AIRCRAFT ACCIDENT INVESTIGATION

I. STATEMENT OF AUTHORITY AND PURPOSE

A. AUTHORITY. Under the provisions of Air Force Instruction (AFI) 51-503, the Eighth Air Force Commander convened this Aircraft Accident Investigation. The investigation was conducted from 18 July 1995 to 4 August 1995. The following individuals were appointed by the commander to conduct the investigation:

1. Lt. Col. Hildery P. White, Jr., Investigating Officer, by letter dated 14 July 1995 (Tab Y-2).
2. Maj. Raymond T. Fleischer, Technical Advisor, by letter dated 14 July 1995 (Tab Y-4).
3. Maj. Allen G. Erickson, Legal Advisor, by letter dated 14 July 1995 (Tab Y-5).

B. PURPOSE. The investigation was to obtain and preserve all available evidence for possible use in claims, litigation, disciplinary actions, adverse administrative proceedings, or any other purposes deemed appropriate by competent authority. The investigation focused on the facts surrounding the Class A aircraft accident involving an F-16C, tail number 87-0273, the Mishap Aircraft (MA) assigned to the 176th Fighter Squadron, 128th Fighter Wing, Truax Field, Wisconsin (Tab A-2). The aircraft crashed while flying low level on VR-1616 near Strum, Wisconsin on 25 June 1995. The pilot ejected safely and the aircraft impacted the ground in a wooded area on private property and was destroyed (Tabs R-2, 3, 4, S-2 thru 8).

II. SUMMARY OF FACTS

A. History of Flight

On 25 June 1995, Captain John C. Wasserburger, Mission Ready Pilot, the Mishap Pilot (MP) was scheduled for a deployment/Surface Attack Tactics (SAT) air-to-ground training sortie (Tabs A-2, B-2, 3, C-2). The sortie was planned as a three-ship mission with a call sign of Hosea 41, 42, and 43. The MP's call sign was Hosea 42. The sortie's scheduled departure time from Truax Field, Wisconsin was 1000 Central Standard Time (CST). The sortie was planned to fly medium altitude to a Visual Flight Rule (VFR) descent for entry into VR-1616, for low altitude training, followed by a 30 degree fly up bombing attack on the Hardwood Range (R-6901) air-to-surface complex. The sortie was planned to continue operating on Hardwood Range with Hosea flight practicing low altitude bombing and strafe events. followed by a VFR recovery to an overhead pattern and landing at Volk Field, Wisconsin. During entry into VR-1616, approximately 2000 feet above ground level (AGL), the MP experienced an explosion and noticeable loss of engine thrust. The MP initiated the Critical Action Procedures (CAPS) for low altitude engine failure. Within seconds of initiating the CAPS, Hosea 43 reported Hosea 42 was on fire. The engine never recovered and with a confirmed fire the MP safely ejected approximately two minutes into the emergency. The aircraft crashed at 1020 CST and was not salvageable. The crash site was located approximately three miles southeast of Strum, Wisconsin, on top of a wooded hill on private property. Civilian injury (Tab V-10) and civilian property damage claims have been annotated (Tab P-2, 3). The 128th Fighter Wing Public Affairs Office handled news inquiries.

NUCLEAR REGULATORY COMMISSION

Docket No _____ Official Exh No. 180

In the matter of PFS

Staff _____ IDENTIFIED ✓

Applicant ✓ RECEIVED ✓

Intervenor _____ REJECTED _____

Cont'g Off'r _____

Contractor _____ DATE 7/1/02

Other _____ Witness _____

Reporter GAA

B. Mission

The mission was scheduled and planned as a three-ship day SAT sortie. The mission was also part of a planned deployment to Volk Field, Wisconsin (Tabs A-2, C-2). The planned profile included single-ship afterburner (AB) takeoffs for Hosea 41 and 43, a military (MIL) power takeoff for Hosea 42, rejoin to route, medium altitude cruise to the entry for VR-1616, letdown, low level navigation, a coordinated three-ship 30 degree fly up to a dive bomb attack on Hardwood Range, low altitude bombing events and low angle strafe on Hardwood Range, and recovery to Volk Field via VFR overhead patterns and full stop landings (Tab V-3, 14, 15).

