

**AIRCRAFT ACCIDENT INVESTIGATION**

2003 JAN 17 PM 3: 58

OFFICE OF THE SECRETARY  
RULEMAKINGS AND  
ADJUDICATIONS STAFF

**1. STATEMENT OF AUTHORITY AND PURPOSE:**

a. Authority: Under the provisions of Air Force Instruction 51-503, The Eighth Air Force Commander appointed Colonel George H. Kotti to conduct an Aircraft Accident Investigation (AAI) of the F-16CG (Serial # 89-2153) accident that occurred near Cannon Air Force Base, New Mexico on 12 May 1997. The investigation took place from 11 June 1997 until 21 June 1997. Technical advisors were Captain Mark W. Anderson (Operations), Captain Christopher P. Rice (Legal), and Master Sergeant Keith S. Bunish (Maintenance).

b. Purpose: An aircraft investigation is convened under AFI 51-503. The investigation is intended primarily to gather and to preserve evidence for claims, litigation, disciplinary and adverse administrative actions, and for all purposes other than mishap prevention. In addition to setting forth factual information concerning the accident, the investigating officer is also required to state his opinion concerning either the cause or causes of the accident or those factors, if any, that substantially contributed to the accident. His opinions must be supported by clear and convincing evidence. The accident investigation report is available for public dissemination under the Freedom of Information Act (5 U.S.C. 552) and AFI 37-131.

**2. SUMMARY OF FACTS:**

a. History of Flight: On 12 May 1997 1LT Paul J. Murray, the mishap pilot (MP), was scheduled as number 4 in a four ship formation for a combined low-level and basic surface attack sortie. The flight of four F-16s (Chappy 01-04) departed Cannon AFB at 0916 MDT and proceeded to the entry point "A" on VR-125 via the planned route. Chappy 01 flight proceeded west along the planned route at approximately 2,000 ft above ground level (AGL) in "Fluid 4" formation with the MP echeloned to the south. After approximately 14 minutes of flight, the MP noticed a moderate thump, a noticeable loss of thrust, and the presence of gray smoke in the cockpit. The MP directed a "knock it off," began a climb, and performed the critical action procedures for an airstart. After an unsuccessful airstart attempt, the MP initiated an ejection (V-2.7-2.11). The ejection was successful, and the MP suffered only minor soreness and abrasions. The aircraft impacted 7.5 nautical miles northeast of Vaughn, New Mexico at 34 41.127 North latitude, 105 09.700 West longitude. (R-1-3). The Cannon AFB (ACC) Public Affairs office handled news inquiries (AA-1-10).

b. Mission: The mission was scheduled and planned as a day, four ship, low-level mission on VR-125 followed by a basic surface attack on R-5104. The mission would terminate with a 4-ship initial at Cannon AFB.

PFS Exh. 192

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NUCLEAR REGULATORY COMMISSION

Docket No. \_\_\_\_\_ Official Exh. No. 192  
In the matter of PFS  
Staff \_\_\_\_\_ IDENTIFIED ✓  
Applicant ✓ RECEIVED ✓  
Intervenor \_\_\_\_\_ REJECTED \_\_\_\_\_  
Cont'g Off'r \_\_\_\_\_  
Contractor \_\_\_\_\_ DATE 7/1/02  
Other \_\_\_\_\_ Witness \_\_\_\_\_  
Reporter elt

c. Briefing and Preflight: Mission planning for the sortie was conducted on the Friday prior to the Monday mishap (V-2.3). On the Sunday prior to the mishap, the scheduled flight lead fell out of the mission as a result of a medical problem that placed him on non-flying duty status. Due to his participation in the mission planning and familiarity with the mission, the original number three was re-designated as the new lead (V-3.2). The MP reported for duty with the required crew rest for the sortie. The flight briefing began at 0630. All the flight members reported that the briefing was comprehensive, and they had a clear understanding of the planned events and their responsibilities (V-2-5). The MP stepped to aircraft 89-2153. The MP called "red ball" maintenance to change a LANTIRN targeting pod setting. The rest of the preflight was normal. The start, taxi, and end of runway operations were uneventful (V-12.1-12.2).

