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AIRCRAFT ACCIDENT INVESTIGATION

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OFFICE OF THE SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

AUTHORITY: Pursuant to provisions of Air Force Instruction (AFI) 51-503, the Ninth Air Force Commander, Lieutenant General John P. Jumper, appointed Lt Col Van F. Chatraw to investigate and determine the facts and circumstances surrounding the destruction of Aircraft F-16 CS/N 86-0361 which occurred over Restricted Area R4201A, Grayling Gunnery Range, MI on 19 March 1996. Major Michael A. Fleming, HQ AFMC/JA, Wright-Patterson AFB, OH, was appointed on 8 April 1996 as a legal advisor. Msgt Michael L. Crosby, 20 CRS, Shaw AFB, SC, was appointed on 29 April 1966 as a maintenance technical advisor (Tab Y1-4).

PURPOSE: An aircraft accident investigation is convened under AFI 51-503. The investigation is intended primarily to gather and preserve evidence for claims, litigation, disciplinary and administration 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:

a. **History of Flight:** On 19 Mar 96, Capt Doug Cligrow, the mishap pilot (MP) was scheduled as Number 3 of a Surface Attack Tactics (SAT) mission in conjunction with an Operational Readiness Exercise (ORE). Lt Col Richard Williams led the mission. (V-2) Flight members were a part of the 162nd Fighter Squadron, Ohio Air National Guard, deployed to the Phelps-Collins Combat Training Center, Alpena, MI. The flight departed Alpena at 0936 hours eastern standard time (EST) and proceeded direct to Restricted Area R4201A at 5000 feet mean sea level (MSL). Upon entering R4201A the flight conducted low altitude operations and performed one SAT attack on a predetermined target. Following the attack, the flight climbed above 4000 feet MSL and conducted target familiarization and range complex orientation with the range controller. It was during this phase of flight that the mishap aircraft (MA) experienced catastrophic failure of the number one bearing assembly in the engine resulting in severe axial buckling and bending and subsequent failure of the engine. Number 4, Lt Stone, informed Capt Cligrow that his engine was smoking. Capt Cligrow started receiving multiple indications within the cockpit of severe engine problems. Shortly thereafter the engine completely failed. Following the checklist procedures Capt Cligrow jettisoned his external aircraft stores on the range and attempted an engine restart. When Capt Cligrow determined that the engine would not restart, he prepared for ejection and ejected from the aircraft over the range at approximately 2000 feet above ground level (AGL). The MA impacted the ground within R4201A at N44-50'31" and W084-32'46" and was destroyed. The MP was picked up by an Army UH-1 helicopter from Camp Grayling

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SECY-02

NUCLEAR REGULATORY COMMISSION

Docket No _____ Official Exh No. 184
In the matter of PPS
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Applicant RECEIVED
Intervenor _____ REJECTED _____
Contracting Off'r _____ DATE 7/1/02
Contractor _____ Witness _____
Other _____
Reporter CELH

Army Airfield and was transported to the Range Control Tower and later to Alpena, MI for medical observation. The MP suffered only minor injuries.

b. Mission: The flight was scheduled and planned as a four-ship SAT mission with the MP flying as Number 3 and the second element leader. The original flight was scheduled for Hardwood Range, but was delayed due to weather conditions. Lt Col Williams selected Grayling Range as a backup option and replanned the flight profile to accommodate required changes. The final flight profile included single ship takeoffs, medium altitude cruise to Grayling Gunnery Range, Restricted Area R4201A, an actual bomb attack on a simulated fuel storage facility on the range using BDU-33 practice bombs, a target familiarization and range orientation tour, and return to base via vectors at medium altitude to initial for overhead patterns.

c. Briefing and Preflight: Capt Cligrow reported for duty at approximately 0600 hours EST. The briefing was conducted by Lt Col Williams in accordance with applicable checklists and guidelines. Prior to the preflight check, maintenance was required to remove frost from the aircraft. The preflight of the MA was standard and unremarkable.