C. Briefing and Preflight

All pilots of the flight showed up for duty approximately 0630 CST (Tab V-3, 14, 15). All three reported adequate crewrest. Mission planning was accomplished prior to brief. The flight briefing began at 0800 CST and all three pilots reported the briefing was comprehensive, in accordance with (IAW) regulations, and all responsibilities and planned events were clearly understood (Tab V-3, 14, 15). The flight was filed on a local 128th Fighter Wing Stereo Flight Plan (Tab K-2). The MP and number three man changed aircraft tail numbers at the duty desk prior to step. This aircraft change was coordinated with the flight lead and squadron supervisors and was not unusual or maintenance related (Tab V-14, 15). The MP stepped to his aircraft on time and reported a normal preflight (Tab V-15). Although the preflight was normal, the MP's aircraft was configured with two wing tanks and an Electronic Countermeasures (ECM) pod. This configuration was communicated to the flight lead who asked and received permission from operations supervisors for the MP to accomplish an AB takeoff. This was a change from the originally planned MIL power takeoff for the MP. After start, ground operations were accomplished without any abnormalities, deviations, or further changes (Tab V-15).

D. Flight Activity

Hosea 41 flight took off at 0957 CST. The takeoffs were single-ship using AB with 15 second spacing between aircraft. Engine response during the takeoff and enroute portions of the flight was reported to be normal by the MP (Tab V-15). The MP rejoined to route formation then assumed a tactical formation for the departure leg cruise at 16000 feet mean sea level (MSL) to the VR-1616 low level (Tabs K-2, V-14). Enroute to VR-1616, Hosea 41 flight adjusted their range time by slipping their time over target (TOT) by ten minutes. This was to deconflict with Dagger flight, who had experienced delays and needed additional range time (Tab V-3).

During the descent into the low level environment, Hosea 41 flight accomplished two 180 degree G-awareness turns at an altitude of 5000-7000 feet MSL. The MP did not use AB during these G-awareness turns. The planned and flown formation during the low level was a three-ship wedge. The MP (Hosea 42) was on the left side of the leader (Hosea 41) about a mile and a half back on a 45 degree bearing. Hosea 43 was on the right side of Hosea 41, the same distance and bearing as the MP, and was one mile line abreast of the MP (Tab V-3, 14, 15). As the flight

continued their descent into the low level, following the G-awareness turns, the MP did use 5 seconds of AB to regain proper formation position, as described above (Tab V-15).

Hosea 41 flight was between steerpoints 3 and 4, in the proper formation, at an altitude of approximately 2000 feet AGL, when Hosea 43 noticed two quick puffs of dirty white smoke, three feet in diameter, come from the front of the nozzle area of Hosea 42 (Tab V-14). Within a couple of seconds of the puffs of smoke, the MP called "Hosea 41 knock it off, knock it off, I think I lost my engine" and began a zoom climb to gain altitude (Tabs N-2, V-15). From the MP's cockpit, the initial indication of a problem was an explosion (probably coinciding with the puffs of smoke seen by Hosea 43) and an immediate loss of thrust. The MP began to zoom the aircraft and execute the CAPS for low altitude engine failure/airstart (Tabs O-37, 63, V-15). The MP placed the throttle to off and back to midrange, jettisoned external stores, put the engine control switch to secondary (SEC), and started the jet fuel starter (JFS) (Tabs O-74, V-15). The pilot estimated his apex at approximately 7500 feet MSL and started a glide at 200-220 knots calibrated airspeed (KCAS). About five seconds into the zoom, Hosea 43 saw flames coming from the nozzle area of Hosea 42 and made the transmission "I see flames coming out of Two. You got flames coming out your back" (Tabs N-2, V-14). The MP recalled hearing the term flame but had no indications, in the cockpit, of an engine fire (Tab V-15). Over the next minute, several calls were made to the MP on the very high frequency (VHF) radio by both Hosea 43 and Hosea 41 referencing the aircraft fire (Tab N-2, 3) These transmissions were not heard by the MP most likely due to the fire burning through the VHF coaxial cable. The MP continued his glide and realized he was not hearing anyone on VHF. During the glide, the engine fire light illuminated, the overheat caution light illuminated, the fan turbine inlet temperature (FTIT) pegged at 1200 degrees C, and the engine revolutions per minute (RPM) stabilized at 20 percent. The MP made a radio call on ultra high frequency (UHF) about these indications and was told, also on UHF, he was on fire by Hosea 41 (Tab N-3). With the confirmed fire and the engine producing no thrust, the MP prepared himself for ejection At approximately 2000 feet AGL and 1020 CST, the pilot initiated the ejection sequence (Tab V-3, 14, 15).