d. Flight: The mishap aircraft (MA), Chappy 04, took off at 0916 MDT on a 125A local stereo flight plan. The takeoff was a single ship 20 second interval using maximum power. Engine response during the pre-takeoff checks, takeoff, and en route portion of the flight was normal (V-2.5-2.7). The flight entered VR-125 at entry point "A". The initial portion of the route was planned at approximately 10,000 ft mean sea level (MSL) to conserve fuel. A thin overcast cloud deck approximately 3,000 ft AGL covered the start of the route. The flight lead elected to fly the route below the weather at approximately 2,000 ft AGL. The flight lead directed the formation to "Fluid Four" with the MP echeloned to the south (V-3.4). At approximately 0930:10 MDT the MP noticed a moderate thump, a noticeable loss of thrust, and the presence of gray smoke in the cockpit. The MP directed a "Knock it Off," began a climb to 2,900 ft AGL, and initiated the critical action procedures for an air start (V-2.7-2.9). Chappy 03 maneuvered to a chase position, and Chappy 01 directed the MP to stay out of the cloud layer (V-3.6). At 0931:14 the MP jettisoned his external fuel tanks. At 0931:33 after an unsuccessful airstart attempt, the MP initiated an ejection at 497 ft AGL (V-2.7-2.10).

e. Impact: At approximately 0931:38 MDT the aircraft crashed on hilly terrain in an unpopulated area and was destroyed by impact damage and a post-impact fire. The two 370 gallon external fuel tanks landed approximately 3 nautical miles east of the aircraft and were also destroyed by impact (O, P-2).

f. Ejection System: The ejection parameters were 497 ft AGL, 184 knots Calibrated Air Speed (CAS), 3300 feet per minute, 1 degree nose low, and a 5 degree right bank. The minimum ejection altitude under these conditions is 45 feet (J-58-62). No deficiencies were noted in the ejection system.

g. Personal and Survival Equipment: All inspections of the MP's personal and survival equipment were current. The emergency locator beacon, the survival radio, and all other survival equipment functioned properly (V-2.11-2.12).

h. Rescue: Each of the other pilots in the formation observed the ejection of the MP and that he had a good parachute. Each member also observed the fireball caused when the aircraft impacted the ground (V-2-5). Chappy 01 notified Albuquerque Center

about the mishap and obtained clearance to depart center frequency in order to notify the Cannon AFB Supervisor of Flying (SOF) (V-3.8).

Chappy 01 directed Chappy 03 to stay low and provide Search and Rescue (SAR) cover for the MP. Chappy 01 and Chappy 02 climbed above the cloud deck and provided high SAR cover, positioning themselves approximately half way between Cannon AFB and the crash site to provide effective radio connectivity with the crash site (V-3.7-3.8).

Shortly after completing a successful parachute landing, the MP contacted the flight on guard frequency and related that he was in good condition. He quickly turned his emergency locator beacon off and switched over to 282.8, maintaining contact with the rest of the flight throughout the remainder of the rescue response (V-4.6).

i. Crash Response: A civilian ranch hand named Spike Linson was the first to reach the crash site. Chappy 03 was flying low SAR cover over the site and noticed Mr. Linson's vehicle approaching the site. He directed the MP to proceed around the ridge and intercept the individual in order to prevent him from approaching the aircraft wreckage (V-2.12-2.13).

When the MP arrived at a point near the wreckage, he saw Mr. Linson's vehicle, but could not locate Mr. Linson. The MP began to call out and whistle in an attempt to draw Mr. Linson away from the crash site. Mr. Linson heard the MP and returned to his vehicle, walking directly through the aircraft wreckage (V-2.13).

Mr. Linson explained to the MP that he was a ranch hand, familiar with the property, and that there was no public access to the site from the direction he had come. Mr. Linson began to take the MP to a gate with access to the nearest highway. As they were proceeding, the MP received a call from Chappy 03 informing him that two additional vehicles were approaching the crash site. The MP and Mr. Linson turned around and went back to the wreckage, where they met three other individuals, a woman who was sitting in a vehicle and two men, who were exploring the wreckage. The MP called out to the men while still a safe distance from the site, but as he was doing so, Mr. Linson ran into the site and asked the individuals to follow him out of the area where the wreckage was located (V-2.14-2.16).