d. Flight: The flight, call sign Dolar 11, took off at 0936 hours EST on an Instrument Flight Rules (IFR) clearance direct to R4201A. The takeoffs were single-ship using military (MIL) power (100% throttle without afterburner). The flight to the range complex was uneventful. After entering the range and conducting a SAT attack the flight maneuvered to familiarize themselves with the various simulated targets on the range. The 4-ship was separated operating as to two separate elements with the second element in 4 to 6 mile trail spacing. During the range orientation, the MP, Dolar 13, experienced a loud bang from within the aircraft and heavy aircraft vibrations followed by the hydraulic/oil pressure light, the secondary engine control (SEC) caution light, and several other lights on the caution panel. Number 4, Dolar 14, informed the MP he was trailing smoke and appeared to be on fire. The MP immediately proceeded with critical action procedures (CAP) and used the emergency jettison button to jettison the two external fuel tanks and the two triple ejection racks (TER). The MP continued with the CAPs and attempted an airstart as he was descending out of 5000 feet MSL. Dolar 11 had maneuvered to a chase position behind the MP and directed Dolar 12 and Dolar 14 to hold above the range at 10,000 feet MSL and 5,000 feet MSL respectively. The MP requested and received a snap vector to Alpena Airbase. However, Dolar 11 directed the MP to stay on the range. The MA started receiving smoke in the cockpit to a degree that the MP was unable to clearly read the engine instruments. Dolar 11 had descended to an altitude of 3000 feet MSL (approximately 2000 feet AGL) after confirming that the smoke, white to light gray in color, was coming directly from the engine. The MP was unable to maintain a flyable airspeed and altitude. He began a descent to maintain an air speed of approximately 200 knots. With the situation continuing to deteriorate and no indications of an engine restart, the MP informed the flight that he would have to get out of the aircraft. Dolar 11 directed a bail out as the MA descended through 3000 feet MSL. The MP successfully ejected from the MA at approximately 1005 hours EST. The MP executed a successful parachute landing on the range sustaining only minor injuries. The

MA impacted on the range and was destroyed. Dolar 11 orbited the area to mark the location of both the MP and MA and establish radio contact with the downed pilot. An Army UH-1 helicopter operating in the local area offered assistance and was vectored into the area by Dolar 11 and the MP. The MP was picked up by the helicopter and transported to the Range Control Tower and subsequently to Alpena Airbase. The remaining flight members returned direct to Alpena Airbase at medium altitude and landed uneventfully.

e. Impact: The MA aircraft impacted the ground on Grayling Gunnery Range (R4201A) at N44-50'31" and W084-32'46". The MA was destroyed upon impact. There were no residual fires. Debris was scattered in an easterly direction from the impact point over an area approximately 400 meters by 200 meters.

f. Ejection Seat: The ejection sequence appeared to deploy successfully and in the proper mode for the flight conditions. However, the MP did experience severely twisted risers and spent much of the descent rectifying this problem. As a result the MP suffered bruising to the calf muscle area on his legs and the biceps muscle area on his arms.

g. Personal and survival equipment: The MA and MP equipment had been properly inspected and was fully functional. The MP was current in ejection seat, hanging harness, and survival training. The guard channel on the survival radio was reported as weak and barely readable by Dolar 11. However, the rescue channel provided clear transmissions.

h. Rescue: The rescue effort was coordinated by Dolar 11 with assistance from the Range Control Officer. Dolar 11 had difficulty spotting the MP's exact position until he established communications and instructed the MP to display his parachute to mark his position. The position was relayed to the Range Control Officer who immediately dispatched personnel on a snow mobile to the MP's location. However, due to the depth of snow on the ground, the snow mobile was experiencing difficulty and was traveling abnormally slow. An Army UH-1 helicopter from Camp Grayling Army Airfield operating in the local area overheard transmissions on the guard radio channel and responded. The helicopter was directed into the area by Dolar 11 and vectored into the final pickup location by the MP. The helicopter transported the MP to the Range Control Tower where the MP telephonically contacted appropriate authorities. The MP was then transported to Combat Readiness Training Center at Alpena, MI.

i. Crash Response: The Range Control Officer contacted the Supervisor of Flying at Alpena Airbase who in turn activated the crash response net for the deployed unit. Personnel responded appropriately to safeguard and preserve evidence, ensure rescue efforts were initiated, and proper medical units were prepared to receive the MP.

j. Maintenance Documentation: A thorough review of the maintenance records for aircraft 86-0361 revealed no discrepancies which would have caused or contributed to the accident. A review of the AFTO Form 781 was accomplished. There were no open

discrepancies which would have prevented the MA aircraft from flying (H-3 to H-30). All airframe and engine scheduled inspections were current (H-9 to H-10). All Time Compliance Technical Orders were current (H-10 to H-12). The MA aircraft had flown two prior missions with engine 509455, and all inspections and servicing were accomplished with no abnormal trends noted (H-15 to H-29). During the walk around inspection the magnetic chip detector was inspected and revealed no wear metal deposits (V-73). A review of the Jet Engine Intermediate Maintenance (JEIM) and Test Cell records indicated a detailed history and accurate documentation of the maintenance performed (Tab Q). The Joint Oil Analysis records indicated no abnormal trends (O-132). A complete review of the MA's previous 90 days maintenance revealed normal procedures and no trends. However, CEMS data indicated that engine 509455 was removed on 1 Nov 95 from aircraft 87-0245 for smoke in the cock pit (O-141). During the trouble shooting process, the number one bearing retaining nut was discovered missing, and two 10/32 nuts were found in the hydraulic pump screens (O-137). These incidents lead to the extensive engine maintenance . (O-136 to O-141)

k. Maintenance personnel and supervision: Aircraft 86-0361 was properly serviced, inspected and prepared for flight by qualified maintenance personnel. Training records were reviewed and all personnel involved in the preflight and launch of the aircraft were qualified. There was no evidence of maintenance malpractice associated with the mishap.

