

EXECUTIVE SUMMARY

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AIRCRAFT ACCIDENT INVESTIGATION REPORT
F-16C SERIAL NUMBER 84-1314
61 FS, 56 FW, Luke AFB, AZ
15 December 1998

OFFICE OF THE SECRETARY
 RULEMAKINGS AND
 ADJUDICATIONS STAFF

1. On 15 December 1998, the mishap pilot (MP) led a four-ship formation student training mission. The mission was a surface attack tactics training mission for students in the number 2 and number 4 aircraft. Briefing, preflight activities, and the first portion of the mission proceeded normally. The number 3 and number 4 aircraft returned to Luke Air Force Base first and were not a factor in the mishap. The mishap aircraft (MA) and wingman subsequently began their return to base (Tab V-2, Tab V-9). During climbout for the return, at about 1530 hours local, the MA experienced engine failure. The MP subsequently ejected and the MA was totally destroyed upon ground impact approximately 40 nautical miles west of Gila Bend, just north of Interstate 8 (Tab M-2).

2. The Digital Electronic Engine Control (DEEC) controls a number of critical functions such as engine fuel flow in the primary (PRI) mode. A backup Secondary Engine Control (SEC) mode also exists. During the mishap sequence, the DEEC detected an internal fault and commanded an autotransfer from PRI to SEC mode. The engine operated normally in SEC mode for approximately eight seconds. The engine then appears to have transferred back into PRI mode. This is abnormal. The DEEC is not designed "take back" control of the engine following autotransfer to SEC mode. The DEEC did not properly schedule engine operation, and flameout occurred approximately 2900 feet above ground level (AGL) (Tab J-38 through J-40).

3. While preparing for ejection, the MP twice attempted to restart the engine, but the attempts were unsuccessful. He then successfully ejected, sustaining no injuries. A civilian then drove him to Luke Air Force Base's Gila Bend Auxiliary Field. The MP then rode in a government vehicle back to Luke AFB (Tab V-9.1, 9.2).

4. The main part of the MA came to rest on Arizona state-owned land leased to a private individual for grazing (Tab CC-10). The two fuel tanks landed on private property. The base realty office is still trying to ascertain ownership of the initial impact point and the landing sites for the canopy, seat, and fuel tanks (Tab CC-9). There is no known property damage. No claims have yet been filed (Tab CC-16). There were no injuries or deaths.

5. Clear and convincing evidence shows the MA experienced low-altitude engine failure due to anomalous faults in one or more of the engine control subsystems, resulting in the mishap. A safe landing was not considered possible.

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.

SUMMARY OF FACTS

1. AUTHORITY, PURPOSE, AND CIRCUMSTANCES

1.1. Authority. This Accident Investigation Board (AIB) was convened and conducted in accordance with (IAW) Air Force Instruction (AFI) 51-503. General Lloyd W. Newton, Commander, Air Education and Training Command (AETC) convened the AIB in a memorandum dated 8 January 1999. General Newton detailed the following personnel to serve on the AIB: Colonel Leonard L. Jarman, 47 FTW/CV, Laughlin Air Force Base (AFB), Texas, AIB President; Lieutenant Colonel John F. Simonetti, 309 FS, 56 FW, Luke AFB, Arizona, Pilot Technical Advisor; Major Steven J. Dunn, HQ AETC/JA, Randolph AFB, Texas, Legal Advisor; and Captain Frank A. McVay, 58 MXS, 58 SOW, Kirtland AFB, New Mexico, Maintenance Technical Advisor (Tab Y-3).

1.2. Purpose. The AIB's purpose was to determine the relevant facts and circumstances surrounding a 15 December 1998 aircraft mishap 40 nautical miles west of Luke Air Force Base's Gila Bend Auxiliary Field ("Gila Bend") and to determine the cause or causes of the mishap. The mishap involved F-16 #84-1314 from the 61st Fighter Squadron (61 FS), 56th Fighter Wing (56 FW), Luke AFB, Arizona (Tab A-2, B-3). The AIB's purpose also included gathering and preserving evidence from the mishap for claims, litigation, disciplinary and administrative action, and for all other purposes deemed appropriate by competent authority.

