AIRCRAFT ACCIDENT INVESTIGATION

AUTHORITY: Under the provisions of Air Force Instruction (AFI) 51-503, the Ninth Air Force Commander appointed Colonel Mark A. Welsh III to conduct an aircraft accident investigation of the F-16CJ (SN 91-0354) accident which occurred approximately 1.5 miles northwest of Pensacola Regional Airport, Florida, on 11 July 1996. The investigation was conducted from 10 Aug 1996 to 30 Aug 1996.

PURPOSE: An aircraft investigation is convened under AFI 51-503. The investigation is intended primarily to gather and preserve evidence for claims, litigation, disciplinary, and administrative needs. In addition to setting forth factual information concerning the accident, the investigating officer is also required to state his opinion concerning the cause or causes of the accident (if there is clear and convincing evidence to support that opinion), or to describe those factors, if any, that in the opinion of the investigating officer substantially contributed to the accident. The report is available for public dissemination under the Freedom of Information Act (5 U.S.C. 552) and AFI 37-131.

SUMMARY OF FACTS

1. History of Flight: On 11 Jul 1996, Captain Frederik G. Hartwig, the mishap pilot (MP), was the leader of a flight of four F-16 aircraft enroute from Shaw Air Force Base (AFB), South Carolina, to Eglin AFB, Florida. The flight was scheduled as part of the hurricane evacuation of 48 20th Fighter Wing (20FW) aircraft. The MP's callsign was Gambler 11 and the flight was designated Gambler 11 Flight. The other members of the flight were designated as Gambler 12, 13, and 14. All four pilots attended a mass briefing for the evacuation mission. The MP then conducted a flight-specific briefing prior to the pilots going out to their aircraft. After starting engines, Gambler 12 and Gambler 14 both experienced aircraft systems problems and two pilots and aircraft from the following flight were moved forward into Gambler 11 Flight to replace them. This is a standard practice and was covered in the mass deployment briefing. The new pilots assumed the callsigns of Gambler 12 and 14. Gambler 11 Flight departed Shaw AFB at 1316 Eastern Daylight Time (EDT). The planned route took them from Shaw AFB northwest to Spartanburg, SC; west to Chattanooga, TN; southwest to Meridian, MS; south to New Orleans, LA; northeast to Mobile, AL; and then east into Eglin AFB. Some of the other aircraft departing Shaw were not configured with external wing fuel tanks, and had to fly a more direct routing to Eglin. Gambler 11's route of flight was designed to guarantee spacing between flights arriving at Eglin, in order to avoid saturation of the Eglin radar approach pattern. The alternative was to delay departures from Shaw to create that arrival spacing...not a practical solution due to the imminent arrival of Hurricane Bertha. The flight was uneventful until the final leg. While heading east, 20 miles north of Pensacola, FL, and in the initial descent for arrival at Eglin, Gambler 11 experienced an engine failure at approximately 21,000 feet above mean sea level (MSL). After performing the critical action procedures (CAPs) for an engine airstart, Gambler

11 saw the north/south runway at Pensacola Regional Airport and turned right to set up for a straight-in flame out approach to Runway 17. During the turn, the engine restarted and stabilized at idle RPM. All cockpit engine indications appeared normal, although the MP could feel an unusual, pronounced airframe vibration that he believed indicated an uncorrected engine malfunction. During the emergency approach, approximately 4.5 miles north of the runway and 1,600 feet above ground level (AGL), the engine failed again. The MP reaccomplished airstart procedures. The engine restarted almost immediately, but failed a third time as the MP advanced the throttle to try and gain airspeed. At this point, the MP knew he would not be able to make it to the runway and started a slight right hand turn towards what he perceived to be a less congested area. He ejected at 209 feet AGL and landed, uninjured, in a tree one block north of the aircraft impact site. The mishap aircraft (MA) crashed in a residential area 1.5 miles northwest of Pensacola Regional Airport, at 3029.829° North latitude, 8712.160° West longitude. The impact damaged one house severely and totally destroyed another, killing a four year old boy inside and seriously injuring his mother. The Eglin AFB (AFMC) Public Affairs office handled news inquiries.

