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CONDUCTED LAW AIR FORCE INSTRUCTION 51-503

BOARD PRESIDENT: COL. MICHAEL L. ROBBINS

DATE OF ACCIDENT: 31 AUGUST 2000

LOCATION: 11-MILES ESE OF ATLANTIC CITY INTERNATIONAL AIRPORT



ATLANTIC CITY AIR NATIONAL GUARD BASE
177TH FIGHTER WING
119TH FIGHTER SQUADRON

F-16C, S/N 83-1138

Identified	Staff	Applicant	Intervenor	Other	DATE	Witness
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UNITED STATES AIR FORCE
AIRCRAFT ACCIDENT INVESTIGATION
BOARD REPORT

AIRCLEAR REGULATORY COMMISSION

OFFICE OF THE SECRETARY
RULEMAKING AND
ADJUDICATIONS STAFF

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EXECUTIVE SUMMARY**AIRCRAFT ACCIDENT INVESTIGATION****F-16C, S/N 83-1138****ATLANTIC CITY AIR NATIONAL GUARD BASE, NEW JERSEY****31 AUGUST 2000**

On 31 August 2000, at 1537 Local (L) (1937 Zulu (Z)), an F-16C aircraft, S/N 83-1138, impacted the Atlantic Ocean 11 miles East Southeast of Atlantic City International Airport. The aircraft assigned to the 119th Fighter Squadron, 177th Fighter Wing, Atlantic City Air National Guard Base, New Jersey, was on a routine Air Combat Tactics (ACT) training mission. The pilot ejected safely from the aircraft and sustained only minor injuries.

Shortly before impact, the pilot was performing normal pre-engagement operational checks in an over water Warning Area. In level flight, at approximately 16,000 feet above mean sea level, the pilot experienced a series of vibrations and immediate deceleration. The engine compressor stalled and oil pressure went to zero. The pilot initiated emergency procedures and turned back towards the coast and the nearest landing airfield. Weather at the nearest airfield was below required flameout landing minimums and the pilot was unable to maintain usable engine thrust to divert to a suitable alternate airfield. The pilot elected to maneuver the aircraft away from land and ejected over water at approximately 1,700 feet above mean sea level.

There is clear and convincing evidence that the primary cause of the mishap was failure and subsequent liberation of a turbine blade from the third stage turbine section of the engine, resulting in damage to the oil system. Loss of engine lubrication and collateral engine damage to the low pressure turbine resulted in insufficient thrust to make a normal approach. Unable to sustain sufficient thrust to reach the alternate airfield, the pilot elected to eject over water. Evidence shows the blade failure was not detectable by the required engine borescope inspection. The inspection is designed to detect and prevent this failure mode and was properly accomplished the evening before the mishap.

Under 10 U.S.C. 2254(d), any opinion of the accident investigators as to the cause of, or the factors contributing to, the accident set forth in the accident investigation report may not be considered as evidence in any civil or criminal proceeding arising from an aircraft accident, nor may such information be considered an admission of liability by the United States or by any person referred to in these conclusions or statements.

1. AUTHORITY, PURPOSE, AND CIRCUMSTANCES

a. Authority.

On 14 September 2000, General John P. Jumper, Commander, Air Combat Command (ACC), appointed Colonel Michael L. Robbins to conduct an accident investigation of the 31 August 2000 crash of an F-16C aircraft, serial number (S/N) 83-1138, off the coast of Atlantic City, New Jersey (NJ) (Tab Y-3). The investigation was conducted at the Atlantic City International Airport from 26 September 2000 through 23 October 2000. Technical advisors were Major Alan S. Huey (Maintenance), Captain Jeffrey I. Wood (Pilot), Captain Jeffrey L. Hedges (Legal), and Captain Kim Olson Gibbs (Medical) (Tab Y-3).

b. Purpose.