E. Impact

The aircraft impacted the top of a wooded hill on private property approximately three miles southeast of Strum, Wisconsin while flying on an easterly heading. The aircraft stalled approximately 50 feet above the wooded hill, pitched nose up, and fell relatively flat, with no forward or rearward momentum, left wing first to the ground (Tabs J- 7, R-2, V-3, 11, 12). The aircraft was on fire before impact and exploded upon impact causing damage beyond economical repair (Tabs J-7, V-3, 11, 12, 14).

F. Egress System

The ejection occurred approximately 2000 feet AGL with the MA level to slightly climbing in a near wings level attitude. Airspeed was approximately 200 KCAS (Tab V-15). The MP assumed the proper position and pulled the ejection handle The ejection seat functioned normally (Tab V-15). The MP felt the opening shock of the parachute within a split second of pulling the ejection handle The parachute risers were initially twisted until the MP pulled them

apart. The MP determined he had a good canopy and did a four line jettison along with discarding his mask and checking his seat kit. The MP estimated he was descending in his parachute one minute before he landed. He felt he was going to land in a field until the last 300 feet of descent. In this last 300 feet the wind died down and the MP realized he would be landing in the trees. He assumed the proper position for tree landing but did not have time to release his seat kit. The MP landed in the trees and was jerked to stop about 30 feet above the ground when his parachute got caught in limbs (Tab V-4, 15). The emergency radio beacon in the seat kit never functioned as reported by the MP and airborne pilots (Tab V-3, 14, 15). The emergency manual chute release handle was deployed but was not commanded by the MP (Tab I-3). Both of these components were sent to LDIL at Kelly AFB, Texas for evaluation (Tab I-3).

G. Personal and Survival Equipment

All personal and survival equipment inspections were checked and were current. The survival vest UHF radio (PRC-90) was used for communications by the MP with other flight members after the MP ejected and made a tree landing. The MP's parachute was caught in tree limbs and the MP was hanging by his harness 30 feet above the ground. The MP began to use his personal lowering device but, due to the arrival of civilian assistance and the uncertainty of the stability of the hung parachute, decided to wait for the civilian help to lower him to the ground. No other survival gear was used during the mishap (Tab V-3, 4, 14, 15).