Two more vehicles, a local fire truck and a county police officer, arrived. At the urging of the MP, all of the individuals departed the crash site and headed for an Entry Control Point (ECP) that had been established by the local police. Shortly after the MP arrived at the ECP, a contingent of security police from Cannon AFB arrived, which was followed soon after by an ambulance with the attending flight surgeon, Captain Beardsley, and other medical personnel (V-2.15-2.18).

Captain Beardsley performed an initial examination of the MP at the ECP and arranged to have the civilians that had been exposed to the crash site transported to a local hospital in a civilian ambulance. He had information transmitted to the civilian medical personnel regarding testing and treatment for hydrazine exposure, and then transported the MP back to Cannon AFB via ambulance. (V-17.1-17.3)

The Disaster Control Group (DCG) was recalled at 0945. Lt Col Charles Hale, the Deputy Support Group Commander, was the on-scene commander for the DCG and departed for the site at approximately 1115, arriving at the ECP at approximately 1330 (V-18.1).

The impact occurred on a remote section of private ranch land far removed from any water sources. Lt Col Hale's top priority was to make the site safe from composite fibers, so that responding personnel could have safe access to the wreckage. His second priority was to deal with hydrazine leakage (V-18.1, DD-2-8). The DCG response went very well and both the landowner and local law enforcement agencies were cooperative and helpful throughout the entire crash response.

j. Maintenance Documentation: Maintenance documentation is divided into two separate sections, Aircraft Maintenance Documentation and Engine Maintenance Documentation. Aircraft Maintenance Documentation provides information and data on the Mishap Aircraft (MA) and includes the engine, when installed in the MA. Engine Maintenance Documentation provides information and data on the Mishap Engine (ME) while it is not installed in the MA.

(1) Aircraft Maintenance Documentation: A thorough review of the active and most recently pulled (filed) AFTO 781 Series MA forms (H) was conducted along with available computerized products. There were no discrepancies that would have prevented the aircraft from flying. Additionally, there were no overdue inspections, time changes, or Time Compliance Technical Orders (TCTO). Archived historical records including AFTO Form 95 Significant Historical Records dating back to aircraft manufacture and AFTO 781 Series Forms dating back to August 1996, were thoroughly reviewed and revealed the following:

(a). The MA departed Cannon AFB NM and arrived at Hill AFB UT on 25 November 1996 for the depot modification program Falcon Up. On this date, the MA's engine (Serial No. 509710) was removed to facilitate ease of maintenance. On 18 March 1997 the ME (Serial No. 509719) was installed in the MA (U-2.4). The ME remained with the MA from this date until the mishap on 12 May 1997. On 27 March 1997, the MA and ME flew a functional check flight at Hill AFB following depot modification. There were no reported engine anomalies (U-2.25). The MA departed Hill AFB UT and returned to Cannon AFB NM on 11 April 1997.

(b) An acceptance inspection was conducted on the aircraft, which included an engine acceptance inspection. The acceptance inspection for the ME was completed on 21 April 1997. No discrepancies were noted during these inspections, although engine operating and flight times were not validated until 30 April 1997 (U-3, H-12).

(c) The MA flew a total of 5 times from the time of installation of the ME before the mishap flight. No engine reported discrepancies were noted during these flights.

(2) Engine Maintenance Documentation: A thorough review of computerized engine management data, TCTO's, time changes, and component histories was conducted. No overdue inspections, TCTO's, or time change items were noted. A

thorough review of the engine work packages and subassembly replacement data revealed the following:

(a) The ME was originally installed in F-16C AFSN 87-0340 belonging to the 523 Fighter Squadron at Cannon AFB NM. The engine experienced an oil consumption problem and was removed and sent to engine test cell for further troubleshooting. Engine test cell confirmed the oil consumption problem on 8 July 1996 (U-4). Upon completion of the test cell runs the ME was sent to the Jet Engine Intermediate Maintenance (JEIM) shop for further maintenance. An Engine Information Worksheet package was initiated (U-5) along with four Subassembly Worksheet packages (U-6, U-7, U-8, U-9). During maintenance, personnel utilizing the engine as a training aid discovered a dent that was out-of-limits on an 8<sup>th</sup> stage compressor blade. The top of the compressor section was removed and work began to repair the compressor blade on 18 July 1996 (U-5). Following the repair of several compressor blades, the compressor top half and the upper actuator rings for the variable stator vanes were installed on 23 July 1996 (U-5.23). An In-Process Inspection (IPI) sheet was completed and dated 23 July 1996 (U-5.11-5.12) for the variable stator vane actuating rings. On 24 July 1996, the variable stator vane bellcrank assembly was installed and the technicians noted that the work required a thorough inspection and IPI (U-5.24). On 25 July 1996, another technician noted in the daily summary log that the lower actuator rings required new bushings and that he had removed the lower actuator rings to replace the bushings (U-5.24).

(b) Technical Order 2J-F110-6-4 SWP 059 07, Page 12, Paragraph 8, for removal and installation of the stage 1 and 2 compressor actuator rings clearly states that removal of the lower actuation rings is prohibited unless the lower outer fan duct is removed (BB-13). This statement is made in two notes prior to the first step in the task. Step one following these notes also requires the removal of the lower fan duct assembly per WP 063 00, if the lower actuator rings are removed during maintenance (BB-13). Failure to remove the lower fan duct assembly means that maintenance on the lower compressor section is necessarily blind.

(c) There is no documentation to support the removal or installation of the lower duct assembly on the ME or its components, and witness testimony supports a finding that the duct assembly was not removed during the critical maintenance on 25 July 1996 (V-7.5-7.6, V8.7). On 26 July 1996, the daily summary log reflects that the variable stator vane rings and connecting bridges were attached, which was done blindly. Following this entry is an entry stating that the IPI's were completed by 03525 (employee number) (U-5.25).

(d) Completion of an IPI requires documentation of a worksheet. An IPI worksheet was completed on 23 July 1996 for the first assembly of the actuator rings, but no IPI sheet was found to support the second assembly of the variable stator vane actuator rings. The technician making the work package entry could not recall if the IPI was accomplished or whether an IPI sheet was initiated or completed (V-9.7). Since

the pages in the work package were not numbered, it is not entirely possible to ascertain whether the IPI sheet was completed and lost, or was never accomplished. However, the evidence clearly suggests that an IPI was not accomplished for the second assembly of the variable stator vane actuator rings (V-10.8). On 30 July 1996 the engine was sent to test cell for operational checks, and the ME outer fan case would not be reopened until the mishap.

(e) The ME was then installed in F-16D AFSN 87-0380 belonging to the 522 Fighter Squadron and the aircraft departed from Cannon AFB NM, and arrived at Hill AFB UT on 22 August 1996, for depot modification under the Falcon Up program. Upon arrival at Hill AFB the ME was removed for ease of maintenance and an acceptance inspection by the depot, which included a borescope and records review. Documentation during this period reveals that an Augmentor Fan Temperature Control (AFTC) unit was bad and replaced (U-10). A telephone conference with Mr. Chavez at the Ogden Depot facility concerning the nature of the malfunction requiring replacement of the AFTC revealed that the unit was actually cannibalized for maintenance and that the original AFTC installed on the ME had no reported discrepancies or anomalies. The ME was then installed in the MA and remained installed until the mishap.

k. Maintenance Personnel and Supervision:

(1) Flightline Maintenance Personnel and Supervision: According to maintenance documentation on the MA, the aircraft was properly serviced and inspected prior to flight (H). Individual training records confirm that the individuals involved in servicing, inspecting, and launching of the aircraft were all qualified and certified for the tasks they performed. The technician who performed the last engine inlet inspection prior to mishap had in excess of 12 years experience on the F-16 weapons system. Additionally, he was properly qualified and certified to perform inlet inspections. He received F-110 engine inlet inspection specific training and completed Air Combat Command mandatory formal training on the F-16 / F-110 inlet inspection (EE-1). The technician noted no discrepancies with the inlet inspection. Maintenance supervision viewed all aspects of the launch prior to the mishap flight as trouble free, and there were no indications that the aircraft had any problems. The investigation board could not find any evidence that flightline maintenance personnel or supervision contributed in any way to the aircraft mishap.