l. Engine, fuel, oil, and hydraulic inspection analysis: The general condition of the failed engine is documented in Tab J. (J-2 to J-4). The number one bearing suffered catastrophic failure. However, due to the destruction of the evidence caused by the crash there is no conclusive evidence to substantiate the cause for the bearing failure (S-2 to S-8). The oil inspection analysis taken after the mishap was a sample from the magnetic chip detector, oil pressure relief valve, and the lube and scavenge pump areas (O-134 to O-135). The results were abnormal wear metal trends. Fuel and Hydraulic samples were not requested. According to all the documentation the MA was properly serviced, inspected, and prepared for flight by qualified personnel (H-15 to H-29). There is no evidence to associate the fuel or hydraulic systems to the mishap.

m. Airframe and aircraft systems: The events leading up to the mishap indicated no abnormalities with the airframe and aircraft systems. During the engine failure the aircraft systems indicated an oil/hydraulic pressure warning light and a secondary engine mode (SEC) transfer light. These indications are normal aircraft systems warning of impending engine failure. These are strong indicators that those systems were operating normally.

n. Operations personnel and supervision: The mission was accomplished under the authority of the 178th Fighter Wing (FW) and the 162nd Fighter Squadron (FS). Lt Col Williams gave the pre-mission brief in accordance with MCI 11-F16 and applicable unit directives. All required supervisor briefings and actions were accomplished. (V-2, 3, 12, 13, 24, 25, 34)

o. Pilot Qualifications: Capt Cligrow was current and fully qualified to perform the scheduled mission. (T-2, 3, 4, 5) His flying experience is as follows: (G-2, 3, 4, 5)

Student Time (T-37, T-38)	201.6 hours
AT-38	29.5 hours
A-7D/K	380.1 hours
F-16B	1.3 hours
F-16C/D	<u>427.5 hours</u>
TOTAL	1040.0 hours

HOURS/SORTIES 30 days/60 days/90 days

<u>30 Days</u>	<u>60 Days</u>	<u>90 Days</u>
11.0/7	17.6/12	18.8/13

p. Medical: Capt Cligrow was medically qualified to fly.(X-2) Toxicology specimens contained no alcohol, elevated carbon monoxide levels, or illegal substances. (X-3)

q. Nav aids and facilities: All applicable NAVAIDS were in operation. Runways and taxi ways had been swept to clear FOD. All parking areas and End of Runway (EOR) areas had been swept and walked by maintenance personnel to clear of all FOD. (V-58)

r. Weather: The weather at the departure base was thin scattered clouds at 25,000 feet with surface winds from the northeast (040°) at 9 knots. Visibility was reported at 10 miles. Early morning temperatures were cold at 22°F. This produced a coat of frost on the aircraft which required deicing. Grayling Range weather was reported as thin scattered clouds at 12,000 feet; winds were from 050° at 11 knots; visibility was 10 miles; and the temperature was reported at a high of 38° F. Weather conditions had no impact on the accident. (K-6, V-4, 30)

s. Directives and publications:

- MCI 11-F16, F-16 Pilot Operational Procedures
- MDS Specific Changes for ANG to MCI 11-F16
- T.O. 1F-16C-1, Flight Manual
- T.O. 1F-16C-1CL-1, Flight Manual Checklist
- T.O. 2J-F110-6-5, Major Assembly Removal and Installation
- T.O. 2J-F110-4, Turbofan Engine

There are no indications of deviation from these directives.



VAN F. CHATRAW, Lt Col, USAF
AFI 51-503 Aircraft Accident Investigating Officer

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 the factors contributing to, the accident set forth in the accident investigation report may not be considered as evidence in any civil or criminal proceedings 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 the evidence which I found to be clear and convincing, the mishap aircraft engine failed and seized due to catastrophic failure of the number one engine bearing. A review of Jet Engine Intermediate Maintenance, Test Cell and Joint Oil Analysis records provided a detailed history and complete documentation of all engine maintenance. These records indicate sound and correct maintenance practices in compliance with applicable directives and published instructions. Therefore, I have concluded that maintenance malpractice **was not** a factor in the mishap and, every safeguard and procedure to detect an impending failure was accomplished. However, due to the destruction of engine parts and materials in the crash, metal analysis tests could not be conducted. Therefore, there is insufficient evidence, of a clear and convincing nature, to determine the exact cause of bearing failure.



VAN F. CHATRAW, Lt Col, USAF
AFI 51-503 Aircraft Accident Investigating Officer