H. Rescue

Hosea 41 immediately transmitted a mayday when the MP ejected (Tabs N-3, V-3). Hosea 41, 43 and Dagger flight relayed information to the Volk Field Supervisor of Flying within seconds of the mishap (Tab V-2, 3, 14). An Army helicopter had just landed at Volk Field and within ten minutes (about 1035 CST) was airborne and enroute to the crash site with three firemen on board plus the helicopter crew (Tab V-8, 9). The MP had landed and was hung up in trees near a road. Several civilians, who witnessed the ejection, immediately began looking for the MP and within ten minutes (about 1035 CST) located him (Tab V-4, 10, 15). The civilians then reported the MPs location to local rescue agencies. The MP, uncertain of how secure his parachute was caught in trees, decided to wait for the civilians to find a ladder (Tab V-15) The local sheriff and emergency medical service (EMS) responded to the MP's location within 20 minutes (about 1055 CST) and with the aid of a ladder removed the MP from the trees (Tab V-4, 10, 15). The EMS took precautions and treated the pilot and checked him for injuries. By the time the EMS were finishing their check of the MP, the Army helicopter from Volk Field had arrived (about 1130 CST). The Army crew then transported the MP to the hospital in Eau Claire, Wisconsin (Tab V-15)

I. Crash Response

Civilian witnesses estimated it took 15 to 20 minutes (1040-45 CST) for the local fire department to arrive on scene at the crash site (Tab V-11, 12). Initial vehicles responding were a pickup truck (volunteer fireman), a tanker water truck , and a sheriff's car. The fire department basically contained the brush fire and the sheriff kept unauthorized personnel away from the site. There

were numerous small explosions from exploding 20 millimeter (MM) cannon rounds (Tab V-11, 12). The Army helicopter from Volk arrived around 1120 CST and the three firemen on board got off at the crash site. The helicopter then departed for the MP's location. Due to the exploding 20 MM rounds, and the uncertainty of hazardous chemical locations (hydrazine, fumes, and fuel), the military firemen made sure no civilians were in the area and waited about one hour for the fire to subside. When the military firemen felt the area was secure, small localized wreckage fires were extinguished (Tab V-5, 9). Numerous other civilian vehicles responded to the crash site but did not interfere with crash response.

The Disaster Control Group at Volk Field met about 1030 CST, ten minutes after the accident notification, to develop a plan of action. By 1100 CST, nine Security Policemen, a three man Hydrazine Response Team, and the pilot and safety members of the Interim Safety Board, were enroute to the crash site. They arrived around 1245 CST. The remaining crash response, including the On-Scene Commander, Munitions/Explosive Ordnance Disposal, the Quality Chief, and three members of the Volk Air Base Operability shop, were enroute to the site by 1145 CST and arrived around 1330 CST. A mobile Command Post full of survival equipment, supplies, and communications gear was part of this remaining response (Tab V-5, 9)

J. Maintenance Documentation

1. A thorough review of the maintenance records for the F-16C mishap aircraft, Serial Number (SN) 87-0273 and engine SN 509847, was conducted. The active aircraft AFTO 781 Series were completely destroyed in the mishap (Tab H-2). AFTO 781As were reviewed for the period 3 May 1995 through 22 June 1995 and showed no maintenance performed relevant to the mishap (Tab U-2 thru 41).

2. According to computerized historic records, no time change items were overdue and no Time Compliance Technical Orders (TCTOs) were overdue (Tab H-4). The mishap aircraft went through a number 2 phase inspection from 6 February 1995 through 7 April 1995 (Tab H-3).

3. A review of the maintenance records revealed the mishap engine (ME), SN 509847, was installed in the MA on 27 March 1995 (Tab U-42). The ME underwent a 3000 TAC inspection on 7 June 1994. The Stage 1 High Pressure Compressor (HPC) dovetail ultrasonic inspection was completed with no defects noted (Tab J-13). During the same inspection two HPC core blades were changed due to FOD in the engine. These blades were located in the 4th and 8th stages of the HPC (Tab V-13). The AFTO Form 95 Historic Engine Records and computerized records were not annotated to reflect the removal and replacement of these blades. The records only indicate what blades were affected by FOD on the Engine Borescope Worksheet (Tab U-48). Procedures for annotating records are in Special Inspection TO 2J-F110-6-4 SWP 059 01 change 7, page 8, paragraph 4. All engine trend data since the 3000 TAC inspection showed normal operation (Tab U-43 thru 46). TCTO 687, inspecting for proper installation of the Variable Stator Vanes (VSVs) Pilot Valve Assembly in the Main Engine Controller (MEC), was completed on 31 January 1995 (Tab U-61, 62). None of the discrepancies or inspections were relevant to the mishap.

