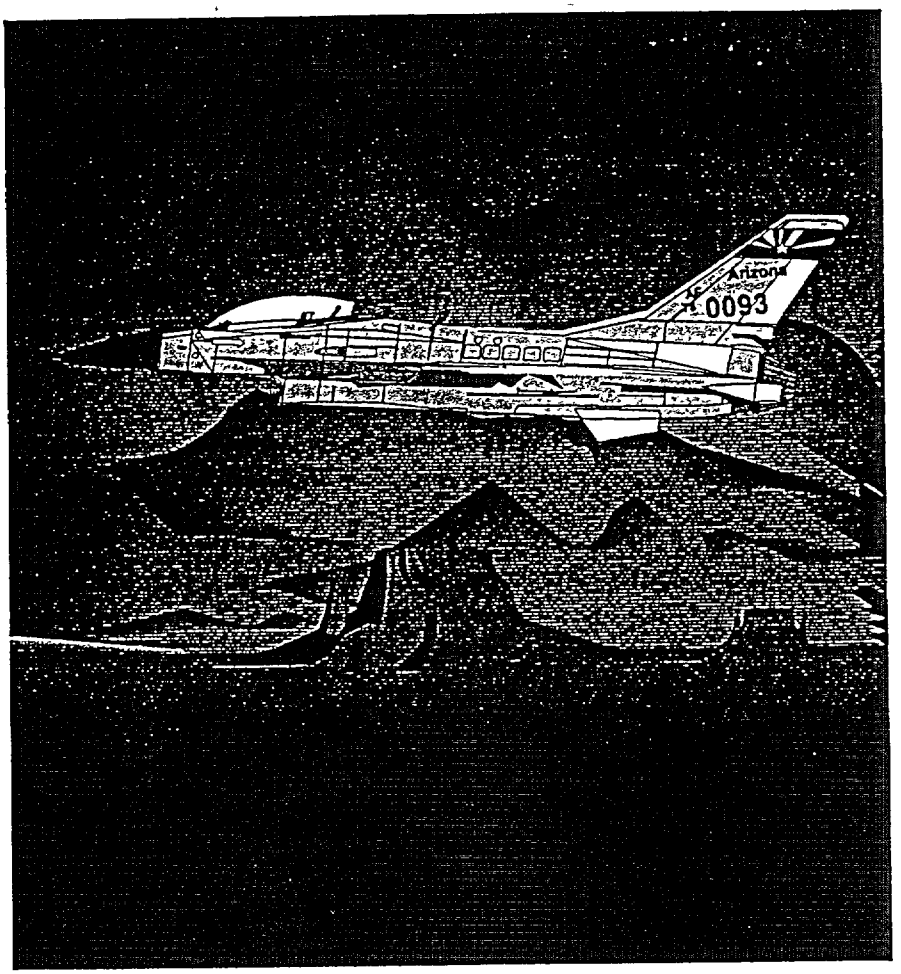
UNITED STATES AIR FORCE AIRCRAFT ACCIDENT INVESTIGATION REPORT

F16B 78-0093
TUCSON IAP



15 MAY 95
LOCATION
135 NAUTICAL MILES EAST OF TIA, ANG
CONDUCTED IAW AFI 51-503

NUCLEAR REGULATORY COMMISSION

Docket No _____ Official Exh. No PFS 179

In the matter of _____

Staff _____ IDENTIFIED _____

Applicant _____ RECEIVED _____

Intervenor _____ REJECTED _____

Cont'g Off'r _____

Contractor _____ DATE 7/1/02

Other _____ Witness _____

Reporter _____

EXECUTIVE SUMMARY
Aircraft Investigation Report
F-16B (SN 78-0093)
Tucson ANG Base, AZ
15 May 1995

During the afternoon of 15 May 1995, an F-16 assigned to the 162nd Fighter Group, Tucson Air National Guard Base, Arizona, was conducting a low altitude navigational training flight. At 1357 MST, at a position approximately 105 nautical miles from Tucson, the engine failed. The two-man crew ejected safely and the aircraft was destroyed upon impacting the ground in an unpopulated area. There was no property damage or personal injury.

