

AIRCRAFT ACCIDENT INVESTIGATION

Staff _____ IDENTIFIED ☒
 Applicant _____ RECEIVED ☒
 Intervenor _____ REJECTED _____
 Other Joint WITHDRAWN _____
 DATE 4-11-02 Witness _____
 Clerk L. Shindurling

1. STATEMENT OF AUTHORITY AND PURPOSE

a. Authority: Under the provisions of Air Force Regulation (AFR) 110-14, the Ninth Air Force Commander appointed Lieutenant Colonel Charles R. Rogers, III to conduct an Aircraft Accident Investigation of the F-16CJ (SN 90-0823) accident which occurred near Cosby, Tennessee on 2 February 1994. The investigation was from 1 March 1994 to 15 March 1994. Technical Advisors were Captain Luther M. Adams, III (Operations), Captain Richard S. Mountain (Maintenance), Captain James L. Flanary (Legal), Major Hernando J. Ortega, Jr. (Medical), and Airman Angela G. Hendricks (Administrative Support).

b. Purpose: An aircraft accident investigation is convened under AFR 110-14. The investigation is intended primarily to gather and preserve evidence for claims, litigation, disciplinary and administrative needs. In addition to setting forth factual information concerning the accident, the investigating officer is also required to state his opinion concerning the cause or causes of the accident (if there is clear and convincing evidence to support that opinion), or to describe those factors, if any, that in the opinion of the investigating officer substantially contributed to the accident. The report is available for public dissemination under the Freedom of Information Act (5 U.S.C. 552) and AFR 4-33.

2. SUMMARY OF FACTS

a. History of Flight: On 2 Feb 94, Captain Michael A. MacWilliam, the mishap pilot (MP), was scheduled as number 2 of a two-ship Dissimilar Air Combat Tactics (DACT) upgrade flight as the instructor pilot. Captain David Y. Knox led the mission filed under callsign Visor 81 (K-2). The flight departed Shaw AFB, SC at 1451 hours Eastern Standard Time (EST) (A-1) and proceeded to the Snowbird Military Operating Area (MOA) in northeastern Tennessee. Shortly after commencing air-to-air tactics with Peach 11, a flight of two F-15s from Dobbins ARB, GA, the MP heard and felt what he described as an explosion followed by a loss of thrust and initiated the airstart sequence (V-1). After several unsuccessful airstart attempts, Captain MacWilliam directed the aircraft toward an uninhabited wooded area and safely ejected. The aircraft crashed and was destroyed. The crash site was 10 nautical miles (NM) South Southwest of Newport, TN at 35° 49.15' North latitude, 83° 16.60' West longitude (R-1). The Shaw AFB (ACC) Public Affairs office handled news inquiries.

b. Mission: The mission was scheduled and planned as a two-ship DACT Flight Lead Upgrade. The planned profile included single ship military (mil) power takeoffs, rejoin, medium altitude cruise to the Snowbird MOA, two versus two (2v2) DACT engagements with F-15s (Peach 11 flight) from Dobbins ARB, GA, and return to Shaw via vectors to initial for overhead full stop landings (V-1, V-2).

c. Briefing and Preflight: Captain MacWilliam reported for duty at approximately 1100L, Captain Knox at 0745L. Both pilots reported getting required crew rest. The flight briefing began at 1255L and both pilots reported that the briefing was comprehensive and that they both had a clear understanding of their responsibilities and the planned events (V-1, V-2). At step time, the

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mishap aircraft was not crew ready. When Capt MacWilliam arrived at the aircraft, a panel toward the rear of the aircraft was down, and he suspected that the Accessory Drive Gearbox (ADG) oil was being serviced. Review of the aircraft forms (U-8) and crew chief testimony (V-3) confirm this to be the case. Engine start and the remainder of ground operations were performed without any unusual occurrences or deviations (V-1, V-2).