(2) Engine Maintenance Personnel and Supervision: Four engine maintenance personnel and the NCOIC of JEIM were interviewed as a result of this investigation. The findings are based on interviews and other related evidence.

(a) The maintenance technician who removed the lower actuator rings on the ME currently works in the support section and has no F-110 Job Qualification Standard (JQS) filed in his training records at this time. When interviewed the individual was unsure of his qualification to perform the task he documented in the daily summary log concerning the lower actuator rings. Additionally, the individual

stated that he was not aware of the requirement to remove the lower fan duct assembly, when removing the lower actuator rings from the compressor assembly. Further, testimony revealed that he was unsure of what his responsibilities were for the use of technical data while performing maintenance. He stated that he did read the technical data when training, but was not sure of his use of technical data while engaged in JEIM maintenance. When asked if he has seen maintenance performed blindly on the lower compressor section of other engines, he stated that he believed so. Additionally, he was unsure about who was responsible for initiating and requesting IPI's on engine maintenance tasks (V-8).

(b) The technician's immediate supervisor was on leave during the particular time period when the lower actuator rings were removed. When interviewed, he was knowledgeable of the requirement to remove the lower fan duct for the type of maintenance conducted and stated that he had not seen blind maintenance performed in the JEIM shop (V-7.3). The immediate supervisor felt qualified, but his JQS contained no documentation initiating, completing or certifying compressor training. The trainee's name was missing from the lower portion of this page (EE-3).

(c) The technician that may have finished the assembly of the variable stator vane components, annotated that an IPI was accomplished for the maintenance. The technician had the appropriate F-110 JQS with compressor maintenance, and his JQS reflected a start date, stop date, and initials, but no certification or trainer verification. The completion date listed in the JQS for these tasks was 22 July 1996 (EE-4). This individual felt he was qualified and believed he was certified in his JQS. He was aware that the procedure on the lower compressor actuator rings was prohibited with the lower fan duct installed. He acknowledged that the log book reflected this violation but could not remember if he was personally aware that this procedure was being conducted at that time, on that engine. He admitted that he has performed blind maintenance in the past and has witnessed blind maintenance on a few occasions within the JEIM shop. Further, he believed it was the production scheduler's responsibility to initiate the IPI sheets on maintenance tasks performed and was unsure of the procedure when unscheduled maintenance of an IPI item was required (V-9).

(d) The individual who was noted in the daily summary log as having performed the IPI on the variable stator vanes was not qualified or certified in his JQS, but he was specially certified to perform IPI's (EE-5). This individual also believed he was properly certified and capable of performing compressor section maintenance. He was clearly aware of standard IPI procedures and responsibilities and noted that the individual maintenance technician is responsible for identifying and obtaining documents for any unscheduled IPI items. This technician also stated that he only performs IPI's with the appropriate IPI document for the job in-hand. Given his usual practice, he could not account for the missing IPI document that the repair technician stated he performed in the daily summary log entry. He also stated that he does perform the required IPI with the lower fan duct installed using a borescope. Though, he would not perform the actual maintenance blindly (V-10).

(e) The NCOIC of the propulsion section was also interviewed. The NCOIC believed that removal and installation of the lower actuator rings was not considered blind maintenance since it could be inspected with a borescope, and therefore, the lower duct did not require removal. After being read the notes and steps in the actuator ring technical order, he acknowledged that he was unaware of that requirement. When questioned on the JQS discrepancies, he noted that the page in question was new and acknowledged a problem with his training documentation. He thoroughly believed his personnel were qualified for the tasks performed. Specific mention by the NCOIC and the other witnesses was made to a lack of F-110 experience at the time of this incident (July 1996). During the time when the lower actuator rings were removed and reinstalled, none of the individuals involved except for the IPI technician, had more than 6 months experience on F-110 engine (V-11).