After extensive witness interviews, review of maintenance documentation, engine records, and other data, the Accident Investigating Officer found that the engine failed due to a fracture in the left main fuel manifold. The left main fuel manifold fractured in fatigue due to a worn loop clamp. This malfunction stopped the fuel flow to the combustion chamber causing the engine to flame-out without the possibility of restart. This caused the accident.

The Accident Investigating Officer also found that an inspection of the fuel manifold loop clamp system was required by Technical Order on the occasion of any engine transfer on 31 May 1994 and beyond. A requirement for such an inspection was missed on 9 September 1994. Additionally, in the opinion of the Investigating Officer, the Technical Order guidance was untimely in requiring periodic inspections of the loop clamp system. After a Technical Order instruction to perform a one-time inspection of the loop clamps on 7 February 1994, this engine was allowed to fly 243.6 hours until the mishap without an additional requirement for a periodic inspection of the loop clamps.

Therefore, in the opinion of the Investigating Officer, the accident was caused by a mechanical malfunction which might have been discovered and prevented if a required random inspection had been accomplished or periodic inspections of the loop clamp had been instituted sooner by Technical Order authorities. Concerning the underlying cause of the fuel manifold loop clamp failure, there is no clear and convincing evidence as to what caused it to fail.

AFI 51-503 ACCIDENT INVESTIGATION REPORT

AUTHORITY. In a letter dated 19 June 1995, Major General Nicholas B. Kehoe, Commander 19th Air Force, appointed Colonel Donald S. Powell, 114 FS/CC, Kingsley Field Air National Guard Base (ANGB), OR, to conduct an investigation pursuant to Air Force Instruction (AFI) 51-503 into the circumstances surrounding an aircraft accident involving F-16B, tail number 78-0093, assigned to the 162nd Fighter Group (FG), Tucson Air National Guard Base, Arizona. He also appointed Major Dennis C. Elvin, 114 FS/LGM, Kingsley Field, OR, to act as the Aircraft Maintenance Technical Adviser. Captain Lisa R. Hall, 355 WG/JA, Davis Monthan AFB, was appointed to act as Legal Advisor.

PURPOSE. To preserve evidence for claims, litigation, disciplinary, and adverse administrative actions, and for all other purposes

SUMMARY OF FACTS

1. HISTORY OF FLIGHT.

On 15 May 1995 a student pilot and instructor pilot were scheduled to fly a single F-16B (call sign Zonker 1) along a low altitude navigational training route, VR263, that proceeds in a clockwise route east from Tucson into southern New Mexico with a return from the southeast (TAB O-12) The takeoff of Zonker 1 occurred normally at 1315 Mountain Standard Time (MST). The flight profile proceeded as planned, with good student performance for the first forty minutes. While performing an oblique, descending maneuver at a point approximately 135 nautical miles east of Tucson, the engine failed. (TAB V-3.2) The aircrew performed Critical Action Procedures (CAPS) for engine failure at low altitude, but were unable to effect an airstart As they were gliding back to Earth, they made a controlled ejection. The two pilots landed safely via parachute. The aircraft impacted the ground and was destroyed. There was minimal collateral damage to private property. There were no deaths or injuries The mishap occurred at 1357 MST. (TAB A-1)

The 162 FG Public Affairs office sent out a news release at 1535 MST This resulted in video and print media inquiries that lasted through the following day Local, Arizona, New Mexico, and Air Force Times coverage resulted (TAB AA-5)

The aircrew consisted of:

- Student Pilot
  First Lieutenant Abdullah M Al Khalifa
  195 FS / International Student (Bahrain)
  Tucson Air National Guard Base, AZ

- Instructor Pilot
  Lieutenant Colonel Carl J Thomae
  Chief of Standardization and Evaluation
  162 FG, Tucson Air National Guard Base, AZ

2. MISSION

The mission was Task Management Training (TMT-1) of the International Syllabus F16400BI, dated October 1994. (TAB AA-7) It is designed as a single ship, F-16B (2-seat) flight with instructor supervision in the rear cockpit. Its purpose is to intentionally expose the student to flying in a high task regime and to employ techniques in cockpit task management. It is flown in the low environment to 300 feet above ground level (AGL) and includes a series of vertical oblique maneuvers. Occasional requirements to change cockpit switches during maneuvering increases the cockpit workload. Sixteen hours of academic preparation and a two-hour simulator mission with the same instructor pilot who will fly the mission precede it. (TAB V-4.1)