2. Mission: The mission was scheduled and planned as a daytime hurricane evacuation sortie. The planned profile was single-ship afterburner takeoffs, with 20 second spacing between aircraft, and radar vectors on departure to intercept the planned route (DD-4). Cruise altitude was Flight Level 260 (26,000') and planned enroute airspeed was 450 nautical miles per hour (knots) true airspeed (K-2). Briefed enroute formation was a "Fluid 4" with Gambler 11 and 13 flying line abreast 6000' apart and Gambler 12 and 14 flying a fluid position outside and aft of the formation off of Gambler 11 and 13 respectively (V-9).

Briefing & Preflight: The MP departed work at 1830 EDT on 10 July, and returned at 0645 EDT on 11 July to perform squadron supervisor (Top 3) duties. Between 0800 and 0900, the 20FW Commander made the decision to execute the hurricane evacuation. The mass mission briefing for deploying pilots started at 1100 EDT. Major James W. Hyatt, 78FS/ADO, conducted the briefing using standard 20FW Mass Briefing slides derived from Multi-Command Instruction (MCI) 11-F16, F-16 Aircrew Operational Procedures. The briefing covered ground operations at Shaw, routing to Eglin AFB, arrival procedures at Eglin, emergency divert bases along the route, applicable Notices to Airmen (NOTAMs), and all required special interest items. All flight members thought the briefing was very thorough and more than adequately covered all required items. Captain Hartwig's follow-on briefing for members of his four-ship flight covered formations to be flown, individual flight member responsibilities, and a review of Eglin arrival information. The flight stepped to their aircraft on time and ground preflight inspections were uneventful. After engine start, Gambler 12 and Gambler 14 both experienced aircraft system problems that required maintenance action. In compliance with the ground spare procedures presented in the mass briefing, the #3 and #4 aircraft from the following flight started engines and joined Gambler 11 Flight. #3 took the Gambler 14 position and callsign, while #4 moved up to become Gambler 12. (V-1 thru V-8, V-27, 29, 31)

4. Flight: Gambler 11 Flight took off at 1316 EDT, six minutes after their scheduled takeoff time. Each pilot executed an afterburner takeoff, with 20 second spacing between aircraft. They flew a radar-assisted trail departure until weather allowed flight joinup and transition to the briefed "Fluid 4" formation. Air traffic controllers gave the flight radar vectors to intercept the planned routing and cleared them to their cruise altitude of FL260. Flight operations from takeoff until the mishap sequence began were unremarkable (V-8, 27, 29).

One hour and 54 minutes after takeoff, Gambler 11 Flight was eastbound toward Eglin AFB, 20 miles north of Pensacola, when the MP felt a "bang or a pop" and the MA began to shudder (AA-3). The MP initially thought he'd hit a bird, but didn't know how that was possible at 21,000 feet. He performed a visual inspection of the aircraft control surfaces but couldn't see any damage. At about that time, the MP felt the MA begin to decelerate and heard the engine RPM winding down. He looked at the engine gauges and saw the RPM slowly decreasing, confirming engine failure. The MP made a radio call to his flight on the VHF radio to inform them of his situation and began to accomplish the critical action (emergency) procedures (CAPs) for an engine airstart. He chose not to accomplish the first step -- External Stores - Jettison -- because he was approaching a populated area at the time and felt he could delay dropping his wing fuel tanks until over a more suitable area (V-10). The MP accomplished the remainder of the CAPs correctly and turned his attention to finding a suitable landing field. The MP slowed to 250 knots indicated airspeed (KIAS) initially, then stabilized at approximately 235 KIAS as he began a very shallow right turn, knowing that all the briefed divert fields for this portion of the flight were to his south, along the coast (AA-3, V-11). As he began the turn, the MP saw a north-south runway well south of his position, near the coast. He also saw a runway east of his position that was closer, but looked too short (V-11). It's reasonable to assume that runway was either Whiting Field North or Whiting Field South (V-15, AA-2). At this same time, Gambler 13 asked Gambler 14, on the VHF radio, to point out the nearest divert field (V-31). Gambler 14 had kept track of suitable divert fields throughout the mission. His navigation system showed the nearest divert field to be approximately 20 miles south of Gambler 11's position. Gambler 14 directed the MP to "Snap right, south", meaning turn right to south immediately (N-3). His first call was on VHF...it's important to note that in the Block 50 F-16CJ, whenever the emergency power unit (EPU) is powering aircraft electrical systems, the VHF radio is inoperative. Gambler 14 realized his error immediately and repeated the call on the UHF radio (V-31). The MP heard that call, continued his turn to the south, and responded, "Got a field right 1 o'clock near the water." Gambler 14 replied, "That's Pensacola" (N-3). Gambler 12 wasn't sure whether the airfield they were looking at was Naval Air Station (NAS) Pensacola or the Pensacola Regional Airport (V-27). Both Gambler 13 and 14 incorrectly thought it was NAS Pensacola (V-29, V-31). Their confusion was the result of mission planners having loaded the geographic coordinates for Pensacola Regional Airport into the aircrafts' horizontal situational display data (a navigational aid), but circling NAS Pensacola on the enroute map each pilot received at the mission briefing (V-31, AA-1). The MP wasn't sure which airfield it was either, but felt it was the nearest suitable runway and decided to try and set up for a straight-in flameout approach (V-11, 17). He didn't really think he could make it to the airfield unless the engine restarted, but decided to head that way, in case the engine did start. There was a large bay just east of the runway and the MP