1.3. Circumstances. The purpose of the mission was surface attack tactics training for two student pilots. Four aircraft, including the mishap aircraft (MA) departed in a four-ship formation to perform training in the South Tactical Range of the Barry M. Goldwater Gunnery Range Complex, Arizona ("Goldwater Range"). The MA led the formation. Two aircraft, number 3 and number 4, split from the formation for a separate return to Luke AFB. The MA and his wingman completed additional training together and were returning to Luke AFB when the mishap occurred (Tab V-2, V-9, V-9.1).

2. ACCIDENT SUMMARY. The MA experienced a low-altitude engine flameout which ultimately caused the mishap pilot (MP) to eject (Tab V-9). The MP ejected safely and was uninjured (Tab V-9, Tab X-2). The MA impacted the ground just north of Interstate 8, approximately 40 nautical miles west of Gila Bend, and was destroyed (Tab A-2). The value of the MA with its associated racks, pylons, and other attachments was \$16,380,042.45 (Tab M-2). The main part of the MA came to rest on Arizona state-owned land leased to a private individual for grazing (Tab CC-10). The two fuel tanks landed on private property. The base realty office is still trying to ascertain ownership of the initial impact point and the landing sites for the canopy, seat, and fuel tanks (Tab CC-9). There is no known property damage. No claims have yet been filed (Tab CC-16). There were no injuries or deaths. Headquarters Air Education and Training Command (HQ AETC) received no questions about the accident. Media interest consisted of articles in local newspapers, the Luke Air Force Base newspaper, and the *Air Force Times* (Tab CC-2 through CC-5).

3. BACKGROUND. The mission of the 56 FW is to train active duty, Air National Guard, Air Force Reserve Command, and international pilots in the F-16. The MA was the lead aircraft of a flight of four F-16s from the 61 FS. The formation was using the call sign CAVE Flight. Each aircraft was crewed by a single pilot. F-16 instructor pilots in CAVE 1 and CAVE 3 were providing inflight supervision and instruction for trainees in CAVE 2 and CAVE 4, who were on routine syllabus training missions (Tab A-2). The MP was CAVE 1 (Tab V-2).

4. SEQUENCE OF EVENTS

4.1. Mission. The purpose of the mission was to train the pilots in CAVE 2 and CAVE 4 in planning and executing surface attack tactics in the F-16 (Tab A-2). The mission was properly authorized by the 61 FS commander (Tab K-2).

4.2. Planning. The mission was adequately planned in a timely manner by all flight members. The MP, CAVE 1, was the flight lead. He briefed the mission using the 61 FS standard briefing guide. The briefing started on time. All aspects of the mission were briefed to all flight members (Tab V-9).

4.3. Preflight. The pilots planned their flight properly and checked Notices to Airmen (NOTAMs). The aircrews assembled, departed for the aircraft, started their engines, and taxied on time. The MA's Jet Fuel Starter (JFS) did not start on the first attempt. The MP attempted to start the JFS with START 2 selected (the normal practice). This vents both of the aircraft's brake/JFS accumulators to achieve JFS rotation. For an undetermined reason, the JFS did not start. He then attempted a start with START 1 selected. This position vents only one of the accumulators to JFS. The start was again unsuccessful. The MA reattempted the start with START 2 selected, and the JFS started normally. The subsequent aircraft engine start sequence was normal (Tab V-9). There were no problems requiring maintenance.

4.4. Summary of Accident. On 15 December 1998 at approximately 1430 hours local (Mountain Standard Time), CAVE 1 departed Luke AFB. He led his four-ship formation on a Visual Flight Rules (VFR) departure on a northerly heading and joined VR 225, a VFR low-level route terminating in the South Tactical Range of the Goldwater Range (Tab V-9). Although there was a thunderstorm advisory and a mid-level deck of clouds (Tab K-3), weather was not a factor on this mission. Because of forecast weather, extra fuel reserves were required in case the aircraft needed to divert to avoid bad weather, and this was briefed (Tab V-9). After four simulated bombing attacks, CAVE 3 and CAVE 4 reached their minimum fuel level and returned to home field. The MA and CAVE 2 remained for a fifth simulated attack. The MP then began leading his two-ship formation back to Luke AFB (Tab V-9). Upon leaving the Goldwater Range on a northerly heading under Visual Flight Rules (VFR), the MA experienced an engine failure while climbing in wings-level flight at 311-316 knots calibrated airspeed (KCAS), approximately 2900 feet above ground level (AGL) over generally level terrain (Tab J-7, O-31). With engine flameout below 350 knots, the recommended procedure is to