This aircraft accident investigation was convened under Air Force Instruction (AFI) 51-503. Its primary purpose is to gather and preserve evidence for claims, litigation, and disciplinary and administrative actions. In addition to setting forth factual information concerning the accident, the board president is required to state his opinion as to the cause of the accident or the existence of factors, if any, that substantially contributed to the accident. This investigation is separate and apart from the safety investigation, which is conducted pursuant to AFI 91-204 for the purpose of mishap prevention. This report is available for public dissemination under the Freedom of Information Act (5 United States Code {U.S.C.} §552) and Department of Defense (DoD) Regulation 5400.7R.

c. Circumstances.

The accident board was convened to investigate the Class A accident involving an F-16C aircraft, S/N 83-1138, assigned to the 119th Fighter Squadron (FS), 177th Fighter Wing (FW), Atlantic City, NJ, which crashed on 31 August 2000 (Tab Y-3).

2. ACCIDENT SUMMARY

The Mishap Aircraft (MA), an F-16C, S/N 83-1138, experienced engine failure during a routine four-ship Air Combat Tactics (ACT) training mission (2 v 2) (Tab B-3). The mishap occurred at approximately 1538 Eastern Daylight Savings Time (EDT) on 31 August 2000 when the plane impacted the water approximately 11 nautical miles East Southeast of Atlantic City International Airport, New Jersey, at the following coordinates: N039-22.4, W074-23.5 (Tab A-2). The Mishap Pilot (MP), Major David G. Haar, ejected successfully (Tab A-2, B-3). The MP suffered only minor injuries (Tab X-3). The aircraft was totally destroyed upon impact with the loss valued at \$19,422,441.72 (Tab M-3). No further military property was damaged (Tab M-2 3). No civilian property was damaged. Media interest, while initially moderate, has abated (Tab EE-3).

3. BACKGROUND

The 177th Fighter Wing, stationed at Atlantic City Air National Guard Base, New Jersey, maintains an F-16 fighter wing capable of day, night, and all-weather combat operations (Tab

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EE-9). The 119th Fighter Squadron is a component of the 177th Fighter Wing (Tab EE-9). The federal mission is to provide combat-ready citizen airmen, aircraft and equipment for worldwide deployment in support of United States Air Force objectives (Tab EE-9). The state mission is to support the citizens of New Jersey by protecting life and property and preserve peace, order, and public safety when called upon by the Governor (Tab EE-9). The wing and its subordinate units are all components of the Air Force's Air Combat Command.

4. SEQUENCE OF EVENTS

a. Mission.

The mission was originally designated as a Large Force Employment (LFE) in Whiskey (W)-108 and W-386 airspace (Tab K-4). W-108 and W-386 are warning areas over the Atlantic Ocean for military flight maneuvers (Tab BB-3). The Mishap Flight (MF) was unable to participate due to a misunderstanding of the vulnerability time for the exercise (Tab V-4.1). Prior to the briefing, the mission was changed to a 2 v 2 ACT mission in W-107 airspace (Tab K-5). Local clearance for the mission was given by the Operations Group Commander (Tab K-2). Variations in the itinerary were authorized by the Commander (Tab K-2).

b. Planning.

The flight lead prepared a standard lineup card for the assigned mission and airspace (Tab K-5). The flight lead fully briefed all flight members using a standard briefing guide (Tab V-4.1). All applicable 11F-16, Volume 3 briefing items were covered to include emergency procedures, ejection, and Search and Rescue procedures (Tab V-4.1). Number three in the flight was a squadron supervisor (Tab V-4.1). The flight members fully understood the mission (Tab V-2.3, V-4.1, V-15.1).

c. Preflight.

Notice to Airmen (NOTAMS) were available to all flight members via a computerized system for the local and surrounding areas (Tab K-9-14). The local flight clearance (Tab K-2) does not reflect the change in the flight plans from the airspace from LFE (AA-104) to ACT (AA-101) (Tab AA-7); however, the Supervisor of Flying (SOF) display (K-4) does reflect this change and the appropriate clearance was filed (Tab V-4.1). Operational, mission, and individual risk management surveys were completed (Tab K-16-18). Engine start was uneventful (Tab V-2.4). The MF taxied together as a 3-ship and was joined by Snake 14 in the arming area (Tab V-2.4, AA-19). Snake 14 was delayed due to an Inertial Navigation System (INS) anomaly and had to re-accomplish an INS alignment (Tab V-15.1, AA-19).

d. Flight.