d. Flight: Visor 81 flight took off at 1451 EST on a DD 175 flight plan (K-3). The takeoffs were single-ship using military power. Engine response during the takeoff and enroute portions of the flight was reported to be normal by the MP (V-1). The 180 NM flight to Snowbird was uneventful. The Snowbird MOA is located over the Great Smokey Mountains in northeastern Tennessee. This is significant in that the surface mean sea level (MSL) altitude is predominately between 5000-6000 ft, with peaks as high as 6600 ft. The flight entered the MOA and accomplished G-awareness maneuvers prior to beginning tactical maneuvers with Peach 11 flight (V-2). During the first engagement, Captain MacWilliam, starting from a close formation, accomplished a rapidly descending and turning maneuver. As he leveled off at approximately 13,000 ft, he felt and heard what he thought to be a loud explosion followed by thick smoke in the cockpit (V-1). The MP called "Knock it off" and began to zoom the aircraft while trying to see the engine instruments. At an apex of 18,000 ft he noted no engine response to his throttle movements. With the RPM "hung" at 60%, Captain MacWilliam began a series of airstart attempts in accordance with (IAW) standard critical action procedures (CAPS) (V-1). Visor 81 was able to rejoin with the mishap aircraft and look him over as he was in a 170-180 knot glide. He noticed no significant damage or any fire or smoke from the distressed aircraft, only an orange ring of fire within the engine itself (V-2). Crash survivable flight data recorder (CSFDR) data indicates this was the turbine section glowing hot due to high temperatures experienced during numerous airstart attempts (O-6). During each airstart attempt, as the RPM reached 52%, the aircraft began to shake violently (V-1). After six unsuccessful attempts at restart, the MP directed the aircraft toward a small ridge line and ejected at approximately 1800 ft Above Ground Level (AGL) (V-1).

e. Impact: The aircraft crashed at 1531 EST in an uninhabited wooded area south of Newport, TN. Parameters at impact were 220 knots, 6° nose down, and 24° right wing low (O-19 through O-20). The impact heading was 036°, and wreckage was scattered along a 380 ft x 1080 ft area (R-1). The aircraft was damaged beyond economical repair (M-1). The 20th Medical Group Bioenvironmental Engineering personnel responded to the crash to identify and remedy environmental damage at the scene. Remedial action was implemented and is continuing at this time (V-5).

f. Ejection Seat: The ejection seat functioned normally. The seat and canopy were not recovered. This is significant because of the probability that unexpended explosive cartridges remain in the seat. Based on the parameters of the ejection, the drogue gun cartridge and alternate mortar cartridge should not have fired. These cartridges could be set off by tampering, mishandling, or even static discharge, and could cause serious or fatal injuries. Of note is that there is no warning information about these dangers on the seat itself. All reasonable measures have been taken to disseminate this information to civilians in the local area to include prominently posted flyers as well as newspaper and television press releases. This information is included as a collateral finding at Tab AA (AA-1 through AA-3.2).

(f) The high pressure turbine showed evidence of trailing edge impacts and small pieces missing from the outer diameter. The high pressure nozzle, rotor, and shroud all had deposits of metal splatter composed of nickel, chromium, aluminum, titanium, and copper.

(g) The low pressure turbine blades showed no evidence of damage although they did have metal splatter attached, especially at the outer diameter. Thermal distress at the 5:00 and 10:00 position (looking from the aft of the engine) originated from high turbine temperatures experienced during the numerous airstart attempts.

n. Operations Personnel and Supervision: The mission was accomplished under authority of the 20th FW and 79th FS. Captain Knox gave the pre-mission brief in accordance with MCR 55-116 and MCR 55-116, Shaw AFB Supplement 1. All supervisor briefings and actions were accomplished.

o. Pilot Qualifications: Captain MacWilliam was current and fully qualified to perform the scheduled mission (T-1 through T-3). His flying experience is as follows:

F-16 C/D	1470.0
F-16 A/B	320.8
AT-38	27.6
<u>Student Time</u>	<u>179.2</u>
Total Time	1997.6

HOURS/SORTIES

Last 30 days	26.8/20
Last 60 days	62.8/42
Last 90 days	86.1/57

p. Medical: Captain MacWilliam was medically qualified to fly (X-2). He suffered only minor injuries (bruises and scratches) related to the ejection and tree landing (X-1). Toxicology specimens contained no alcohol, elevated carbon monoxide levels, or illegal substances (X-3). Additionally, the toxicology specimens from all involved maintenance personnel were also negative (X-4 through X-12.2).

q. NAVAIDS and Facilities: All applicable NAVAIDS were in operation. There were no NOTAMs applicable to this accident.

r. Weather: The weather was clear with seven-plus miles visibility. The winds were out of the southwest; 100 knots at 26,000 ft; 10 knots on the surface. Altimeter was 30.21 (W-2, W-4, W-5).

s. Directives and Publications:

MCR 55-116, F-16 Pilot Operational Procedures
MCR 55-116, SAFB Sup 1 Local Operating Procedures
T.O. 1F-16CJ-1, Flight Manual
T.O. 1F-16CJ-1CL-1, Flight Manual Checklist

There are no indications of deviation from directives.