3. BRIEFING AND PREFLIGHT

The student arrived at the 195th Fighter Squadron at 0900 for the 1100 briefing. He conferred with the IP at 1000, checked weather and NOTAMs, prepared his mission data card, and did some "hand flying" to prepare for the mission The briefing began on time and was thorough. The prior academic instruction, prior simulator instruction, and preflight briefing were all well-understood by the student. (TAB V-5.2)

It is noteworthy that during the simulator training that occurred three days prior, a low altitude engine flameout during this mission profile was practiced. (TAB V-3.1, V-4.1)

4. FLIGHT ACTIVITY.

Zonker 1 departed Tucson International Airport (TIA) at 1315 L on a Visual Flight Rules (VFR) flight plan to the altitude of 9500 feet Mean Sea Level (MSL) The aircraft proceeded to the entry point of VR-263 at the Tucson Tacan 035 degree radial at 29 miles. A G-warm-up exercise was performed, then the low altitude navigation route was entered. (TAB V-5.1)

Tasks during the route included Straight-Ahead Oblique Jinks (SOJ), Rolling Oblique Jinks (ROJ), and Turning Oblique Jinks (TOJ). These are vertical maneuvers that include a climb, then descent and return to minimum altitude and the navigation route. In addition, the student was occasionally given a cockpit task to perform, such as changing the IFF or Chaff/Flare setting (TAB V-3.1, V-5 1)

At about 42 minutes into the flight, during a descent, the IP advised the student to retard the throttle to maintain the desired airspeed After that was done, the engine instruments showed that the engine was rolling back below idle power parameters (TAB V-3.2)

This occurred at about 1200 feet AGL and about 430 knots The IP took control of the aircraft, turned slightly to point toward unpopulated terrain, and began a climb. From the rear cockpit he also jettisoned the only external store that could be jettisoned, the centerline fuel tank (TAB V-3.2) He sought 250 knots at the top of his climb, but arrived at 190 knots and settled for that as a glide speed (TAB V-3.2)

He got the student to shut the throttle off from the front cockpit as the RPM decreased through approximately 42 % He selected the back up fuel control (BUC) from the rear cockpit. He coaxed the student to return the front cockpit throttle to idle at about 15 % RPM. He instructed the student to move the jet fuel starter (JFS) toggle switch to the "Start 2" position. After a normal delay, the JFS drove the RPM back to 22 %, where it remained for the duration of the glide. Thus, the Critical Action Procedures (CAPS) for this circumstance were properly performed by the aircrew. (TAB AA-8, V-3.2)

The throttle was moved slowly forward between the IDLE and BUC IDLE positions, as prescribed There was no RPM or Fan Turbine Inlet Temperature (FTIT) reaction. The aircraft continued to descend without power in a process that the IP estimated to last a minute, from start to finish. Switch positions were double-checked between the student and IP. (TAB V-3.2, V-4.2)

The IP advised the student that they had only one chance for an airstart. He also told the student that they would probably have to eject. Approaching what the IP estimated to be 2000' AGL, he told the student, "We've got to get out" He instructed that he would pull the handle from the rear cockpit and that the student should get into ejection body position. (TAB V-3.2, V-4.2)

The instructor then attempted a mini-zoom maneuver to level the aircraft and slow it as much as possible. When he had accomplished this, he pulled the ejection handle. (TAB V-3.2)

5. IMPACT.

The aircraft impacted privately-owned desert ranch land 25 nautical miles west of Deming, New Mexico (coordinates 32 degrees 16' north, 108 degrees 15' west). No structures were nearby. The aircraft was destroyed upon impact A brush fire of less than one acre was caused by the crash Private property damage was minimal (TAB AA-6.5, M-2, P, R-2, S-1)

6. EGRESS SYSTEMS.

By the best estimate of the Instructor Pilot, the ejection was initiated at the following parameters:

- 2000 feet AGL (approximately 6800 feet MSL)
- 160 KCAS
- 17 degrees nose up pitch attitude
- 2 degree climb, as indicated by the flight path marker in the HUD