The flight took off as a four-ship at 1516 Local (L) EDT (1916 Z) from Atlantic City International Airport, New Jersey, on Runway 31 (Tab V-15.1, AA-19). The departure consisted of afterburner takeoffs (20-second intervals) with a trail departure using radar assistance (Tab V-2.4). The MF rejoined to a box formation when Visual Meteorological Conditions (VMC) were attained (Tab V-2.4). The radar assisted trail departure was accomplished due to a cloud deck that obscured visibility from approximately 1,200 feet MSL (Mean Sea Level) to 7,000 feet MSL (Tab V-2.4, V-3.2, V-3.5, V-15.1). On departure the flight proceeded in a southeasterly direction

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and climbed to an altitude of approximately 15,000 feet MSL until entering W-107 airspace (Tab O-12.26).

Once in the airspace, at an altitude of approximately 16,000 feet, the flight accomplished G-awareness turns, operational checks of the weapons systems, and checks of the flare systems (Tab O-17.8, V-1.2). At approximately 1928 Z, the MP (Snake 12) experienced compressor stall-like vibrations in his aircraft and immediately called a "knock-it-off" to terminate maneuvering and began a turn to the northwest to head toward Atlantic City International Airport (Tab V-1.2, V-2.4, AA-19). As the MP assessed the situation, the flight lead rejoined to a chase position and observed "thin wispy smoke" coming from the rear of Snake 12's aircraft (Tab V-2.5). The MP noted he had high Fan Turbine Inlet Temperature (FTIT) of 875 degrees Celsius and low rpm (70%), and the nozzle was operational (Tab N-2). Shortly thereafter, Snake 11 noted the "wispy smoke" had stopped and Snake 12 reported he had a Hydraulic/Oil warning light and his oil pressure was zero with normal hydraulic pressure (Tab V-1.3). The MP then set his power at approximately 77% and established a maximum range airspeed hoping to make it 1930 Z, the MP jettisoned his empty centerline fuel tank over the ocean to reduce drag on the airplane (Tab V-1.4, AA-19). This location was approximately: N3909.8, W7356.3 (Tab AA-19). The MP fired the Emergency Power Unity (EPU) at approximately 1933 Z, according to checklist procedures, to ensure electrical and hydraulic power should the engine seize (Tab V-1.4, AA-19).

About this time, the MF attempted to contact McGuire AFB, NJ, and Atlantic City International Airport to ascertain if weather conditions would permit a safe approach and landing (Tab V-4.2). The weather at Atlantic City International was reported to have a ceiling of 1,700 feet Above Ground Level (AGL) (Tab K-8). Due to the continued vibrations and lack of thrust, the MP continued to head towards Atlantic City International Airport as the only possible landing airfield (Tab V-1.5). However, due to an undercast, the MP was unable to acquire the airfield visually (Tab V-1.5). The MP was considering a Simulated Flameout (SFO) landing in accordance with local guidance (AA-15). At approximately 1936 Z and 7 Nautical Miles (NM) from the airfield at 5,600 feet MSL and 206 knots (kts) the MP decided that he did not have sufficient weather to make a safe SFO approach into Atlantic City International Airport (Tab V-1.5). The minimum ceiling required to attempt an SFO approach is 2,000 feet AGL (Tab V-3.4, V-1.5). The MP made a left hand turn to get the aircraft over the water to avoid any populated areas (Tab V-1.6, AA-19).

The MP entered a broken cloud deck at approximately 3,000-4,000 feet MSL (Tab V-1.6, V-3.5). Shortly thereafter, he was able to catch a glimpse of the Absecon Inlet and visually orient himself (Tab V-1.6). The MP directed Snake 11 to clear the area of boats (Tab V-1.6). At approximately 1937 Z, the MP tried Secondary Engine Control (SEC) (Tab V-1.6, AA-19). This had no positive effect on engine operation (Tab V-1.6). The SOF was in communication with the MP and Atlantic City Approach cleared the airspace for the emergency aircraft (Tab N-4-10). The SOF reminded the MP of the minimum ejection altitude of 2,000 feet AGL (Tab V-3.5). The MP ejected at approximately 1938 Z (Tab AA-19).