perform a constant decrease in speed to the desired airspeed, climbing if required to achieve minimum recommended ejection altitude (Tab V-10). Below 5000 feet AGL, there will probably be insufficient time to restart the engine prior to reaching minimum recommended ejection altitude (2000 feet AGL). In that case, primary consideration should be given to preparing for ejection (Tab V-10). The MP did not have sufficient airspeed to zoom above 5000 feet AGL (Tab V-10). Accordingly, ejection became his primary consideration. He made initial turns to avoid populated areas before jettisoning his fuel tanks. He also twice attempted to restart the engine (Tab J-39 through 40, V-9). The attempts were unsuccessful (Tab V-9.1). There are two options a pilot has for restarting an aircraft engine while the aircraft is airborne (also known as an "airstart"). The primary option is a "spooldown" airstart, for which the throttle is advanced from OFF to IDLE as the revolutions per minute (rpm) is decreasing from 50-25% (Tab V-10). The first airstart was begun at 276 KCAS and 31% rpm in the primary (PRI) mode as selected automatically by the aircraft Digital Electronic Engine Control (DEEC) (Tab O-27, J-39). This start was unsuccessful. Prior to beginning the second airstart, the pilot manually selected Secondary Engine Control (SEC) mode, which is recommended for a second attempt (Tab V-9.1, V-10). However, altitude and airspeed did not allow obtaining normal parameters for a SEC mode airstart. Engine rotation was below 20% and Fan Turbine Inlet Temperature (FTIT) was 730 degrees. Airspeed was approximately 220 KCAS and altitude was approximately 2800 feet AGL (Tab J-39). The SEC mode appeared to be working normally, but the airstart was unsuccessful due to the high initial FTIT and the relatively low airspeed (Tab J-40). The high FTIT peak in this airstart caused turbine damage and accounts for the orange plume of flame coming from the rear of the aircraft which the wingman noted during this time and which the MP noted after his ejection (Tab V-2, V-9.1). The MP ejected safely at approximately 1600 feet AGL. The MA was destroyed on impact with the ground (Tab A-2).

4.5. Impact. The MA impacted the ground on open, level, uninhabited terrain at 1531 Mountain Standard Time (MST) at N32° 50.8' latitude, W 113° 26.3' longitude, approximately 2 miles north of Interstate 8 (Tab R-11). Flight parameters at impact were 180 knots on a heading of 310° with wings level, and 8 degrees nose low attitude. Aircraft configuration at impact included an Acceleration Monitoring Assembly, two wing pylons, centerline pylon, MAU-12 bomb rack, AIM 9 launcher, LAU-129 launcher, SUU-20, TER 9A rack, and fuel tank pylon (Tab M-2). The aircraft debris scattered in a northwesterly pattern. The racks and launchers generally remained in the vicinity of initial impact, along with a portion of the bottom fuselage. The left wing came to rest about 540 feet from the initial impact, with the right wing in a relatively straight line 230 feet further to the northwest. Midway between the wings and slightly to the north lay the engine nozzle section. The rest of the engine continued northwesterly, breaking into two additional major pieces. The aft part of the fuselage with the vertical stabilizer was found about 980 feet northwest of the initial impact point, coming to rest against a tree (Tab R-12). Two empty 370 gallon external tanks were jettisoned approximately one minute prior to aircraft impact on privately-owned land at approximately N 32° 47' latitude, W 113° 24.0 longitude. The seat and canopy came down southeast of the impact point at approximately N32° 50.1' latitude, W 113° 25.4' longitude, and N32° 49.9' latitude, W 113° 25.5' longitude respectively (Tab R-15).