The ejection was initiated from the rear cockpit The canopy, rear seat, and front seat, departed the aircraft in sequence, which was normal. Parachute opening, as well as survival kit and raft deployment were automatic Both parachute canopies were fully deployed The IP effected a 4-line jettison successfully The student did not attempt this procedure. (TAB V-3 2, V-3 3, V-4 2)

7. PERSONAL AND SURVIVAL EQUIPMENT.

Water, radio beacons, survival radios, and day flares were used prior to helicopter extraction at the site. The only piece of equipment that malfunctioned was the IP's AN/PRC-90 survival radio, which was stuck in the BEACON transmit mode even when the VOICE switch positions were selected. It was disabled by removing the battery The student's AN/PRC-90 radio worked correctly. (TAB V-1.2, V-3.3)

8. RESCUE

A flight of two A-10s based at Davis Monthan were the first to locate the crash site Radio communication with the aircrew was established. Radio contact to the 162 FG Command Post by the A-10's was established via relay through other aircraft participating in the search and rescue effort. (TAB O-1) Thus, the approximate location of the site could be told via land line to the New Mexico Highway Patrol (TAB V-2.1)

First on the scene, at about 1420 hours, were 2 Mexican ranch hands in a pickup truck who did not speak English The first New Mexico Highway Patrolman was on the scene at approximately 1435 hours (TAB V-3 3, V-4.2)

One A-10 pilot advised the downed pilots that a better helicopter landing site was located about 200 yards north of their original position That move was made via the ranch pickup truck belonging to the ranch hands (TAB V-3.3)

A helicopter pick up by the AFRES 305th RQS, Davis Monthan AFB, occurred at approximately 1610 Mountain Standard Time (MST) Two HH/60G Pave Hawk aircraft were sent to the crash site for the aircrew extraction, which occurred approximately two hours and ten minutes after the mishap. (TAB V-2.1, V-3.4, V-4 2)

9. CRASH RESPONSE.

Civilian ground personnel responded first to the scene. New Mexico Highway Patrolmen found the site next They were alerted to the incident and location by 162 FG Command Post personnel. The property owner, Mr. Pinkey Gunter, extinguished a small brush fire that occurred as a result of the crash. (TAB V-2 1, V-2 2, V-3.3, V-3 4, V-4.2)

10 MAINTENANCE DOCUMENTATION.

Aircraft documentation was satisfactory. There were no aircraft or engine discrepancies, related to the mishap, recorded in aircraft AFTO Form 781 series (TAB H-8)

- There were no overdue Time Compliance Technical Orders (TCTOs) (TAB H-8)
- Regarding scheduled aircraft inspections (not engines), there were no overdue inspections (TAB H-8)

- Oil analysis records were complete and no discrepancies were noted. (TAB D)

- The mishap engine, serial number PWOE697142, was installed in Aircraft 78-0093 on 9 Sep 94. (TAB D)

- There was one Time Change Item (TCI), the PTO Shaft, on an authorized overfly. It was originally scheduled to be replaced at 1200 hours, but was extended, by proper authority, to 1300 hours The PTO shaft was 22 hours into the authorized overfly. (TAB AA-16, H)

- The last scheduled inspection was conducted on 15 Feb 95. This was an engine 50 hour. It was accomplished 32.0 Engine Flying Hours 9 (EFHRS) prior to the mishap, 15 May 95. There was no remarkable unscheduled maintenance performed on this aircraft between 15 Feb 94 and 15 May 95. (TAB H-2, H-3, H-4, H-5)

11. MAINTENANCE PERSONNEL AND SUPERVISION.

The aircraft preflight and routine maintenance played no part in this mishap.

- All personnel assigned to perform borescope inspections on the engine were certified and are seasoned, 7-level technicians. Inspection of AF Form 623, On The Job Training Records, are satisfactory. (TAB AA-12, AA-13)

12. POST MISHAP AIRFRAME AND AIRCRAFT SYSTEM ANALYSIS.

A review of analyses conducted by the Oklahoma City Air Logistic Center (OC-ALC) on engine instruments, miscellaneous instruments, and miscellaneous lights, panels, and switches substantiated the mishap pilot's account of the probable conditions of the airframe and aircraft systems at the time of ejection and impact. (TAB J)

There were no indications that the mishap aircraft was other than intact with all systems functional, except the engine, at time of impact.