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c. Impact.

The flight lead indicated that aircraft S/N 83-1138 impacted the water at approximately N39-21.9, W074-21.3 (Tab N-10). Flight parameters at impact were: 200 kts, 7 degrees nose down, 25 degrees left bank, true heading of 055 degrees and 1 G (force of gravity) (Tab O-12.30, O-17.30). The ejection seat, canopy, engine diagnostic unit, and a few miscellaneous aircraft parts have not been recovered to this date (Tab R-2-5). The external centerline fuel tank, jettisoned approximately 8 minutes prior to impact, was recovered separately (Tab R-2).

f. Life Support Equipment, Egress and Survival.

The ejection seat has not been recovered; but, the ejection sequence was without anomalies and the MP landed in the water (Tab N-5). Flight parameters at ejection were approximately 168 kts, heading 118 degrees true heading, and an altitude of 1,680 feet MSL (Tab O-17.28). At parachute deployment, the MP experienced a twist in his parachute risers, which he was able to correct (Tab V-1.7). He also noted his leg straps had been too loose (Tab V-1.10). The MP was unable to disconnect the left side of his oxygen mask when executing his post-ejection checklist (Tab V-1.7). The Life Preserver Units (LPUs) had risen to an unfamiliar position to the MP making them hard to locate (Tab V-1.7-8). The MP deployed the LPUs about the time that he entered the water (Tab V-1.8). The Universal Water Activated Release System (UWARS), which attached the pilot to the parachute risers, functioned properly releasing the risers when the pilot entered the water (Tab V-1.8). The MP was in good condition upon entering the water and was able to enter the life raft on his second try despite the 5- to 6- foot sea swells (Tab V-1.10, V-1.8). The personnel locator beacon automatically activated upon ejection and transmitted until the pilot entered the water (Tab I-22). The pilot did not shut off the beacon (Tab V-1.22). The beacon malfunctioned shortly after the pilot entered the water (Tab I-22). The life raft was found to be leaking air around the main oral inflation tube approximately 12 hours after recovery (Tab I-24).

The helmet and oxygen mask connector, parachute and components, survival vest, anti-G suit, life preserver, drogue, and survival kits/rafts inspections were all current (Tab DD-3-11).

g. Search and Rescue.

The ejection occurred at approximately 1538 local time (Tab A-2). Snake 11, the flight lead, witnessed the ejection and passed coordinates, Tactical Air Navigation System (TACAN) radial and Distance Measuring Equipment (DME) distance, and general location of the survivor and crash site in accordance with local guidance (Tab AA-8, N-5). Snake 11 continued to orbit over the MP and was able to observe entry into the life raft and pickup by the State Police (Tab N-6-7). Snake 13 flight loitered over water in a high-low orbit conserving fuel in the event they would be needed (Tab V-15.2, N-21). They also assisted in contacting the Rescue Forces and attempted to contact the MP in the water (Tab N-16-17). The Coast Guard helicopters were launched within minutes of the ejection (Tab N-26). In the interim, New Jersey State Police Marine Unit personnel witnessed the mishap and dispatched boats (Tab N-28). Their boats had already arrived on the scene and rescued the MP by the time the Coast Guard helicopters arrived (Tab N-28). The total time from ejection until the MP was pulled from the water was less than 10 minutes (Tab V-15.2, AA-19).

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The pilot suffered only minor injuries secondary to the mishap (Tab X-3). Over the subsequent week, Sea Tow, a local marine salvage company, searched for and recovered items from the ocean floor (Tab R-6-7, EE-8). There were no difficulties noted in the rescue or recovery efforts (Tab R-6-7, EE-5). Given that the jet crashed off a popular local beach, there were several civilian witnesses and boats in the area (Tab EE-8).