decided that if he "didn't get any help from the engine," he'd "turn the airplane out over the bay and eject" (V-11).

As the MP rolled out of his turn, now headed south towards Runway 17 at Pensacola Regional Airport, his engine restarted. All cockpit engine gauges read normal for inflight idle conditions (which would match the "midrange" throttle position selected by the MP while accomplishing the airstart CAPs) (J-12). At that point, the MA was roughly 13,000 feet AGL and 15 miles from Runway 17 (AA-3). Gambler 13 and 14 were in a trail position about one mile behind and above the MA, while Gambler 12 was in a safety chase position, approximately 30° aft and 2,000 feet out from the MA (V-27, 31). Although Gambler 13 and 14 would get as close as 1500 feet to the MA later in the scenario, they were always well above him and presented no conflict or concern to the MP at any time during the mishap sequence (V-22, 31). Now with an engine providing at least some semblance of normal idle thrust, the MP felt the aircraft begin to accelerate and saw the RPM and airspeed increase. The MP remembers the RPM stabilizing at "around 80%" (V-13). Crash survivable flight data recorder (CSFDR) data shows engine core RPM at 76-78% during this timeframe (O-44). For the first time, the MP was confident he could make the runway (V-13). Although he could tell the engine was running and providing some degree of thrust, the MP still felt a noticeable vibration. He decided that any throttle movement might cause the engine to fail again. Since he now felt he could make the runway with the engine operating as it was, he elected to leave the throttle alone and not check engine response with throttle movement (V-16).

With the engine now operating, and airspeed increasing, the MP began to worry that he might end up with too much energy to successfully stop the airplane on the runway, so he lowered the nose and increased his descent rate to "lose some of the altitude" (V-13). CSFDR data shows an increase in nose down pitch attitude, and corresponding increase in airspeed, beginning roughly one and a half minutes into the mishap sequence. That places the MA between 12 and 14 miles north of the field when this happened (O-40, 41, 50, AA-3). The MP maintained this higher descent rate for approximately one minute (O-40, 41, 50). The airspeed increased from the 235 KIAS the MP was holding during his initial turn south, to a maximum of just over 300 KIAS (V-40). Gambler 12, flying the safety chase position, was surprised when the MP "lowered his nose, sped up, and put out his speed brakes" (V-28). He momentarily fell out of his chase position and had to catch up with the MA (V-28). As he rejoined, he noticed that Gambler 11 still had his wing tanks and made a call on the VHF radio suggesting the MP jettison them. Gambler 13 repeated the call on the UHF radio and the MP jettisoned his wing tanks over a swampy area approximately 8 miles north of the field (V-29, AA-3). As Gambler 12 rejoined to his safety chase position, he noticed that the MA's speedbrakes were open. Believing that the MA was still without an operating engine, Gambler 12 suggested that the MP close his speedbrakes. This call was also on the VHF radio; Gambler 13 immediately called the MP on the UHF radio and directed him to close his speedbrakes. Gambler 13 believes he made that call approximately 8-9 miles from the runway (V-28 thru V-30). None of the other pilots in Gambler 11 Flight knew the MA's engine had restarted and the MP did not make any transmissions about the type approach he was attempting to fly (V-28, 30, 32). Gambler 12, the safety chase, was the only one of the

other flight members with a good view of the MA's flight path and parameters. Although surprised by the increased descent rate, he felt it inappropriate to tell the MP how to fly his airplane, since the MP probably had more information about his situation than Gambler 12 did. He did however, continue to make radio calls stating range to the runway every 5 miles. All of these calls were on the VHF radio (V-28).