3. OPINION AS TO THE CAUSE OF THE ACCIDENT: Under 10 U.S.C. 2254 (D), any 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 proceedings arising from an aircraft accident, nor may such information be considered an admission of liability by the United States or by any person referred to in those conclusions or statements. Based upon evidence which I found to be clear and convincing, it is my opinion as investigating officer that the cause of the accident was engine failure as a result of damage sustained when the #3 blade of the first fan stage failed, separated, and propagated damage throughout the fan, compressor, and combustion sections as it was ingested. Because the origin area (a piece of the leading edge measuring 0.7 inch radially by 0.4 inch axially) of the initial high cycle fatigue fracture on blade #3 was never located, the root cause of the fatigue or time of initial fracture cannot be determined at this time. Additionally, it cannot be determined if a fracture would have been visible to inspection prior to the mishap flight.

Charles R. Rogers

CHARLES R. ROGERS, III, Lieutenant Colonel, USAF
AFR 110-14 Accident Investigation Board
Investigating Officer

Ut. Bates No. (PFS-)	PFS Bates No.	PFS File Name	From	To	Date	Document Description	Issue	Sent to Date
40119-40127	57817-57825	Contention 7 Utah K	Pedersen, Richard M., Lt. Col.	Hq, 12 th Air Force	04/23/94	<p>Aircraft Accident Investigation Board (w/redaction) re: 02/07/94 F-16CG (SN 90-0764) accident. The mission was a two-ship BFM 3 training mission, the primary objective of which was to increase the pilots' air-to-air proficiency. While setting up for the third engagement, the mishap aircraft experienced an explosion and severe engine and airframe vibrations, followed by an engine stall and stagnation. The mishap pilot attempted two unsuccessful airstarts. For an unknown reason, the engine had experienced a high cycle fatigue fracture of a fourth stage turbine blade below the blade platform and subsequent damage to the low pressure turbine. The pilot successfully ejected while approaching the minimum recommended ejection altitude. The aircraft crashed 1 1/2 nautical miles north of Soper, OK, approximately 12 nautical miles south southeast of Tulsa International Airport, OK.</p> <p>Altitude just prior the incident was 11,000' MSL and 364 knots calibrated airspeed, and 10,300' when he attempted the first airstart. The MP attempted an unsuccessful zoom maneuver at 2200' and 150 KCAS before he ejected.</p> <p>Stores were not jettisoned.</p> <p>The mishap pilot had 130.5 F-16 hrs and 2648.3 hrs of military flight time.</p> <p>Weather was VMC and not a factor.</p> <p>The Investigating Officer opined that the MP displayed exemplary situation awareness throughout the entire incident. Despite the loss of the aircraft, he recommended that the MP be commended for his actions.</p>	K	
40128-40138	57826-57836	Contention 7 Utah K	Pedersen, Richard M., Lt. Col.	Hq, 12 th Air Force	04/23/94	<p>Aircraft Accident Investigation Board (Duplicate without reaction of 40119-40127)</p>	K	

2. SUMMARY OF FACTS:

a. History of Flight:

(1) Two F-16CG aircraft, call signs Tulsa 11 and 12, took off from Tulsa IAP at 0914 CST (TAB Z-1). They were to conduct a Basic Fighter Maneuver (BFM) mission in the Rivers MOA (TAB V-1). At approximately 0945 CST while setting up for the third engagement, [REDACTED] experienced an explosion and severe engine and airframe vibrations, followed by an engine stall and stagnation (TAB J-5, V-1). [REDACTED] attempted two airstarts, but was unable to start the engine and regain useable thrust. For an unknown reason, the engine had experienced a high cycle fatigue fracture of a fourth stage turbine blade below the blade platform and subsequent damage to the low pressure turbine (LPT) (TAB J-5, S-4, S-5, V-1). At approximately 0948 CST, [REDACTED] ejected successfully without injury while approaching minimum recommended ejection altitude (TAB A-2, N-10, V-1). The aircraft crashed on private property used for cattle grazing 1 1/2 nautical miles (NM) north of Soper, OK., approximately 120 NM south-southeast of Tulsa International Airport (IAP), Tulsa, OK (TAB A-2, P-2). Actual damage to private property was minimal (TAB P-2).