5. MAINTENANCE

a. Forms Documentation.

A review of the active Air Force Technical Order (AFTO) 781 series forms for the MA did not reveal any evidence of unresolved maintenance discrepancies (Tab H-2-3). A review of the MA historical files and the previous 30 days of records in the Core Automated Maintenance System (CAMS) revealed no negative trends, open discrepancies in flight line maintenance actions, missed inspections, or time change items which contributed to the accident (Tab H-2, H-4, H-6). A review of the Automated Records Check for the MA further indicated there were no overdue inspections or Time Compliance Technical Orders (TCTO) (Tab H-4, H-6). The aircraft records do list several TCTOs uncompleted, but not overdue (Tab H-4, H-6). Among these is TCTO 2J-F100(III)-577, which replaces the third stage turbine blades with a more robust design (Tab V-6.3).

b. Inspections.

A review of the AFTO 781 series aircraft forms revealed no overdue inspections (Tabs D-2, H-4, H-6). A review of the inspection records of the Mishap Engine (ME) showed that an HS3 borescope inspection of the Low Pressure Turbine (LPT) had been performed on 30 August 2000 within the proper 5-hour inspection interval (Tab U-15.16-17).

c. Maintenance Procedures.

A review of the active AFTO 781 forms on the MA revealed that maintenance, preflight, and servicing actions performed on the aircraft prior to the mishap were not related to the accident (Tab H-2, U 5-7). Engine maintenance completed on 29 Jun 2000 included a 200-hour engine phase inspection, IFM (Inlet/Fan Module) removal and reinstallation for NDI inspection, and Fan Turbine Inlet Temperature (FTIT) system troubleshooting (Tab U-17.2). All maintenance was completed and the engine was released from Test Cell (Tab U-17.2). After installation in the MA, the engine accumulated 71.3 hours without incident prior to the mishap (Tab J-26).

d. Maintenance Personnel and Supervision.

A review of the AF Forms 623 (On-the-Job Training Records) and AF Forms 797 (Tasks, Knowledge, and Technical References) for the Jet Engine technicians involved in the August 2000 inspection, indicated the individuals assigned to work on the MA were properly trained and held the requisite skill levels (Tabs EE-11-12). After reviewing 177th Aircraft Generation Squadron and 177th Maintenance Squadron maintenance records, maintenance supervision was determined to be adequate and not a factor in the mishap (Tab U-5-13).

e. Fuel, Hydraulic and Oil Inspection Analysis.

The fuel sample taken from the fuel truck used to service the MA prior to the mishap flight was normal (Tab J-2). A sample of engine oil taken after the last sortie flown prior to the mishap flight was normal (Tab D-2). A review of the past 30 days Joint Oil Analysis Program (JOAP)

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analysis for the MA showed no abnormalities (Tab U-3-4). The above results indicate fluids were not a factor in this accident.

f. Unscheduled Maintenance.

All unscheduled maintenance performed on the mishap aircraft and engine since 12 November 1998, the date of the last scheduled maintenance inspection, had no bearing on the mishap (Tab H-2-3).

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

a. Condition of Systems.

The pilot reported all systems were working normally up until the engine failure (Tab V-1.1-15). At impact, the aircraft engine (model F100-PW-220E, Serial Number PW0E704008) was turning at moderate RPM in SEC mode (Tab J-27, O-18.30, V-1.3), but was not producing useable thrust (Tab V-1.3-5).

According to post-mishap analysis of the engine, one of the third stage blades from the low pressure turbine section failed and liberated, causing damage to components aft of this section of the engine (Tab J-27, V-5.2, V-6.2-3, V-14.2). The liberated blade or other subsequently liberated debris severed the number five bearing compartment oil pressure and scavenge tubes, leading to rapid depletion of the engine oil (Tab V-5.2). Pressure and scavenge tubes route engine oil to and from the number five bearing cavity, respectively. The number five bearing compartment showed signs of severe friction throughout due to the depletion of engine oil (Tab J-21).