13. POST MISHAP FUEL, HYDRAULIC, OIL, AND ENGINE INSPECTION ANALYSIS.

A review of analyses conducted by the Oklahoma City Air Logistic Center (OC-ALC) and the San Antonio Air Logistic Center (SA-ALC) substantiated the mishap pilots' account of the probable condition of the aircraft fuel, hydraulic, oil, and engine systems at the time of ejection and impact. (TAB J)

- Fuel Analysis Fuel samples met required specifications and limits, with no detectable contamination noted (TAB U-4, U-5, U-6)

- Hydraulic Analysis Hydraulic fluid test samples were not available for testing. (TAB U-7)

- Oil Analysis: The oil sample of the mishap engine was consistent with aircraft destruction by ground impact. (TAB D)

- Engine Analysis: The SA-ALC analysts determined the engine failed due to a fractured left hand main fuel manifold This manifold, which provides fuel to the engine combustion chamber, fractured due to excessive vibration caused by a worn loop clamp (part number ST1042-08). Aside from the fuel manifold and assorted related parts, all other damage to the engine occurred during ground impact. (TAB J)

- The last documented inspection of the suspected components was TCTO 2J-F100 (II)-622 (a one time inspection of the loop clamps), which was completed 15 Feb 94 and recorded in the Automated History, Part I. The purpose of the TCTO was to "reduce the possibility of a main fuel manifold fracture or chafe through due to loop clamp cushion material deterioration or unsupported fuel manifolds due to missing or mispositioned loop clamps " (TAB U-1, U-2)

- TCTO 2J-F100 (II)-622 was conducted by properly trained technicians (TAB AA-12, AA-13)

- It is the normal practice of this unit to insure coordination and standardization of TCTOs through cross functional meetings that result in the utilization of AFTO Form 2410 and MA Form 54. That occurred in the case of this TCTO. (TAB AA-9, AA-10)

- Additional inspection guidance was provided to the F-16 community by Interim Operational Supplement, 1F-16A-6-21S-12, dated 31 May 94. The supplement was received and distributed by unit personnel on 10 Jun 94. This supplement instructed that an inspection of the main fuel manifold loop clamps and third state fan disk lugs should be performed after a specific occurrence -- specifically, an engine transfer.

  The intent of this additional requirement was to re-inspect the main fuel manifold and third stage fan disc lug prior to installation on a different aircraft, "If the sum of the engine time since last phase inspection plus the aircraft time until the next scheduled phase inspection exceeds 200 hours "

- The mishap engine, PW0E697142, was taken from aircraft 78-0111 and installed on mishap aircraft 78-0093 on 9 Sep 94. In accordance with 1F-16A-6-21S-12 and the formula in 1F-16A-6-21, the sum of the engine time since last phase inspection was 54 hours. Those hours were added to the Aircraft Time Until Next Scheduled Phase Inspection (186 6), totaling 240 6 hours, and indicating that the inspection of the main fuel manifold clamps was due According to the aircraft and engine records, this inspection was not performed, and if accomplished, may have revealed discrepancies that led to this mishap. (TAB U-3.2, V-7, V-9, V-13, V-14)

- A random engine inspection is one required due to a specific occurrence that is unpredictable, such as the decision to transfer an operational engine from one aircraft to another. A periodic engine inspection is one that is to be accomplished at specified intervals of engine operating time: 50 hours, 100 hours, 50 hours, 200 hours .The history of inspections of the failed engine for the fifteen months prior to the mishap is as follows