(2) All following times are based on Tulsa 11's recorded takeoff time of 0914 plus event data recorded by the aircraft's Seat Data Recorder (SDR) (TAB Z-1, AA-1). The SDR records flight profile data, system status data, and Digital Backup Unit data. Aircraft impact and destruction are based on SDR data termination (TAB AA-1).

b. Mission:

The mission was scheduled as a 2 ship BFM 3 training mission to be flown IAW MCI (ANG) II-208, the Flying Training F-16 Pilot Training instruction (TAB A-2, V-1, V-2, AA-2). The primary objective of the mission was to increase the pilots' air-to-air proficiency. The mission overview planned for single ship takeoffs with 20 second spacing, weapon systems checks enroute to the area, a G-awareness maneuver, one heat-to-guns cine track exercise, both visual and Beyond Visual Range (BVR) BFM engagements, and a return to Tulsa IAP for recovery and landing (TAB V-1). Tulsa 11 was flown by [REDACTED] and Tulsa 12 was flown by [REDACTED] (TAB K-4).

c. Briefing and Preflight:

Both flight members reported adequate crew rest for the mission (K-4). The preflight briefing began at 0715 CST and was briefed in detail by [REDACTED]. Emergency divert fields were specifically briefed. The briefing covered all applicable items required by existing regulations (TAB V-2). Both members of the flight indicated they clearly understood the objectives, the general flow of the mission, and had no questions about the flight briefing. Both pilots arrived at their jets IAW briefed times and began preflight inspections. Preflight, start, taxi, marshaling and arming were uneventful (TAB V-1, V-2).

d. Flight Activity:

(1) Tulsa 11 flight was filed and cleared for the Zebra 4 stereo flight plan (TAB K-4). At approximately 0914 CST, they accomplished single ship takeoffs with 20 seconds spacing between aircraft (TAB V-1, Z-1). They rejoined into a 2 ship formation while accomplishing air-to-air systems checks enroute to the working area. The outbound portion of the stereo flight plan terminated when entering the River MOA (TAB V-1, V-2).

(2) Tulsa 11 flight completed a G-awareness maneuver, one heat-to-guns exercise and two visual BFM engagements as briefed. [REDACTED] had some minor problems with [REDACTED] air-to-air radar, but this had no effect on the overall mission conduct. After the second engagement, Tulsa 11 and 12 split up with approximately 35-40 NM separation for a one-v-one BVR setup to a visual engagement. Tulsa 11 went to the southwest part of the River MOA and Tulsa 12 went to the northeast (TAB V-1).

(3) [REDACTED] first indications of any problems were an explosion followed by severe airframe and engine vibrations. The vibrations seemed related to engine revolutions per minute (RPM) - the higher the RPM, the more severe the vibrations and inversely, the lower the RPM, the less severe. The vibrations continued for the rest of the flight and regardless of engine RPM, were so severe that it was difficult to read the cockpit instruments at any time (TAB V-1). At approximately 31 minutes after takeoff at 0944:52 CST, the aircraft engine stalled and then stagnated. The fatigue fracture of a fourth stage turbine blade had resulted in the ensuing damage to and drag on the LPT which drives the engine fan. This produced drag on the engine fan which limited and disrupted airflow to the engine compressor inlet, producing an engine stall and stagnation. From this point on, [REDACTED] engine was no longer capable of producing useable thrust (TAB J-5).

(4) As [REDACTED] analyzed [REDACTED] situation, [REDACTED] simultaneously turned toward the nearest suitable emergency airfield, Grayson County, approximately 60-65 NM south-southwest of [REDACTED] position (TAB V-1). Grayson was the specifically briefed emergency airfield for [REDACTED] position at the time of the emergency (TAB V-2). The airfield has a 9000 FT runway (TAB AA-3). [REDACTED] knew Grayson was beyond engine out gliding distance, but turned in that direction hoping the engine would begin to produce enough thrust to continue flying. If that were the case, [REDACTED] wanted to land at the nearest suitable airfield as soon as possible because the engine had already shown it was unreliable. [REDACTED] also knew that there were small civilian airports in Antlers and Hugo, OK. Although [REDACTED] felt [REDACTED] might have been able to glide and complete flameout approach at either airfield, [REDACTED] felt neither was suitable (TAB V-1). Both airfields were less than 3500 feet long and were only used by light civilian aircraft (TAB V-1, AA-4). Minimum recommended runway length for the F-16 is 8000 FT. [REDACTED] notified [REDACTED] of [REDACTED] problem. [REDACTED] immediately turned southwest and attempted to rejoin on [REDACTED] aircraft. [REDACTED] had difficulty finding [REDACTED] due to [REDACTED] radar problem and could only provide assistance over the radio. [REDACTED] was not able to locate [REDACTED] until [REDACTED] visually acquired [REDACTED] during the ejection (TAB V-2).