4. Computerized engine records and AFTO Form 95s were available. However, the engine records lacked complete documentation for the period 13 July 1990 through 8 July 1992. A total of 864.9 hours of Engine Operating Time (EOT) were missing when the engine was received at Truax Field, Wisconsin on 1 December 1992 (Tab V-13). TCTO 662, dated 1 December 1991, involves inspection of the VSV casing and lever arm assemblies if the engine HPC core section had any maintenance accomplished within the previous 200 hours EOT or less. Because of the incomplete records it could not be determined if or when TCTO 662 was accomplished. The only documentation during the 864.9 hour time span is shown by computerized records which only reflect removal and replacement of the engine from various aircraft (Tab U-49 thru 60).

K. Maintenance Personnel and Supervision

A review of training records for all individuals who performed maintenance on this aircraft and engine for thirty days prior to the mishap showed them to be adequately trained and qualified for the maintenance performed. Supervision insured a strong training program existed in all the maintenance branches. Aircraft 87-0273 was properly serviced and inspected by qualified personnel on 25 June 1995. There was no evidence of maintenance malpractice associated with this mishap.

L. Engine, Fuel, Hydraulic, Oil Inspection analysis

1. Engine SN 509847 suffered a catastrophic failure in the second stage of the HPC resulting in a significant amount of chaffing and abrading subsequently resulting in a titanium fire in stage three of the HPC. Due to the extensive fire damage to the compressor and the overtemperature in the turbine section, the ME was producing no useable thrust at impact (Tab J-3, 4, 5, 6, 9, 10). Post accident investigation of the ME revealed two second stage compressor VSV lever arms at one time were misaligned causing fatigue on various stage two and three compressor blades. Four of the fatigued stage two compressor blades liberated from the core of the engine during the 25 June 1995 flight (Tab J-4, 9). However, when the VSVs and VSV lever arms were disassembled during the post-accident investigation they were in their proper position (Tab J-4). Engine Special Inspection TO 2J-F110-6-4, change 12, SWP 059 01, Table 1, page 10, states, if an engine has operated with VSV lever arms misaligned, the HPC core shall be returned to depot for complete replacement of compressor blades. No record of misaligned VSVs or VSV lever arms could be found in any maintenance records.

2. Engine oil samples taken from engine SN 509847 prior to the mishap were normal with regard to wear metals (Tab U-47). Post crash engine oil samples indicated a rise in Fe (iron) 2 parts per million and in Mo (molybdenum) 8 parts per million. There are no records of oil samples from the oil servicing cart. The results of the oil sample from the OC-ALC/TIESC laboratory report were inconsistent with the results reported from the oil sample analyzed at Truax (Tabs J-11, 12, U-47). Hydraulic fluid samples indicated a count of particles but could not be translated and did not indicate condition of the sample (Tab J-11). Accurate fuel samples could not be taken from the aircraft internal fuel cells or the engine. A fuel sample was taken

from one of the jettisoned 370 gallon drop tanks. The sample from the drop tank was free of organic contamination (Tab J-11,12).

M. Airframe and Aircraft Systems

1. All primary and secondary flight controls functioned normally prior to impact and no abnormalities were noted (Tab V-15).

2. Avionics, hydraulics, instruments and electrical systems functioned normally, until the explosion and inflight fire, with no malfunctions reported by the pilot (Tab V-15).

N. Operations Personnel and Supervision

1. Hosea 42 was properly scheduled on an OPS Form O-1, Daily Flight Schedules by the 128th Fighter Wing (Tab K-3). The flight was properly cleared on a local flight clearance with all pre-mission requirements authenticated by Major Robert W. Fritsch on the 128th Fighter Wing Local Flight Clearance/Flight Order (Tab K-4).