A borescope inspection of the third stage blades in the low pressure turbine section was performed and documented by engine technicians the day prior to the mishap (Tab U-5, U-8). The technician observed no tip curl on any blades, and noted all blades were within specifications (Tab V-11.5-6).

The emergency locator beacon operated in automatic mode upon ejection, but failed after contact with the water. A Product Quality Deficiency Report was initiated (Tab I-22).

The inflatable life raft inflated properly after ejection (Tab I-24). Approximately 12 hours after recovery of the pilot, it was noted that the life raft started leaking from around the main oral inflation tube (Tab I-24). A Product Quality Deficiency Report was initiated (Tab I-24).

b. Testing

A post mishap metallurgical analysis of the recovered third stage blades performed by Pratt and Whitney revealed that the blades were operating within normal temperature ranges (Tab J-36, EE-10).

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7. WEATHER

a. Forecast Weather.

The unit tailored weather forecast was obtained, prior to takeoff, via the internet from the 15th Operation Weather Squadron (Tab K-6-7). The Atlantic City International Airport, KACY, forecast on 31 August 2000, from 1400 to 0000 Z (1000 to 2000 L) for predominant weather conditions was: surface wind from 100° magnetic at 11 kts, visibility greater than 6 statute miles, a scattered cloud layer at 1,200 feet AGL, and another overcast cloud layer at 3,500 feet AGL. Temporary conditions (less than 1 hour duration) were forecast between 1400 and 2000 Z to be: visibility 3 statute miles with light rain showers, and an overcast cloud layer at 1,200 feet AGL. The forecast from 2000 to 0000 Z was: surface wind from 110 degrees at 7 kts, visibility greater than 6 statute miles, a scattered cloud layer at 800 feet AGL, and an overcast cloud layer at 2,500 feet AGL. Temporary conditions were forecast between 2000 and 0500 Z to be: visibility 4 statute miles, mist, overcast cloud layer at 800 feet AGL with a 40 percent probability of wind from 200° magnetic at 5 kts, 2 statute miles visibility, thundershowers with rain, and an overcast cloud (cumulonimbus) layer at 800 feet AGL (Tab K-6-7).

b. Observed Weather.

At the time of the mishap, weather at Atlantic City International Airport was: skies overcast at 1,700 feet with 10 statute miles visibility (Tab K-8). Sea-level pressure was 1020.3 millibars with local temperature of 79° Fahrenheit (F) and 26° Celsius (C) (Tab K-8, K-21). Dew point was 73° F and 23° C (Tab K-8). Wind direction was noted to be 110° true at 11 knots (Tab K-8). Altimeter setting was noted to be 30.13 inches of Mercury (Tab K-8). Cloud tops were observed to be between 3,500-4,000 feet MSL (Tab V-3.5).

c. Space Environment.

Not applicable.

d. Conclusions.

Weather was a factor in this mishap. The weather at the recovery base was not good enough to execute a SFO approach (2,000 foot AGL minimum ceiling). If the weather had been above SFO approach minimums, there is a high probability the MP would have attempted this approach at Atlantic City International Airport. All other usable airfields were beyond the range of the disabled aircraft.

8. CREW QUALIFICATIONS

a. Mishap Pilot

Major Harr, Snake 12, is an experienced F-16 pilot with 1,270 F-16 flying hours and 2,220 total flying hours (Tab G-4-7). He was current and qualified to fly the mission (Tab T-7-15, AA-4).

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His recent flying experience is as follows (Tab G-2-3):

	Hours	Sorties
30 days	8.8	06
60 days	16.6	13
90 days	22.6	17

b. Mishap Flight.

The MF (Snake 11 flight) consisted of: Capt. Steven C. Ziomek (Snake 11), Maj. David G. Harr (Snake 12), LtCol. Mathew S. Wengler (Snake 13), and Maj. Michael J. McQuade (Snake 14) (Tab K-2). Their flying hours and recent experience are as follows:

Capt. Ziomek: 738 F-16 hours (Tab AA-9-10)

	Hours	Sorties
30 days	16.1	12
60 days	36.3	28
90 days	62.6	45

LtCol. Wengler: 2533 F-16 hours (Tab AA-11-13)

	Hours	Sorties
30 days	34.4	20
60 days	57.0	36
90 days	65.0	42

Maj. McQuade: 1559 F-16 hours (Tab AA-14)

	Hours	Sorties
30 days	5.9	05
60 days	5.9	05
90 days	9.7	08

9. MEDICAL

a. Qualifications.