4.6. Life Support Equipment, Egress, and Survival. Egress, survival, and life support equipment was properly installed and inspected, and operated as designed (J-20). The MP initiated the ejection sequence at about 1600 feet AGL and 184 knots (Tab O-31). The Advanced Concept Ejection System (ACES II) seat automatically selected mode 1 (sea level to 15,000 feet above mean sea level below 250 knots) (Tab J-17). The egress system, including canopy jettison, seat activation, and parachute deployment, all worked according to manufacturer specifications (Tab J-20). The MP recalls having some twisted risers on his parachute which he cleared, and he then made a four-line cut, which is recommended after proper parachute deployment, eliminating some of the parachute lines to achieve increased stability and maneuverability (Tab V-9.1). The Emergency Locator Transmitter (ELT) functioned normally (Tab N-2).

4.7. Search and Rescue (SAR). CAVE 2 initially orbited the MP's location at 1530 hours local time (Tab A-2, V-2). CAVE 2 departed due to low fuel at 1536 hours (Tab N-5). A few minutes later, a two-ship formation of A-10s, SNIDELY Flight, reported to the scene to assume SAR efforts and remained on station until ground assistance to the pilot was available (Tab N-2 through N-5, V-9.2). After the MP landed, he attempted radio contact with SNIDELY flight, but he did not make contact (Tab V-9.1). Upon notification of the mishap, the support group commander began assembling the disaster control group (DCG) at 1535 hours. At 1539 hours, the 56 FW Commander initiated a key staff recall (Tab CC-7). A United States Marine Corps helicopter from Yuma Marine Corps Air Station, Arizona was launched to rescue the MP, but the Luke AFB Events Log does not document when that helicopter took off. Approximately three to five minutes after the MP landed, civilian and law enforcement vehicles from nearby Interstate 8 began arriving at the scene (Tab V-9.2). The Marine helicopter had not yet arrived. The MP, using a cellular phone belonging to one of the civilians on the scene, called the 61 FS and spoke to his squadron commander (Tab V-9.2). The 61 FS commander informed the wing commander that the military search and rescue effort was no longer needed (Tab V-10). For this reason, Luke AFB sent no further assets to the crash site for search and rescue. The police, apparently believing the civilian on scene was a Department of Public Safety (DPS) employee, left the pilot and went to secure the wreckage (Tab CC-7, V-9.2). The MP accepted a ride with the civilian to Luke AFB's Gila Bend Auxiliary Field ("Gila Bend"). During the ride, the 56 FW/CC called the MP on the cellular phone to ascertain whether the MP was injured, which he was not (Tab V-9.2). At Gila Bend the MP was offered a ride back to Luke AFB in the Marine helicopter which had landed there. The MP declined the helicopter ride because he would have to be medically restrained during the flight (Tab V-9.3). A government employee then transported the MP and his wingman (who had landed at Gila Bend) to Luke AFB in a government-owned vehicle (Tab V-9.3). Although a rain shower materialized over the impact and landing site shortly after the MP landed, weather was not a factor during the search and rescue effort (Tab K-6, V-9.1, 9.2). The MP and his wingman arrived at the Emergency Room of the Luke AFB Medical Treatment Facility at 1900 hours (Tab CC-8). A flight surgeon examined the MP and determined he suffered no injuries (Tab X-2).

4.8. Recovery of Remains. Not applicable.

5. MAINTENANCE

5.1. Forms Documentation. All existing AFTO Form 781 series aircraft forms were reviewed for accuracy and completeness. The aircraft forms for the MA were meticulously maintained. To aid in this review, a six-month Core Automated Maintenance System (CAMS) historical snapshot was used to cross-reference the form entries. There were no deficiencies related to the mishap recorded in the MA's Form 781 series (Tab H-2, H-6 through H18). There were no overdue Time Compliance Technical Orders (TCTO) (Tab H-3). The engine (Serial #PWOE703415) was installed in the MA on 2 September 1998. TCTO 6J3-4-117-522 was completed on 10 April 1998 (Tab U-44). All other TCTOs were current (Tab U-43 through U-44). There were no adverse trends evident throughout the engine history (Tab U-10 through U-42).

5.2. Inspections. The MA completed #2 Phase Inspection on 2 February 1998. The MA had 50.8 hours remaining until the next phase inspection (Tab H-14). On 3 December 1998, the engine underwent a 50 Hour Inspection. No deficiencies were noted during the inspection (Tab U-48 through U-50).