(5) Just prior to the incident, [REDACTED] had been flying with the engine set at full military power while climbing through approximately 11,000 feet (FT) above mean sea level (MSL)/10,300 FT above ground level (AGL) and at 364 knots calibrated airspeed (KCAS) (TAB J-5, V-1). Average terrain elevation near [REDACTED] position was approximately 700 FT MSL (TAB AA-5). Based on cockpit indications,

initially interpreted the engine malfunction as an engine rollback pulled the throttle back to the idle position at 0945:21 (TAB J-5, V-1). Despite difficulty reading the engine instruments, [REDACTED] soon noticed that engine RPM was decreasing and fan turbine inlet temperature (FTIT) was increasing, giving [REDACTED] indications of an engine stagnation. In addition to the stagnation, [REDACTED] felt that the problem was much worse due to the explosion and continuing vibrations. [REDACTED] then accomplished the emergency checklist procedures which called for an engine shutdown to clear the stagnation and an airstart attempt (TAB V-1).

(6) [REDACTED] began to execute the Critical Action Procedures (CAPs) for an engine airstart (TAB AA-6). Based on [REDACTED] current parameters and cockpit indications, [REDACTED] planned to attempt a SEC spooldown airstart and established a 270-290 KCAS glide (TAB V-1, AA-1). A SEC airstart is required when attempting an airstart below 10,000 FT AGL (TAB AA-6). [REDACTED] was flying at approximately 10,300 FT AGL at the time (TAB AA-1). [REDACTED] did not jettison [REDACTED] empty centerline fuel tank due to [REDACTED] concentration on other airstart procedures. [REDACTED] felt the weight and drag of the empty centerline fuel tank would not appreciably affect [REDACTED] glide nor increase [REDACTED] time aloft (TAB V-1). At 0945:21, [REDACTED] placed the throttle to off to clear the engine stagnation. [REDACTED] next moved the engine control switch from the PRI to the SEC position at 0945:28, which is confirmed by the SDR. At 0946:33, [REDACTED] selected START 2 on the Jet Fuel Starter (JFS) to assist with the airstart. Approximately 1 second prior to selecting JFS START 2, the SDR shows the engine control switch was placed back in PRI (TAB J-5, V-1). While working to maintain the recommended spooldown airspeed of 275 KCAS, [REDACTED] noticed the engine RPM had decreased below the minimum recommended 25% RPM. According to [REDACTED] testimony, [REDACTED] immediately moved the throttle to IDLE at 18-20% RPM to initiate an airstart at 0945:36 (TAB J-5, V-1). The SDR shows the throttle was advanced to idle at 17% RPM and 698°C FTIT (TAB J-5). Despite the lower than recommended 25% RPM, the airstart began as soon as the throttle was advanced from OFF to IDLE, appearing to progress normally although the vibrations were still present (TAB J-5, V-1). At some time between 0945:33 and 0946:00, the JFS started running (TAB O-14). [REDACTED] continued to maintain [REDACTED] 270-290 KCAS glide (TAB V-1).

(7) The SDR indicates that the engine appeared to approach normal idle power indications, then stalled a second time at 0946:45. At some time between 0946:30 and 0946:50, the throttle was advanced to MIL (TAB J-5). [REDACTED] quickly recognized the second engine stall and stagnation. Although engine instruments showed that the attempt appeared to progress normally, [REDACTED] felt [REDACTED] still had the same problems [REDACTED] had prior to initiating the first airstart due to the second stagnation and continuing severe vibrations (TAB V-1).