Concerned that his engine was still vibrating, and feeling that he now had better control of his energy level (airspeed and altitude), the MP slowed his descent rate and decided to try and capture a 1 to 1 glide ratio to the runway (1000' of altitude for every mile from the runway). He remembers his altitude as being about 4,000 feet at that point (V-14). CSFDR data shows that the MA was just below 4,000 feet and roughly 7 miles from the runway when the pitch attitude and airspeed began to decrease as the MP slowed his descent (O-40, 41, 50, AA-3). The MP wasn't sure how long the runway was and called Pensacola Approach Control to ask for the runway length. Pensacola responded with the MA's range to the airport... "6 miles" (N-5). The MP asked again for runway length and was told "7,000 feet" (N-5). At this point, 4.5 miles north of the runway, at approximately 1,600 feet AGL, CSFDR data shows the throttle was increased to near military power (full power, without afterburner) (J-13, AA-3). Although the MP does not remember pushing the throttle up, he did see and feel the decrease in engine RPM that followed as the engine failed for the second time (J-13, AA-3).

The MP again accomplished the CAPs for engine airstart and the engine RPM began to increase almost immediately (J-13). The MP, however, could tell from visual references that he wasn't going to make the runway, knew he was below the recommended minimum bailout altitude of 2,000 AGL, and didn't think the engine would provide useable thrust in time to recover. There were houses everywhere he looked below him. It looked less densely populated to his right (west), so he started a right hand turn trying to aim the MA at an area where "there were few, if any, houses" (V-15). Somewhere in this shallow turn, the MP again advanced the throttle to near military power and the engine failed a third time (J-13). The MP also made radio calls saying he "may not make the field," and subsequently, was "going to have to bail out" (N-5). The MP continued to try and guide the aircraft into an open area. When the MA got low and slow enough that his control inputs weren't affecting its flight path, the MP ejected (V-15).

Note: The above narrative doesn't attempt to include all radio communications made between Gambler 11 Flight members and the air traffic control (ATC) agencies supporting them. There is no indication that air traffic control was a factor in this accident. The MP felt that he received all the help he needed from the ATC agencies and controllers involved (V-23). A complete transcript of UHF radio calls during the mishap sequence is available in Tab N. The intra-flight VHF frequency was not monitored by ATC; no recording is available of the VHF transmissions.

5. Impact: (See Diagrams AA-4 and AA-5) The MA crashed into a residential area 1.5 miles north northwest of Pensacola Regional Airport at approximately 1416 CDT. Crash site coordinates are 3029.829° North latitude and 8712.160° West longitude. The MA was 18-25° nose low, heading 198° magnetic, and in 10° of right bank when it first hit a tree 36.6 feet above

the ground (R-2, S-1, O-28, 36, 41). It continued through the tops of two more trees, then impacted, upright, on the eastern edge of Schwab Drive. It skidded across the intersection of Schwab and Lansing Drives, knocking over a telephone pole and power lines on the southwest corner of the intersection (S-4). It continued through a hedgerow and the right wingtip struck the eastern kitchen wall of the house at 2081 Lansing Drive (P-2, S-5). Still upright, the MA continued along the eastern (side) wall of that house, collecting a 1989 Dodge Caravan parked in the driveway and dragging it along under the left wing (S-6/7). The MA slid from back to front through the eastern half of the residence at 2090 Caswell Drive, completely destroying the house and a 1993 GMC Jimmy parked in the driveway (P-2). Both civilian casualties were in this house at the time of impact. The aircraft continued until hitting a large tree in the front yard of that house, where it came to rest (R-2, S-7/8).

6. Egress System: The MP initiated ejection at 209 feet AGL, 165 KIAS, 5° nose low, in a slight right bank. The escape system functioned as designed in the Mode I range of the Advanced Concept Ejection Seat II (ACES II). The MP had a full parachute between 300-350 feet AGL and was recovered uninjured (J-20 thru J-22, X-1).