The MP was medically qualified to perform all flying duties. At his most recent physical exam on 1 April 2000, he was medically cleared to fly until 30 April 2001 (Tab CC-3). The MP was flying under an indefinite medical waiver for retained orthopedic fixation devices (Tab CC-6). This waiver was initially granted by HQ TAC SGPA on 11 December 1990 (Tab CC-4). It was renewed on 24 August 1992 by the ANGRC SG and granted indefinite status in May 1996 (Tab CC-5-6). He was not taking any medications or supplements and was free of illness at the time of the mishap (Tab V-1.12).

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b. Health.

The MP's post-accident examination revealed only minor injuries as a result of the mishap (Tab X-3). These injuries included bruising to the upper thighs and minor low back pain caused by straps pulling upon parachute opening (Tab X-3).

c. Toxicology.

Toxicology reports for the MP reflect normal levels of carbon monoxide and no detection of ethanol or drugs (Tab X-4). Toxicology samples were not obtained on the maintenance personnel.

d. Lifestyle.

There is no evidence of unusual habits, behavior, or stress on the part of the pilot (Tab V-1.12-13). There is no evidence of unusual habits, behavior, or stress on the part of the borescope technicians (Tab V-11, V-12).

10. OPERATIONS AND SUPERVISION

a. Operations.

The Operations tempo of the 177th FW is similar to that of many other ANG units - busy, but not overwhelming (Tab V-13.1). The wing is preparing to send people and aircraft, as part of an Air Expeditionary Force (AEF), to Operation Southern Watch (Tab V-13.1). The 119th FS is comprised mostly of highly experienced F-16 pilots (Tab AA-3-6). There was no reported or observed degradation of maintenance actions by personnel in the 177th Logistics Group as a result of the operations tempo (Tab V-13.1).

b. Supervision.

The mission was properly authorized and released by the 177th FW Ops Group Commander (Tab K-2). The SOF at the time of the accident was a highly experienced F-16 pilot (Tab AA-3). All maintenance associated with the MA was supervised and authorized in accordance with technical directives. All maintenance personnel interviewed for this investigation were highly experienced and well motivated (Tab V-8.1, EE-11-12). Operations tempo and supervision were not factors in this mishap.

11. HUMAN FACTORS ANALYSIS

There is no evidence that human factors contributed to this mishap.

12. GOVERNING DIRECTIVES AND PUBLICATIONS

a. Primary Operations Directives and Publications.

AFI 11-202, Volume 1, Aircrew Training
AFI 11-202, Volume 3, General Flight Rules
AFI 11-401, Flight Management
AFI 11-2F16, Volume 1, F-16 Aircrew Training
MCI 11F16, Volume 3 Pilot Operational Procedures, F-16
Technical Order 1F-16C-1, F-16C/D Flight Manual

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AFI 11-401, Flight Management
AFI 11-2F16, Volume 1, F-16 Aircrew Training
AFI 11-2F-16, Volume 3, F-16 Operations Procedures
Technical Order 1F-16C-1, F-16C/D Flight Manual

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b. Maintenance Directives and Publications.

Time Compliance Technical Order 2J-F100(III)-577

c. Known or Suspected Deviations from Directives or Publications.

There are no known or suspected deviations from directives or publications by the pilot, the maintainers, or supervisory personnel connected with the mishap mission.

13. NEWS MEDIA INVOLVEMENT

The 177th FW Public Affairs Office generated two press releases – the first on 31 August 2000 and the second on 8 September 2000 (Tabs EE-4-5). In addition, a press conference was conducted on the date of the accident (Tab EE-3). Over the next few weeks, media interest was moderate from local media sources (Tab EE-3, 6-7). The last media inquiry was received on 29 September 2000 (Tab EE-3).