5.3. Maintenance Procedures. TCTO 6J3-4-117-522, performed on 10 April 1998, was the only required, scheduled, and documented maintenance performed on the MA's DEEC (Tab U-44).

5.4. Maintenance Personnel and Supervision. No maintenance except the TCTO described in paragraph 5.3 above was performed on the MA's DEEC. A review of individual training records (AF Form 623) and Individual Training Requirements Notices indicated that maintenance personnel who worked on all other preflight and launching maintenance tasks for the MA had been properly trained (Tab U-45 through U-47). The technician using the flexible borescope during the 50 Hour Engine Inspection was trained and current on the performance of this task (Tab U-47).

5.5. Fuel, Hydraulic, and Oil Inspection Analyses. Analysis of the oil cart (OC-24), hydraulic cart (HC-24), liquid oxygen (LOX) carts (#21 & #22), and fuel fluids used to service the MA prior to the mishap found no discrepancies (Tab J-23 through J-26). Post-mishap analysis of the MA's fuel, oil, and hydraulic fluid revealed that all of these fluids were within technical limits (Tab 1-27 through 1-29). Oil samples (5 ea.) prior to the accident were normal (Tab D-2).

5.6. Unscheduled Maintenance. Unscheduled maintenance since last inspection was reviewed and found to have no bearing on this mishap (Tab H-6 through H-18). The following is a history of the AFTO Form 781A unscheduled maintenance discrepancies summarized from the aircraft forms and jacket files for 30 days prior to the mishap (H-2).

<u>DATE</u>	<u>DISCREPANCIES</u>	<u>CORRECTIVE ACTION</u>
13 Nov 98	Chaff did not dispense	Cleaned Cannon plug on dispenser
23 Nov 98	Clock inoperative	Replaced Clock
23 Nov 98	HQ will not go into computer mode	Reloaded FMT NETS, Ops Check Good (OCG)
23 Nov 98	SMS MFL'S 001/004/028/142/143	Recorded as delayed discrepancy
7 Dec 98	CCIP symbol intermittent with station 7 selected	Replaced station 7 pylon
8 Dec 98	Chaff did not dispense properly	Replaced dispenser
9 Dec 98	Nose Wheel Steering turned off while taxiing aircraft	Adjusted Nose Landing Gear Weight on Wheel Switch OCG
14 Dec 98	Failed FLCS Test	Filled and bled hydraulic system. OCG

6. AIRCRAFT AND AIRFRAME, MISSILE, OR SPACE VEHICLE SYSTEMS

6.1. Post-mishap analysis was assisted by data provided by the Crash Survivable Flight Data Recorder, Seat Data Recorder, and Data Transfer Cartridge (Tab J-2). Recorded data revealed the hydraulic systems, electrical power system, and flight control systems were operating as designed throughout the mishap sequence. Instruments, indicators, and warning lights appeared to be functioning properly as well (Tab J-22). Control surfaces, navigational instruments, communications and environmental systems were also operating normally (Tab V-9).

6.2. Engine Analysis. The DEEC controls a number of critical functions such as engine fuel flow in the PRI mode. A backup SEC mode also exists. During the mishap sequence, the DEEC detected an internal fault and commanded an autotransfer from PRI to SEC mode. This is as designed. The engine operated normally in the SEC mode for approximately eight seconds. The engine then appears to have transferred back into PRI mode. This is abnormal. The DEEC is not designed to "take back" control of the engine following autotransfer to SEC mode. The DEEC did not properly control engine operation and flameout occurred (Tab J-30 through J-40). The teardown analysis of the DEEC could not determine the cause of the fault that resulted in autotransfer of engine

control to the SEC mode. The analysis also could not tell what caused the attempted transfer back from SEC mode to PRI mode (Tab J-40).

6.3. Jet engine intermediate maintenance (JEIM) engine records and data were properly maintained and reflected appropriate parameters for the engine operation during operational checks (Tab U-2 through U-42).

7. WEATHER

7.1. Forecast Weather. Forecast weather for the mishap area was FEW clouds at 6000 ft, BROKEN clouds at 10000, 12000, 17000, 20000, and 24000 ft, and 7 miles visibility with light rain showers (Tab K-6).