7. Personal and Survival Equipment: All personal and survival equipment inspections and time changes were current and properly documented (BB-2). All personal life support equipment functioned properly during the ejection sequence (J-20). The MP's helmet visor blew to the back of his helmet during the ejection sequence but his oxygen mask remained on his face until after landing. The MP felt the gyro stabilize the seat after ejection, experienced a mild opening shock, and looked up to check his parachute canopy, which appeared normal. His attention was then drawn to his aircraft's impact with the ground. Realizing how low he was, he turned his attention to landing and pulled on the right riser to try and steer away from a house he was going toward. Either that attempt to steer the parachute, or the normal oscillations of the chute, caused him to narrowly miss the house and go through the branches of a tree in the front yard (AA-5). The MP's raft and seat kit hung up in the tree, while his parachute fell loosely over a smaller tree nearby. This left the MP approximately 10 feet in the air, suspended from the tree by his undeployed seat kit and the raft lanyard, face down and hinged at the waist, with his head slightly higher than his feet. He decided to wait for assistance from local citizens already arriving in the area. (V-18 thru V-22)

8. Rescue: The MP remained in the tree for about 10 minutes. Residents of the area he landed in were eventually able to place a step ladder in the back of a pickup truck, drive the truck underneath him, and have him step on to the ladder and disconnect from the seat kit. A Pensacola Fire Department paramedic was already on the scene and examined him shortly after he was on the ground. A rescue helicopter from NAS Pensacola had been dispatched shortly after the crash following notification by NAS Pensacola tower personnel and was circling the scene within minutes. Local authorities were able to relay to the helicopter that the MP had been recovered and the helicopter returned to NAS Pensacola. A police officer subsequently drove the MP to the NAS Pensacola Hospital for examination, treatment, and testing. The MP was

released from the hospital early that evening and transported to Eglin AFB to rejoin his unit. (V-18 thru V-21, CC-9)

9. Crash Response:

a. Civilian: Initial response was conducted by the City of Pensacola Fire and Police Departments. Pensacola Regional Airport tower personnel initiated the crash response. Pensacola Fire Department Station 6 received an Alert-2 alarm at 1419 CDT and received actual notification of the aircraft crash at 1421 CDT. They arrived at the accident site at 1424 CDT and were given a situation overview by an off-duty firefighter already on scene. At that point, Station 6 Captain J.M. Wise assumed on-scene command, pending the arrival of the Battalion Fire Chief. Units of the Pensacola Regional Airport Crash Response Team were also on scene very quickly and helped extinguish the initial fire. (CC-1 thru CC-10)

b. Military Response: The first military personnel on scene were from NAS Pensacola. They assumed on-scene commander (OSC) and security duties approximately 1 hour after the accident. An Explosive Ordnance Demolition (EOD) team and judge advocate (JA) representatives from Hurlburt Field were also on scene within the first two hours. The Disaster Control Group (DCG) at Eglin AFB was notified of the crash at approximately 1430 CDT and assumed overall responsibility for the military response. Eglin dispatched the OSC, Interim Mishap Board President, and representatives from base security police, fire department, environmental management and safety on a helicopter that arrived on scene at 1730 CDT. A second helicopter transported maintenance, EOD, and JA representatives, as well as the alert photographer. The remainder of the DCG convoyed to the crash site. The Hurlburt Mobile Command Post van was sent to the scene along with a hydrazine response team from Eglin. Transition from Navy/civilian to Air Force control of the crash site occurred after the DCG convoy arrived. During this transition period, Pensacola City Firefighters found and recovered the body of the young boy who died in the accident. Eglin AFB Security Police established an inner cordon to protect the scene and control access, while the Pensacola Police Department continued to maintain an outer perimeter. The DCG remained at the crash site, conducting cleanup activities (including environmental) and wreckage removal through 15 July 96. The Chief of Eglin's Hazardous Material Spill Response Team remained on site through the evening of 18 July supervising the contracted environmental cleanup. Detailed summaries of DCG and environmental cleanup actions are attached (V-41 thru V-45, CC-11 thru CC-16).

10. Maintenance Documentation: Review of the aircraft maintenance forms (AFTO 781 series) revealed no discrepancies related to this mishap. All required modifications to the aircraft (Time Compliance Technical Orders - TCTOs) and items requiring maintenance overhauls (Time Changes) were accomplished and upcoming inspections properly documented. All airframe, egress system, life support and engine inspections were current. Servicing actions were up to date and properly documented. The previous mission flown on 11 July was uneventful, and appropriate thruflight (through-flight) inspections were accomplished and properly documented (U-1 thru U-10, BB-3).