15 Feb 94	TCTO 2J-F100-622 requires a one-time inspection of the main fuel manifold loop clamps Completed. No defects were noted and no periodic inspection of the loop clamp was directed.
07 Apr 94	50 hour inspection. No inspection of the loop clamps was required.
20 May 94	100 hour inspection. No inspection of the loop clamps was required.
24 May 94	Metal was found on the mishap engine magnetic plug, requiring an engine removal. This created a logical time to conduct a 200 hour inspection of the engine, which was accomplished. No inspection of the loop clamps was required.
31 May 94	Interim Operational Supplement 1F-16A-21S was published, requiring a loop clamp inspection at the time of an engine transfer, subject to an Engine Time Formula
28 Jun 94	The mishap engine was installed in aircraft 78-0111 after its 200 hour inspection was completed No inspection of the loop clamps was required
06 Sep 94	50 hour inspection completed. No inspection of the loop clamps was required
09 Sep 94	The mishap engine was transferred to aircraft 78-0093. An inspection of the loop clamps was required but was not accomplished
21 Nov 94	Change 4 to T.O. 1F-16A-6-21 incorporated Interim Operational Supplement 1F-16A-21S and added the requirement to inspect the loop clamps during the 200 hour inspection. No instructions to retroactively inspect any engine was included.
08 Dec 94	100 hour inspection completed. No inspection of the loop clamps was required
15 Feb 95	50 hour inspection completed. No inspection of the loop clamps was required.
15 May 95	Mishap occurred The engine had 243.6 hours on it since the first required inspection of the loop clamps in February 1994. In that time, no periodic inspection of the loop clamps had been required. In that time, one inspection required due to the random occurrence of an engine transfer was required but not accomplished.

- Testimony provided by a Pratt and Whitney field representative indicated that at least five flight incidents (flame out single engine recoveries) have occurred in the F-15 community since 1990. These were due to similar fuel manifold failures The witness stated that two F16 flame outs occurred during the same period due to fuel manifold failures These resulted in one successful recovery and one aircraft loss (TAB V-16)

14 OPERATIONS PERSONNEL AND SUPERVISION.

There is no evidence that the 162 FG Supervisor of Flying, Crisis Action Team members, Command Post personnel, or others in the operations and supervisory chain performed their duties in other than a thorough, responsible manner on the day and time of the mishap There is no evidence that any operational directives were violated in the course of the mishap flight

15. CREW QUALIFICATIONS.

The instructor pilot, Lt Col Thomae, is the Phase Manager for the Task Management Training Program He does most of the platform instruction on the subject. He has performed "road show" instruction on the subject for Marine, Canadian, and U.S. Air Force flying units He is the Group's most qualified instructor in this mission. Lt Col Thomae was current and qualified to perform the mission he was assigned on 15 May 1995. (TAB V-4 2)

The student pilot, lLt Al Khalifa, was making satisfactory progress in his program. He had completed all prerequisites and was well prepared for the mission he was assigned on 15 May 1995 (TAB V-4.2)

16. MEDICAL

Both pilots were medically qualified for flight (TAB G-1, G-2) There is no evidence in the medical records or toxicology studies that would have contributed to this accident. The student received a slight cut beneath his left eye from his helmet visor during the parachute landing fall Neither the instructor nor student suffered spinal injury. (TAB X-1, X-2)

17. NAVAIDS AND FACILITIES

Navigation aids and airfield facilities were not a factor in this accident.

18. WEATHER

Weather was not a factor in this accident.

The sky condition in the vicinity of the incident was clear. Surface winds were from the southwest at 15 knots, gusting slightly higher at times. (TAB V-3.4)

The weather at Tucson International Airport during the time of flight was VFR, with light winds. (TAB W.1)