(f) Failure to properly use technical data and failure to accomplish a necessary IPI (BB-21-26), coupled with the low level of F-110 experience in the JEIM shop during this period (FF) indirectly contributed to the mishap. The unit made several attempts to gain more personnel with experience in the F-110 engine (FF, V-11) and supervision recognized that this was a serious problem (FF, V-11.9-11.11). All individuals interviewed from the JEIM shop appeared conscientious and concerned.

(g) It is important to note that a one time inspection of all compressor maintenance performed at Cannon AFB was initiated following the mishap. No other defects were noted during this inspection (CC).

l. Engine, Fuel, Oil, and Hydraulic Inspection Analysis: Fuel samples from the ME fuel control were analyzed and noted as meeting specifications, however, the sample was too small for a full spectral analysis (J-57). Samples were also taken from each of the fuel storage and delivery vehicles that serviced the aircraft. These samples met specifications. The cryogenic liquid oxygen tank #2 was also sampled and sent to Holloman AFB, NM for analysis, and the sample met specifications (J-52-57). Hydraulic fluid samples were taken from the crash site, but these samples were contaminated with ground soil as the result of impact. No other contamination was noted. Engine oil screens, filters and chip detectors were all free of contamination (J-5, U-11).

m. Airframe and Aircraft Systems: A thorough examination of the wreckage, surviving computerized data (O) and the testimony of the MP clearly indicate engine failure (V-2.9). All other primary aircraft systems and emergency systems functioned normally. Examination of the engine warning and fire warning lights indicate that the engine light was illuminated and that the fire light was not illuminated at time of impact (J-63). The evidence shows that the fire associated with engine failure remained within the engine case. There were no other failures or malfunctions outside of the engine that contributed to the mishap.

During the engine tear down, a stage 1 compressor variable stator vane arm pin was found disengaged from the lower stage 1 actuator ring at the 9 o'clock position (S-4,

5). The vane arm had chafing marks, which correspond to the place where it was contacting the outside end of the lower stage 1 actuator ring. The lower actuator ring end cap had a corresponding chafe mark where the arm pin was contacting the actuator ring. These marks could not have occurred as the result of impact and the evidence conclusively indicates that the pin was disengaged and operated in this position for an extended period of time. The actuating arm pin was not properly installed on 26 July 1996 when the last maintenance was accomplished on the particular engine component.

Two stage 2 variable stator vane arm levers were found to be improperly engaged in the actuator ring at the 6:30 position (S-3). One of the levers had dented the square tubing of the actuator ring and the other adjacent lever was positioned in the actuator ring rig hole. The disengagement of these pins could also indicate misassembly, or they could have become disengaged during impact (V-6.8-9). Therefore, this finding remains inconclusive.

Six second stage blades had released from the second stage compressor just aft of the stage 1 compressor variable stator vanes. The retainer rings securing the blades were properly installed and appeared serviceable (V-6.10). Examination of one of the recovered blades shows a fracture in the foot of the blade, which allowed it to release from the compressor disk. The fracture of the blade was caused by fatigue failure of the metal in the blade foot.

There was no indication of a foreign object entering the second stage compressor rotor area from a source forward of the stage 1 variable stator vanes (V-6.10).

The area of the compressor aft of the stage 2 rotor was virtually destroyed. The remnants of the compressor components clogged the compressor outlet area just forward of the combustion section. A compressor fire occurred burning through 360 degrees of the outer compressor case at the third stage rotor area.

The physical evidence indicates that the mishap engine failed due to the high cycle fatigue of a stage 2 compressor blade, which was a direct result of one stage 1 variable stator vane not being properly engaged in the actuator ring following maintenance. In addition, this fatigue may have been compounded by the possible misalignment of 2 trailing edge stage 2 variable compressor vanes. The failure occurred with approximately 27.5 engine operating hours from the time of misalignment of the stage 1 variable stator vane. This failure of the stage 2 blade destroyed the remainder of the compressor and rendered the engine completely inoperable.