11. Maintenance Personnel and Supervision: The mishap aircraft was properly serviced, inspected, and prepared for flight (U-1 thru U-6). Training records were reviewed; all maintenance personnel involved with the preflight and thruflight inspections, maintenance actions, and launches were qualified to perform those tasks (BB-1).

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

a. Engine: (See Diagrams U-27 and U-28) Clear evidence of failure of a Stage 1 fan blade prompted engine analysis by the Wright Patterson Systems Project Officer (SPO) (S-9). A nick was found where blade #19 failed, with sand-type particles (silicon) embedded in the area, showing foreign object damage (FOD) (J-3, 24). After the foreign object hit the blade, stresses normal to engine operation caused a crack to develop. The blade separated along that crack, shearing approximately five inches above the root. Three pieces of that sheared blade section were recovered. The largest was found lodged in the engine fan section stage 2 stator vanes. The other two were found in the debris from the fan stator cases. (J-4, U-27,28).

b. Fuel: Fuel samples taken after the mishap from a main fuel line and the fuel flow proportioner were analyzed and found to be normal (U-24).

c. Hydraulic: A hydraulic fluid sample taken from the left horizontal stabilizer after the mishap was analyzed and found to be normal (U-25).

d. Oil: Historical records of engine oil samples prior to the mishap sortie were reviewed; no discrepancies were found (U-23). Oil samples taken from the exhaust nozzle actuator after the mishap were also analyzed and found to be normal (U-26).

13. Airframe and Aircraft Systems: Analysis by Lockheed Martin of the crash survivable flight data recorder (CSFDR) and seat data recorder (SDR) showed the sequence of events and engine performance throughout the mishap (J-6 thru J-15).

a. Lockheed Martin examined cockpit control panels and warning and caution lights. All switches were appropriately positioned and lights properly illuminated for the emergency situation (J-16 thru J-18).

b. The aircraft fuel system was broken down and examined. All components operated normally throughout the mishap sortie (J-15 thru J-18).

c. Both hydraulic pumps were examined, also showing fully operational systems (J-17,18).

d. The flight control system was analyzed and found to be operating normally (J-17,18).

e. The emergency power unit (EPU) operated normally, providing electrical power to essential systems as the engine RPM fell below 52% (J-16 thru J-18).

f. At impact, all landing gear and landing gear doors were retracted, flaperons were retracted, and the speedbrakes were closed (J-18).

14. Operations Personnel and Supervision: The 20FW Commander, Colonel John W. Rosa, made the decision to evacuate F-16s from Shaw AFB prior to the arrival of Hurricane Bertha (V-3). The flight was authorized by Captain Frederik G. Hartwig, 77th Fighter Squadron (FS) Assistant Operations Officer (ADO), for Lieutenant Colonel Salvatore Collura, the 77th FS Operations Officer (DO) (DD-1). The mass mission briefing was conducted by Major James W. Hyatt, 78FS/ADO. The 20FW Commander, Operations Group Commander (Col James M. Corrigan), and 78FS Commander (Lieutenant Colonel Jon W. Armstrong) attended the mass briefing. All flight members testified that the briefing was very thorough and more than adequately covered all necessary and required items (V-1 thru V-8, V-27, 29,31).

15. Pilot Qualifications:

a. The MP was current and fully qualified to perform the scheduled mission (T-1 thru T-9). He is a certified mission commander and instructor pilot (G-3). His flying hours, by type aircraft, are (G-2):

F-16B	1.1
F-16C	1189.6
F-16D	148.9
T-37B	1298.6
T-38A	7.3
AT-38	34.2
Student	183.7
Total Time	2863.4

His recent flying experience is as follows (G-2):

Last 30 days	16 sorties/34.8 hours
Last 60 days	26 sorties/46.7 hours
Last 90 days	32 sorties/54.1 hours

16. Medical:

a. Pilot: The MP was medically and dentally qualified to fly and had a current flight physical. He did not suffer any injuries as a result of his ejection (T-3, X-1). Toxicological examination found carbon monoxide within normal limits and no evidence of ethanol or drugs (X-2).

b. Maintenance Personnel: Three 77th Fighter Squadron (Shaw AFB) personnel who performed maintenance actions on the mishap engine underwent command-directed urinalysis. Results showed no evidence of drug use (X-9).

c. Civilians: Robbin Cannon, age 30, suffered burns over multiple parts of her body after the aircraft crashed through her home (X-7). Mrs Cannon's four year old son, Sean, was fatally injured and died at the accident scene (X-8).

