindrical device. Enables airflow and other engine functions to produce acceleration for an aircraft or can aid in equipment operations.

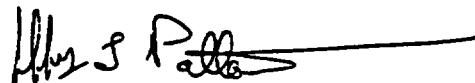
**Zoom** – A pilot action exchanging airspeed for altitude by raising the nose of the aircraft above level flight. A required maneuver to increase chances for a successful ejection at low altitude.

ATTCH 1-5

## STATEMENT OF OPINION

Under 10 U.S.C. 2254(d), any opinion of the accident investigations 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 proceedings arising from an aircraft accident, nor may such information be considered an admission of liability by the United States or any person referred to in those conclusions or statements.

1. Shortly after takeoff at 1252 Arizona time on 7 January 1999, the mishap pilot (MP) and the mishap instructor pilot (MIP) experienced severe vibrations and loss of thrust from the mishap aircraft (MA) (Tabs V-5-11,12; V-6-18). The MP zoomed the aircraft, jettisoned the external stores, and turned to the west (Tabs V-5-13,14). The MIP assessed the aircraft was losing altitude and commanded the MP to eject (Tab V-5-21). Both pilots ejected without significant injury. The MA impacted the ground and was destroyed.
2. Clear and convincing evidence shows that the MA's F-100 PW-220E engine suffered an internal failure of the fan drive turbine (FDT) (Tab J-13). The FDT damage originated in the 3<sup>rd</sup> stage turbine blades, by which one or more blades failed structurally, which caused rotor imbalance, blade impingement on the turbine shroud, loss of 4<sup>th</sup> stage turbine blades, engine stall and loss of thrust (Tabs J-14, J-16). The most likely cause of the 3<sup>rd</sup> stage turbine blade failure was creep induced stress rupture of a blade tip (Tab J-16).
3. There is no evidence that the MP or MIP could have foreseen the cause of the mishap or prevented it once they recognized the engine problem. The MP correctly performed emergency procedures. The mishap crew's turning the MA turn away from inhabited areas prior to their ejection, undoubtedly prevented possible serious injury and loss of life on the ground.



JEFFREY L. PATTON, Colonel, USAF  
President, Aircraft Investigation Board

11 February 1999

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Date