n. Operations Personnel and Supervision: The mission was accomplished under the authority of the 27FW and the 524 Fighter Squadron. The mass briefing was attended by a member of the squadron top three and the flight lead gave a detailed mission briefing. During the flight, Chappy 01 provided excellent leadership and guidance, especially during the emergency sequence and rescue response. (V-3) Supervision was not a factor in this mishap.

o. Pilot Qualifications: 1Lt Murray was current and fully qualified to perform the scheduled mission. His flying experience is as follows (G-2-4):

F-16C Primary time	132.6
F-16D Primary time	44.5

AT-38 Primary time	24.1
Other Time	14.6
Student Time	<u>192.6</u>
Grand Total	408.4

30/60/90 Day history report:

Last 30 days	29.2 hr/12 sorties
Last 60 days	49.9 hr/26 sorties
Last 90 days	60.2 hr/32 sorties

p. Medical: 1LT Murray was medically qualified to fly. He suffered only minor abrasions and soreness related to the ejection. Toxicology specimens contained no alcohol, elevated carbon monoxide levels, or illegal substances (X-3). 1LT Murray was returned to flying status 31 May 1997 (V-17.2).

q. NAVAIDS and Facilities: All applicable NAVAIDS were operational. There were no NOTAMS applicable to this accident.

r. Weather: The Cannon observed weather at the time of the accident was 3,500 ft broken, 10,000 ft overcast and 7 miles visibility. Temperature was 11 degrees Celsius, and the winds were 060 degrees at 15 knots with gusts to 24 knots. The forecast weather for the mishap area was 3,000 ft scattered, 22,000 ft Broken, Surface winds 060 degrees at 15 knots (W). Observed weather in the mishap area was 3,000 ft broken (V-3.4).

s. Governing Directives and Publications:

MCI 11-F16 Vol 3 Pilot Operation Procedures—F-16;  
MCI 11-F16 Vol 3 CAFB Supplement 1, F-16/EF-111 Aircrew Operational Procedures;  
CAFBI 11-250 Base Flying Procedures;  
T.O. 1F-16CG-1 Flight Manual;  
T.O. 1F-16CG-1CL-1 Flight Manual Checklist;  
Cannon AFB F-16 Inflight Guide;

There are no indications of significant deviations from the directives governing the conduct of the mission.

### 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 or causes of, or 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.

Based upon evidence, which I found to be clear and convincing, it is my opinion as investigation officer that the cause of the accident was catastrophic failure of the engine compressor due to the separation of six second stage compressor blades. The blades released and destroyed the compressor core, rendering the engine totally inoperative. The compressor blades failed due to high cycle fatigue, which was caused by the misassembly of a variable stator vane on the first stage actuating ring.

Post accident investigation revealed that the vane arm pin on the left side of the engine just below the cutline (nine o'clock position) had been misassembled. The misassembly caused the lever arm pin to become trapped at the end of the actuating ring in the gap beneath the bridge connector, creating a misaligned stator. This misalignment caused the downstream rotor blades to pass through disrupted airflow, a pressure pulse, and created a condition where excessive cyclic loading resulted in the failure of a second stage blade.

On 26 July 1996, inexperienced Jet Engine Intermediate Maintenance (JEIM) shop personnel at Cannon AFB accomplished maintenance on the lower compressor variable stator vane actuator rings without removing the lower fan duct assembly. This was a direct violation of the technical order. In addition, a required In-Process Inspection was not accomplished or documented for the work that was performed. It was during this period of maintenance that the variable stator vane was misassembled.

Substantial evidence is available to indicate that the low experience level of the JEIM personnel was an underlying factor in this accident. When the engine maintenance was performed on the mishap engine, the unit was in the process of transitioning from the F-111 to the F-16. During this period, the JEIM shop had only one individual, a Senior Airman, with substantial F110-GE-100 engine experience.

The MP was qualified and current in the aircraft. Mission planning, briefing and flight operations were not a factor in the mishap, and the evidence shows that the MP responded quickly to a critical emergency at a low altitude, making a proper and timely decision to eject.

  
GEORGE H. KOTTI, Colonel USAF  
AFI 51-503 Accident Investigation Board  
Investigating Officer