2. The flight briefing was conducted at 0800 CST and thoroughly covered all required items (Tab V-3, 14, 15). The MP completed all flight planning before the flight brief. Hosea 41 flight was properly filed on a 128 Fighter Wing Stereo Flight Plan (Tab K-2).

O. Pilot Qualifications

Captain Wasserburger was current and qualified to perform the scheduled mission (Tabs G-2, 3, 4, 5, 6, T-2 thru 6). He had flown a similar mission three days prior (Tabs G-2, 3, 4, 5, 6, V-15). He is a pilot and mission commander with the following flying experience:

F-16C/D	399.0 HOURS
F-16B	1.1 HOURS
A-10A	560.9 HOURS
AT-38B	26.5 HOURS
OTHER	1.5 HOURS
STUDENT	190.7 HOURS
TOTAL	1179.7 HOURS

30/60/90 DAY FLYING TIME/SORTIES
LAST 30 DAYS-- 7.6 HOURS/6 SORTIES
LAST 60 DAYS-- 21.5 HOURS/16 SORTIES
LAST 90 DAYS-- 32.1 HOURS/23 SORTIES

P. Medical

The pilot was medically qualified to fly the mission. His most recent flight physical was performed on 24 May 1995 and no significant abnormalities were found. Post accident toxicological studies were normal. He was uninjured during ejection but sustained minor abrasions when landing in trees. Post accident examination revealed no other significant injuries. There is no evidence physiological factors contributed to the accident (Tab X-2).

Q. Navaids and Facilities

There were no operationally significant NOTAMS the morning of the accident. The NOTAMS, navaids and other facilities were not a factor in this mishap (Tab V-2, 3, 8, 14, 15).

R. Weather

Weather was not a factor in this mishap. Cloud conditions throughout the area were scattered to nonexistent. Visibility was six miles in haze and the winds were very light. (Tabs K-8, 9, 10, 11, 12, V-2, 3, 8, 14, 15).

S. Governing Directives and Publications

The following instructions and technical orders applied to the flight operations of Hosea 42:

AFI 11-206	General Flight Rules
AFI 11-401	Flight Management
MCI 11-416	F-16 Operational Procedures (ACC/USAFE/PACAF/AETC/NGB/AFR) Chapter 8/128 FW Supplement
T.O. 1F-16C-1	F-16C/D Flight Manual
T.O. 1F-16C-1-1	F-16C/D Supplemental Flight Manual
T.O. 1F-16C-1CL-1	F-16C/D Flight Crew Checklist
T.O. 1F-16C-34-1-1CL-1	AVIONICS and Non-Nuclear Weapons Delivery Flight Crew Procedures SCU-2, F-16C/D
176th Fighter Squadron Inflight Guide	
Air National Guard F-16C, Block 30 Combat Guide	

There are no indications of deviations from directives or publications.

III. 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.

Based on evidence which I found to be clear and convincing, it is my opinion as the investigating officer the cause of the accident was a catastrophic engine failure and fire. The fire rapidly progressed to areas outside of the engine section and became uncontrollable. The most probable cause of the engine failure and fire was the liberation of four, stage two, HPC blades. When the stage two HPC blades liberated, the resulting chafing and abrading started a titanium fire in stage three of the HPC. Once this fire began it quickly breached the engine compartment spreading the fire to the aft fuselage area and most likely the aft fuel cell (Tab J-4, 8, 9, 10).

Post accident investigation revealed fatigue, most likely caused by improper installation of two VSV lever arms, caused the stage two blades to liberate. However, during the post accident investigation all VSV lever arms and, for that matter, all VSVs were found properly installed (Tab J-3, 4). A thorough search of available maintenance records showed no history of improperly installed VSVs or VSV lever arms.

Hildery P. White Jr.

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Accident Investigation Officer