23 October 2000



MICHAEL L. ROBBINS, COL, USAF
President, Accident Investigation Board

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STATEMENT OF OPINION**F-16C ACCIDENT****31 AUGUST 2000**

Under 10 U.S.C. 2254(d), any opinion of the accident investigators as to the cause of, or the factors contributing to, the accident set forth in the accident investigation report may not be considered as evidence in any civil or criminal proceeding arising from an aircraft accident, nor may such information be considered an admission of liability by the United States or by any person referred to in these conclusions or statements.

OPINION SUMMARY: The primary cause of the mishap, supported by clear and convincing evidence, was failure and subsequent liberation of a turbine blade from the third stage turbine section of the engine. This failure resulted in damage to the oil system. Loss of engine lubrication and collateral engine damage to the low pressure turbine resulted in insufficient thrust to attempt a normal approach. Unable to sustain sufficient thrust to reach the alternate airfield, the pilot elected to eject over water. Evidence shows the blade failure was not detectable by the required engine borescope inspection. The inspection was designed to detect and prevent this failure mode and was properly accomplished the evening before the mishap.

DISCUSSION: The Mishap Pilot (MP), flying the mishap aircraft (MA), F-16C, S/N 83-1138, is a capable and qualified pilot. On the date of the mishap he was healthy and in good physical condition. His training and experience show he was capable of performing the mission required on 31 August 2000. Faced with a serious aircraft emergency, he performed the critical actions necessary to attempt to recover the aircraft. He demonstrated sound judgment when presented with deteriorating conditions. When faced with marginal weather at the closest airfield and insufficient thrust to proceed to the alternate airfield, the MP chose the best course of action - steer clear of populated areas and bail out over water. This decision resulted in a successful ejection and prevented possible serious injury or loss of life on the ground. The MP suffered minor injuries.

Analysis of the MA and why it failed led to research of its history, inspection criteria and maintenance performed. A review of the MA documentation did not reveal any evidence of unresolved maintenance discrepancies. Additionally, the accident investigation revealed neither improper maintenance practices nor overdue inspections. Individuals assigned to perform work on the MA were properly trained and held the requisite skill level. Maintenance supervision was determined to be adequate and there is no evidence they could have foreseen or prevented the cause of this accident.

Up until the failure of the engine, the aircraft was fully functional, with no noted problems. Detailed analysis of the engine revealed significant damage to the turbine section, specifically the low pressure turbine module. The third stage turbine in this module contains 68 small airfoil shaped blades that combine with other engine components to produce thrust. Any failure in the low pressure turbine will adversely impact the engine's ability to produce thrust. This area of the engine requires a borescope inspection at specific intervals based on flying time or computerized

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engine equipment that records cycle time. Cycle time measures when this section of the engine is at a certain temperature or higher, over a given time span. Borescope inspections of the third stage turbine blades were performed by qualified and trained personnel. They were accomplished at the required intervals directed in the specific engine technical orders. A borescope inspection of the third stage blades was performed and properly documented by engine technicians the day prior to the mishap. The technician noted all blades were within specifications.

Post-mishap engine analysis indicates one of the third stage blades from the low pressure turbine failed. When the third stage turbine blade failed and liberated, it caused damage to components aft of this section of the engine. The number five bearing compartment oil pressure and scavenge tubes were severed leading to rapid depletion of the engine oil. The number five bearing failed and the bearing compartment showed signs of severe friction throughout due to depletion of engine oil. Damage to the third and fourth stages of the low pressure turbine and engine friction, from lack of oil, resulted in a loss of engine thrust in the MA.

The MP had insufficient thrust to make a normal approach. Weather at the nearest airfield was below required flameout landing minimums and the MP was unable to maintain sufficient engine thrust to divert to a suitable alternate airfield. The MP elected to maneuver the aircraft away from land and ejected over water. The MA impacted the water and was destroyed.

23 October 2000


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F-16C, S/N 83-1158, 20000631