19. GOVERNING DIRECTIVES AND PUBLICATIONS. The following publications were applicable to the mission:

AFI 11-206	General Flight Rules	25 Jul 1994
AFI 11-401	Flight Management	11 Jun 1994
MCI 11-208	F-16 Training and Qualifications.	01 Jul 1993
MCI 11-416	F-16 Pilot Operational Procedures	07 May 1993
MCI 11-416, CH 8	Local Operational Procedures	15 Aug 1994
MCR 60-2, Vol I	Aircrew STAN/EVAL Program Organization and Administration	01 Dec 1994
MCR 60-2, Vol III	Aircrew STAN/EVAL Program Evaluation Criteria - Fighter	30 Nov 1992
AFP 11-404	G Awareness For Aircrew	19 Aug 1994
T.O. 1F-16A-1	F-16A/B Flight Manual	07 Mar 1994
	Change 1	14 Nov 1994
T.O. 1F-16A-1-1	F-16A/B Flight Manual Supplement	28 Nov 1994
	Change 1	06 Feb 1995
T.O. 1F-16A-1-3	F-16A/B Flight Manual Supplement	01 Oct 1994
T.O. 1F-16A-34-1-1	F-16A/B Avionics and Nonnuclear Weapons Delivery Flight Manual	06 Jun 1990
	Change 4	26 Apr 1993
TCTO 2J-F100(II)-622	Borescope Inspection of Main Fuel Manifold Loop Clamps, for F100-PW-200/-220E Engines, F-16 Aircraft	07 Feb 1994
T.O. 1F-16A-6-21	Scheduled Inspection and Maintenance Requirements	05 Oct 1992
T.O. 1F-16A-6-21S-12	Interim Operational Supplement	31 May 1994
Inflight Guide	162nd FG Brain Box	01 Apr 1995
	Change 1	01 Jun 1995
F16AOOBI	ANG International Basic Tactical Training Course Syllabus	01 Oct 1994

20. DEFICIENCIES.

Together, T.O. 1F-16A-6-21 and Interim Operational Supplement 1F-16A-6-21S-12 required a fuel manifold loop clamp inspection upon engine transfer from one operational aircraft to another. A requirement to accomplish such an inspection was missed on 09 September 1994.

15 August 1995

DONALD S. POWELL, Col, USAF
Accident Investigation Officer

STATEMENT OF OPINION

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 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.

1. In my opinion, this accident was caused by a mechanical malfunction. Specifically, it was caused by engine failure without possibility of airstart, due to fuel starvation. It was determined by Logistics Center analysts that during the last flight of F-16A, 78-0093, the left main fuel manifold failed due to excessive vibration and metal fatigue (TAB J-14, S-7). The excessive vibration of the fuel manifold, located in the fan duct, occurred when a loop clamp, intended to stabilize the manifold, failed (TAB J-3, 4, 14, S-5). There is no evidence that any action by those operating the aircraft or supervising the operation contributed to this mishap.

2. In my opinion, there were two significant factors that contributed to the accident. First, a Technical Order requirement to inspect the fuel manifold loop clamps at the time of an engine transfer was established on 31 May 1994 (TAB A-11). At the unit level, an inspection of the loop clamps required for this reason was not accomplished when the engine was transferred from another aircraft on 9 September 1994 (TAB U-3.2, V-7, 9, 13, 14). If a detectable loop clamp deficiency existed eight months prior to the mishap, it would likely have been found during this inspection. This missed inspection may have contributed to the eventual failure of one loop clamp on this engine on 15 May 1995.

3. Second, at the Logistics Center level, a requirement for periodic inspection of the fuel manifold loop clamps was not established in a timely manner. There were three Technical Orders referring to loop clamp inspections in 1994 (TAB AA-11). The first of these, on 7 February, required a one-time inspection of the loop clamps. The second, on 31 May, was the requirement to inspect the loop clamps in the case of an engine transfer, addressed above. The third, on 21 November, required an inspection of the loop clamps during any 200 hour engine inspection thereafter. By the instructions of those Technical Orders, it was possible for the mishap engine to acquire 243.6 hours over a fifteen month period, from the one-time inspection in February 1994 to the accident in May 1995, without encountering a requirement to inspect the loop clamps at a 50, 100, or 200 hour engine inspection (TAB U-1, 2, A-11). Had a requirement for periodic inspection been established and encountered in that time period, any anomaly of the loop clamps that existed would likely have been found. Thus, in my opinion, the failure to establish a requirement for periodic loop clamp inspections in a more timely manner may have contributed to this aircraft accident.

4. The underlying cause of the loop clamp wear and failure at this point in the life of the engine is of significant interest also There is no clear and convincing evidence as to that cause, nor to the rate at which loop clamp or loop clamp pad wear is occurring. No opinion is issued as to this contributing cause.

5. In summary, it is my opinion that the accident was caused by a mechanical failure which might have been discovered and prevented if a required random inspection had been accomplished or if periodic inspections of the loop clamp system had been instituted in a more timely manner by Technical Order authorities.

15 August 1995

DONALD S. POWELL, Col, ORANG
Accident Investigation Officer