7.2. Observed Weather. Observed weather at Gila Bend 2 minutes after the mishap was BROKEN clouds at 4000, 15000, and 25000 ft, visibility 15 miles, dissipating thunderstorms, cumulonimbus clouds southwest moving northwest, and winds 320 at 4 knots (Tab K-5). Weather was not a factor during the mission (Tab V-2, V-9). The wingman estimated clouds at 8000 feet mean sea level at the mishap site (Tab V-2). Minutes after the mishap, while the MP was on the ground, light rain fell (Tab V-9.1).

7.3. Space Environment. Not applicable.

7.4. Conclusions. The mishap flight was properly conducted within the limits of the weather described in paragraph 7.2 above. Weather was not directly a factor during this mishap. The MP tailored the return-to-base flight (also known as the recovery) to remain below the clouds (Tab V-9). However, the mishap events occurred during the MP's climbout from the Goldwater Range, so regardless of the recovery chosen, the flameout would have occurred at low altitude (altitude below 5000 feet). The mishap flight remained clear of all weather throughout the sequence, and weather did not hamper search and rescue (SAR) efforts.

8. CREW QUALIFICATIONS

8.1. The MP was a fully qualified instructor pilot in the F-16. His most recent mission qualification flight evaluation was on 10 December 1998 (Tab G-12). His ground training items such as physiological training and ejection seat training were current (Tab G-5 through 8). He had also completed training to certify him as a flight examiner on 11 August 1998 (Tab T-5). He was current in all mission tasks required on the mishap mission (Tab G-5 through 13, Tab T-1 through 5).

8.2. The MP was highly experienced in the F-16 as indicated by the following flight hours (not including the mishap flight) (Tab G-2, 3):

Total 3358.9 hours
F-16 1735.4 hours

He had the following 30/60/90 day flying hour breakdown (not including the mishap flight)(Tab G-4):

17.1/25.3/47.5

9. MEDICAL

9.1. **Qualifications.** The MP was medically qualified for flight duty at the time of the mishap (Tab T-3).

9.2. **Health.** Results of post-mishap medical examination records found nothing related to the mishap (Tab X- 2).

9.3. **Pathology.** A post-mishap physical examination and toxicological test indicated the MP experienced no medical or physical conditions that interfered with his ability to safely operate his aircraft (Tab X-2, 3).

9.4. **Lifestyle.** There were no indications of abnormal behavior, unusual habits, or undue stress of any persons involved which could be related to the accident (Tab V-1 through V-9, V-10).

9.5. **Crew Rest and Crew Duty Time.** The MP had more than the required 12 hours of uninterrupted crew rest prior to the mishap duty day. He was within his maximum 12-hour crew duty day at the time of the mishap (Tab V-9).

10. OPERATIONS AND SUPERVISION

10.1. **Operations.** The squadron tasking and operations tempo at the time of the mishap was normal and not considered a factor in this mishap (Tab V-9, V-10).

10.2. **Supervision.** Oversight of the mission was effected in two ways: through the Supervisor of Flying and through the squadron "Top 3" officer. Standard practice requires pilots to receive a "Top 3" briefing before leaving to fly. The MP and his flight complied with this practice (Tab V-10).

11. **HUMAN FACTORS ANALYSIS.** No witness testimony or technical exhibits indicated applicable human factors issues. Operations and maintenance personnel indicated no undue stresses or factors which contributed to the mishap (Tab V-1 through 10).

12. **GOVERNING DIRECTIVES AND PUBLICATIONS.** There were no known or suspected deviations from the following directives and publications applicable to the mishap mission:

HQ AETC Syllabus F16C0B00PL, May 1997 - *USAF Basic Operational Training Course F-16C/D*

TO. 1F-16C-1, 27 Feb 1995 Change 8, 21 Sep 98 - *Flight Manual F-16C/D Blocks 25, 30, and 32*

MCI 11-F16 Volume 3 - F-16 Pilot Operational Procedures

13. NEWS MEDIA INVOLVEMENT. An *Air Force Times* article dated 28 December 1998 entitled "String of F-16 Crashes Continues" discussed the mishap, stating it was the sixth Air Force F-16 mishap since 1 October 1998 (Tab CC-2). The Luke AFB newspaper, the *Tallyho*, contained an 18 December 1998 article entitled "Luke Pilot Ejects Safely." The article focused on the MP's successful ejection and the importance of pilot safety (Tab CC-3). Two articles in *The Daily News-Sun*, both dated 16 December 1998, discussed the mishap. One focused on the MP's successful ejection and mentioned a previous F-16 mishap near the base on 22 October 1998. The other noted the concerns of Congressman Bob Stump, R-Arizona, concerning the repeated F-16 mishaps. The article reported, however, that the Congressman's main concern is that residential real estate development is beginning to encroach on the base (Tab CC-4,5).