(8) At 0947:05 and an estimated 5000 FT MSL/4300 FT AGL, [REDACTED] moved the throttle to OFF a second time to attempt to clear the second stagnation (TAB J-5, AA-1). Since the JFS was now running, [REDACTED] planned to do a JFS assisted PRI airstart. This would allow [REDACTED] to hold a slower airspeed in order to decrease [REDACTED] descent rate and give [REDACTED] more time. [REDACTED] does not remember what airspeed [REDACTED] finally slowed to (TAB V-1). The SDR shows airspeed decreasing during this time, with a last recorded airspeed of 243 KCAS approximately 19 seconds prior to ejection (TAB AA-1). The Statement of Damage to Private Property estimated aircraft ground impact at approximately 210 KCAS (TAB P-2).

(9) As [REDACTED] reached to move the engine control switch from what [REDACTED] thought was SEC, [REDACTED] noticed it was already in PRI. [REDACTED] elected to continue the airstart in PRI again because [REDACTED] was running out of time and approaching the minimum recommended controlled bailout altitude of 2000 FT AGL (TAB V-1, AA-7). [REDACTED] was skeptical about getting a successful airstart since [REDACTED] had noticed no improvement after the first attempt (TAB V-1). [REDACTED] advanced the throttle to IDLE at 0947:15 and an SDR estimated 4200 FT MSL/3500 FT AGL to initiate the second airstart attempt (TAB J-5, AA-1). Testimony indicated that he thought he was higher at an estimated 7300 feet MSL (TAB V-1).

(10) At 3300 FT MSL/2500 FT AGL, [REDACTED] had made a conscious decision to eject if the engine did not produce any usable thrust on this attempt. The engine again tried to start, but stalled

and stagnated a third and final time at 0947:54 and an estimated 2200 FT MSL/1500 FT AGL (TAB J-5, TAB AA-1). [REDACTED] began a zoom maneuver in preparation for ejection. Simultaneously [REDACTED] advanced the throttle to mil one last time to see if [REDACTED] could get any usable thrust from the engine, but the stagnation continued. The aircraft [REDACTED] at an unknown altitude and slowed to approximately 150 KCAS (TAB V-1). At 0948:19 [REDACTED] ejected based on a "Canopy Open" signal recorded by the SDR (TAB O-15). [REDACTED] indicated that [REDACTED] had plenty of time to complete all post ejection procedures, watch [REDACTED] aircraft crash, and then prepare for [REDACTED] parachute landing (TAB V-1).

c. Impact:

Aircraft 90-0764 crashed and was destroyed at 0948:38 CST (TAB AA-1). The aircraft impacted on private property used for cattle grazing approximately 1 1/2 NM north of Soper, OK (TAB P-2, A-2). Actual damage to private property was minimal. Some damage to fencing was done by the crash recovery team and some by several head of cattle who were apparently spooked by the crash. A gate was also damaged by the cattle. Actual cost of this damage, not including soil and environmental work associated with the crash site itself, has not been determined because of wet conditions at the site, but is expected to be less than \$1000.00 (TAB P-2 thru P-4).

f. Ejection:

[REDACTED] ejected from [REDACTED] aircraft at 0948:19 CST (TAB O-15). [REDACTED] stated [REDACTED] could not locate the 4-line jettisons on [REDACTED] parachute, but was not concerned. The parachute ride was very stable with no oscillations. [REDACTED] landed 1 to 1 1/2 NM north of the crash site (TAB V-1).

g. Personal and Survival Equipment:

(1) All personal and survival equipment inspections were current (TAB AA-8).

(2) Other than the pilot's inability to locate the parachute 4-line jettisons during the parachute decent, no personal/survival equipment difficulties were noted during ejection (TAB V-1).

h. Rescue:

(1) The crash occurred at approximately 0949 CST on 7 February 1994 (TAB A-2). At this time, [REDACTED] notified Fort Worth Center by radio of the ejection. [REDACTED] next contacted squadron operations and the Supervisor of Flying. [REDACTED] flew one low pass over [REDACTED] position. [REDACTED] was waving and appeared to be unhurt. [REDACTED] then returned to Tulsa IAP (TAB V-2).

(2) Immediately after completing [REDACTED] parachute landing fall, [REDACTED] was approached by two civilian males in a pickup truck who wanted to know if [REDACTED] needed any help. [REDACTED] did not contact [REDACTED] on [REDACTED] survival radio because [REDACTED] felt it was more important to get to a telephone to call squadron operations at Tulsa IAP (TAB V-1).