17. NAVAIDS and Facilities: All applicable navigation aids and facilities were in operation. The only applicable Notice to Airmen (NOTAM) was that Naval Air Station Pensacola was closed from 1400-1600 Central Daylight Time (CDT) due to an aerial demonstration practice by the Navy's Blue Angels Demonstration Team. This NOTAM was briefed during the mass mission briefing (K-4).

18. Weather:

a. Forecast: The weather forecast for Eglin AFB from 1200 CDT to 1600 CDT showed scattered clouds at 2,500 feet, scattered clouds at 10,000 feet, and a broken cloud deck at 25,000 feet, with visibility of 7+ miles and rain showers in the vicinity. Winds at FL260 were forecast to be from 290° at 20 knots, with surface winds from 190° at 10 (gusting to 15) knots (K-3).

b. Actual: Actual weather at the accident site 25 minutes prior to the crash was clear skies with 10 miles visibility. Surface winds were calm (W-2). A special weather observation taken at NAS Pensacola, 10 miles southwest of the crash site, showed clear skies, 6 miles visibility, and surface winds from 200° at 8 knots at the time of impact (W-1).

19. Directives and Publications: The following directives and publications were reviewed during the investigation:

T.O. 1F-16CJ-1, Flight Manual
T.O. 1F-16CJ-2-70FI-00-1, Power Plant System
T.O. 1F-16CJ-6WC-1-11, Parts I and II, Preflight and Thruflight Inspection Workcards
MCI 11-F-16, Vol I and III, Pilot Training and Pilot Operational Procedures
Shaw AFB Instruction (SAFBI) 21-102, Impoundment of Aircraft/Equipment
SAFBI 36-102, Personnel Training, Certification, and Maintenance Procedures for Ground Operation of Installed Engines; Borescope Inspection, and Blade Blending for Assigned Engines
ACCI 21-166, Objective Wing Aircraft Maintenance
ACCI 21-166/SAFB Supplement 3, Objective Wing Aircraft Maintenance
20th Fighter Wing Aircrew Aid
20th Fighter Wing FOD Prevention Program
20th Fighter Wing FOD Program Self-Inspection Checklist
20th Fighter Wing Weekly FOD Prevention Checklist

SAFB Quality Assurance Flash 95-Q21-345, F110-129 Fan Blade Inspection
SAFB Quality Assurance Flash 95-Q03-44, F-16 Engine FOD Damage Reporting

There were no deviations from directives that contributed to the accident.

MARK A. WELSH III, Col, USAF
Accident Investigation Officer

PFS-40721

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STATEMENT OF OPINION

Under 10 U.S.C. §2254(d), any opinion of the accident investigator as to the cause or causes 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.

Cause:

There is clear and convincing evidence that the root cause of this accident was engine foreign object damage (FOD), resulting in catastrophic failure of a stage 1 fan blade (J-3, J-23). The subsequent engine failure was the trigger for all actions, decisions, and results of the mishap sequence that followed. Wright Lab analysis indicates the foreign object was primarily silicon based, although an iron particle was also found in the impact area on the failed blade (J-23). Mr. Larry Perkins, who conducted that analysis for the Wright Lab, told my maintenance advisor that a silicon/iron composition would be consistent with a piece of concrete, or possibly a very rough rock. I was unable to determine the exact origin of the foreign object or when the damage occurred.

Contributing Factor:

Aircrew training, specifically straight-in simulated flameout (SFO) approach training, was a contributing factor in this accident. Although the MP's knowledge of straight-in SFO procedures is excellent, the circumstances of the mishap sequence didn't necessarily lend themselves to a textbook solution. With his throttle at 80% power, the MP didn't feel comfortable in his ability to fly the steeper glidepath called for in F-16 emergency procedures and still transition to a safe landing...and stop on the available runway. I firmly believe routine straight-in SFO training (aircraft, not just simulator) would have led the MP to make a different set of decisions during the mishap sequence.