14. ADDITIONAL AREAS OF CONCERN. The investigation did not discover any other areas of concern that had a bearing on the mishap.



LEONARD L. JARMAN, Colonel, USAF
President, Aircraft Accident Investigation Board

21 JANUARY 1999

Date

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. On 15 December 1998, the mishap pilot (MP) led a four-ship formation student training mission. The mission was a surface attack tactics training mission for students in the number 2 and number 4 aircraft. Briefing, preflight activities, and the first portion of the mission proceeded normally. The number 3 and number 4 aircraft returned to Luke Air Force Base first and were not a factor in the mishap. The mishap aircraft (MA) and wingman subsequently began their return to base (Tab V-2, Tab V-9). During climbout for the return, at about 1530 hours local, the MA experienced engine failure. The MP subsequently ejected and the MA was totally destroyed upon ground impact approximately 40 nautical miles west of Gila Bend, just north of Interstate 8 (Tab M-2).

2. The MP was an experienced instructor pilot and was certified as a flight examiner (Tab T-5). He was respected as well-motivated and possessing above average flying skills (Tab V-10). The mission was well planned and briefed (Tab V-2, V-9).

3. The aircraft was well-maintained with thorough documentation. Pilot testimony and post-mishap analyses of the major systems revealed no malfunctions other than in the engine control system (Tab V-9, J-2 through J-40).

4. The Digital Electronic Engine Control (DEEC) controls a number of critical functions such as engine fuel flow in the primary (PRI) mode. A backup Secondary Engine Control (SEC) mode also exists. During the mishap sequence, the DEEC detected an internal fault and commanded an autotransfer from PRI to SEC mode. The engine operated normally in SEC mode for approximately eight seconds. The engine then appears to have transferred back into PRI mode. This is abnormal. The DEEC is not designed "take back" control of the engine following autotransfer to SEC mode. The DEEC did not properly schedule engine operation, and flameout occurred approximately 2900 feet above ground level (AGL) (Tab J-38 through J-40).

5. Below 5000 feet AGL, an engine restart is unlikely before 2000 feet AGL. Pilots are warned not to delay ejection below 2000 feet AGL while attempting to restart a failed engine (Tab V-10). While preparing for ejection, the MP twice attempted to restart the engine, but the attempts were unsuccessful. He then successfully ejected, sustaining no injuries. A civilian then drove him to Luke AFB's Gila Bend Auxiliary Field. The MP then rode in a government vehicle back to Luke AFB (Tab V-9.1, 9.2). Clear and convincing evidence shows the pilot had limited options during the mishap sequence and he did nothing to create or aggravate the situation.

6. The main part of the MA came to rest on Arizona state-owned land leased to a private individual for grazing (Tab CC-10). The two fuel tanks landed on private property. The base realty office is still trying to ascertain ownership of the initial impact point and the landing sites

for the canopy, seat, and fuel tanks (Tab CC-9). There is no known property damage. No claims have yet been filed (Tab CC-16). There were no injuries or deaths.

7. In the Accident Investigation Board President's opinion, clear and convincing evidence shows the MA experienced low-altitude engine failure due to anomalous faults in one or more of the engine control subsystems, resulting in the mishap. A safe landing was not considered possible.



LEONARD L. JARMAN, Colonel, USAF
President, Aircraft Accident Investigation Board

21 JANUARY 1999

Date

NUCLEAR REGULATORY COMMISSION

Docket No. _____ Official Exh. No. 12

In the matter of PFS

Staff _____ IDENTIFIED

Applicant _____ RECEIVED

Intervenor _____ REJECTED _____

Other Joint _____ WITHDRAWN _____

DATE 4-11-02 Witness _____

Clerk L. Shindurling