(3) [REDACTED] was transported to the crash site by the two civilians in the pickup truck. [REDACTED] noticed there were 20 to 30 civilians standing around the burning wreckage of [REDACTED] aircraft. Concerned about their safety, [REDACTED] asked a local sheriff to clear the personnel away from the wreckage for at least 1/2 mile. [REDACTED] then went to a local farmhouse (TAB V-1).

(4) [REDACTED] was driven by the Highway Patrol to the Hugo airport where [REDACTED] was picked up by a fellow squadron member in a privately owned Cessna 182 and transported back to Tulsa IAP (TAB V-1).

1. Engine, Fuel, Hydraulic, and Oil Inspection Analysis:

Post mishap samples were taken from the servicing equipment last know to service the MA. Samples taken from servicing carts included engine oil, hydraulic fluid, liquid oxygen. In addition, Jet A Fuel was sampled from refueler #12 and the bulk storage tank. All samples were analyzed by the USAF Aerospace Fuels Laboratory at Wright-Patterson AFB and were found to be within applicable technical order tolerances (TAB U-9).

m. Airframe and Aircraft Systems:

(1) Post-accident analysis of the engine by San Antonio Air Logistics Center (SA-ALC) indicated that most of the engine appeared normal except for damage incurred in the crash impact. However, one blade in the fourth stage low-pressure turbine was broken off below its platform at the top of the blade/disk attachment area (TAB S-4). Examination of the fracture surface revealed indications of a fatigue fracture mode. The fatigue area appeared to originate on the pressure side of the blade just forward of the aft face of the blade root. It then propagated all the way across the aft face and approximately one-half inch forward along the pressure side of the root. Based on existing procedures used at the time, this area was not easily nor normally inspected by maintenance personnel. The location of this blade was almost directly opposite the location of a heavy rub on the fourth stage airseal knife-edges. Further, the SA-ALC investigator determined that domestic object damage (DOD) caused by the fourth stage blade fatigue failure and the resultant damage to the LPT rendered the engine incapable of producing usable thrust (TAB J).

(2) Engine Manufacturer:

Pratt and Whitney
179600 Beeline Hwy.
Jupiter, FL 33478-9600

(3) All maintenance performed on the subject engine since it was placed in service on 13 May 1991 was done by the 363rd Fighter Wing at Shaw Air Force Base. None appeared related to the mishap (TAB J).

n. Operations Personnel and Supervisors:

This flight was authorized by [REDACTED] on a computer generated local flight clearance form number O-29 (TAB K-4). The mission was briefed IAW applicable guidance (TAB V-1, V-2).

o. Crew Qualifications:

(1) Examination of aircrew flight records revealed that [REDACTED] was qualified and current in the F-16 CG [REDACTED] is a flight commander and a 4 ship flight lead (TAB G, T-1, V-1).

(2) [REDACTED] has 6000 hours total flying time (TAB V-1). Of that [REDACTED] has 2648.3 hours of military flight time, the majority of which is in fighters. At the time of the accident [REDACTED] had 130.5 hours in the F-16, all of it in the Block 42 F-16CG powered by the Pratt and Whitney 220 engine. [REDACTED] 30/60/90 day totals were 8.8/24.5/47.6 hours (TAB G-3). Although relatively inexperienced in the F-16 [REDACTED] had earned an Exceptionally Qualified on [REDACTED] initial mission checkride (TAB T-2, T-3).

p. Medical:

[REDACTED] was medically qualified at the time of the mishap (TAB AA-9).

q. Nav aids and Facilities:

All nav aids and facilities were operating and functional during the mission (TAB K-6).

r. Weather:

Weather was VMC and not a factor (TAB K-5, K-6, V-1).

s. Directives and Publications:

The following publications were applicable to this mission:

MCI (ANG) 11-208
MCR 55-116
T.O. 1F-16CG-1

Flying Training - F-16 Pilot Training Instruction
Operations - F-16 Pilot Operational Procedures
F-16CG Flight Manual

d. Statement of Opinion:

- (1) Maintenance personnel at both Shaw AFB and Tulsa IAP had no reasonable way of preventing this accident.
- (2) [REDACTED] displayed exemplary situational awareness and outstanding airmanship through out this entire incident. Despite [REDACTED] unknowingly hopeless situation and the loss of the aircraft, [REDACTED] should be commended for [REDACTED] actions on 4 February 1994.

Richard M. Pedersen

RICHARD M. PEDERSEN, 14 Col, USAF
Investigating Officer