The MP did a good job accomplishing the CAPs in a timely fashion after the initial engine failure. His decision to delay jettisoning the tanks was a reasonable one. Although he could have dropped them sooner than he actually did, his distraction is understandable; a more timely reminder from his safety chase aircraft might have helped. His decision to proceed to Pensacola

Regional Airport was also a reasonable one. There were three realistic airfield options available to him when his engine first failed: Whiting Field; NAS Pensacola; and Pensacola Regional (AA-2). The longest runway at Whiting Field is 6,000 feet. F-16 pilots are taught from their first days of training that, in an engine out situation, they should go to a field with at least 8,000 feet of runway if at all possible. My experience as an instructor pilot and evaluator in the F-16 leads me to believe that most F-16 pilots will consider a 7,000 foot runway, if that's all that's available, but I can say with confidence that few would elect a 6,000 foot runway unless there was absolutely no other option. NAS Pensacola was seven miles farther away from the MA than Pensacola Regional when the engine first failed (AA-2). While the MP was making his divert decision, his engine was still not running. At the time, he didn't even think he could make Pensacola Regional (V-11), much less reach a runway seven miles farther away. From north of Pensacola, looking south, Runway 17 at Pensacola Regional stands out exceptionally well (Photo Z-1a). This is the angle from which the MP first saw the runway, although this photograph was taken from much closer to the field. Photo Z-1a was taken from approximately 7 miles north of the runway and 4,000 feet AGL. It's noteworthy that even from this relatively low altitude and close range, the residential areas just north of the airfield don't look nearly as densely populated as they do from the closer look and different angle shown in Photo Z-1b. My operations advisor for this investigation flew the mishap profile in an F-16. From the area where the MP first saw Runway 17, my investigator could clearly see the runway, but couldn't see any built up areas at all, except the industrial area in the bottom left quadrant of Photo Z-1a. It wasn't until he was much closer to the field that he began to see the populated areas. In the actual mishap sequence, by the time the MP reached that point, he was committed to Runway 17 at Pensacola Regional; the other fields were no longer viable options.

The MP's initial setup for a straight-in flameout approach to Runway 17 was textbook. He held a constant maximum range airspeed during his initial turn to the south, devised an optional gameplan (eject over the bay) in case the engine didn't respond or he elected not to continue to the runway, and completed all the required items for an engine restart. At this point, the events driving his decisions became more complicated. After the engine restarted, although the emergency checklist doesn't direct it, the MP considered checking engine response before changing any flight parameter of the flameout approach he'd already started. He elected not to do this because of the considerable airframe vibration that was accompanying engine operation. There are multiple references in the F-16 emergency procedure checklists for engine malfunctions advising pilots to minimize throttle movements whenever possible. It is entirely reasonable that, since his engine had already failed once, the MP associated the airframe vibration with an engine malfunction, and elected not to move the throttle to check engine response, especially since he perceived he could make it to the runway with the thrust he was already getting.

His subsequent decision to lower the nose and decrease his glidepath (angle of approach), was a conscious decision to deviate from the straight-in SFO profile he had already established. This decision was based on a lack of comfort in his ability to effectively control his energy level with thrust at 80% RPM, if he stayed on the steeper straight-in SFO glidepath. The MP felt that

losing some of his excess energy early in the approach would help his transition to landing and insure he was able to stop on the 7000 feet of runway available to him (V-13). The MP's lack of comfort in proper execution of the straight-in SFO pattern indicates a training shortfall. The MP has not accomplished a straight-in SFO in over two years and had only done a couple before that. Although there are well-defined procedures for straight-in SFO practice, weather, volume of air traffic and airspace availability severely limit the opportunities pilots actually have to practice them at some bases. My experience as an F-16 squadron operations officer, F-16 squadron commander, and group commander for a unit that includes two F-16 squadrons, tells me the MP's limited experience flying straight-in SFO approaches is not atypical. By all accounts, the MP is a very talented, credible, and well respected F-16 pilot and flight instructor. Training records show that he consistently took time to practice overhead SFOs during his training missions over the past year (T-14). Had he been able to practice straight-in SFOs with the same regularity, from different altitudes, with different power settings, and assess his performance through tape review, it's entirely reasonable to assume he would have done so, and been much more comfortable in his ability to control energy level in the transition from the SFO glidepath to landing. As it was, he went with the gameplan he felt he was best qualified to execute and that he believed gave him the best chance to successfully recover the aircraft. Tragically, the engine failed again.

Mark A. Welsh III

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Accident Investigation Officer

NUCLEAR REGULATORY COMMISSION

Docket No. _____ Official Exh. No. 10

In the matter of PFS

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