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AIRCRAFT ACCIDENT INVESTIGATION REPORT

F-16C SN: 86-0343

SPANGDAHLEM AIR BASE, GERMANY

DANIEL B. CECIL, Colonel, USAF
Investigating Officer

JAMES E. ARNOLD, Major, USAF
Legal Advisor

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Technical Advisor

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1. STATEMENT OF AUTHORITY AND PURPOSE

a. By order of the Commander, Headquarters Seventeenth Air Force, Colonel Daniel B. Cecil, Vice Commander, 601st Support Wing, Sembach Air Base, Germany, was appointed by orders, dated 1 September 1993, to conduct an investigation into the crash of an F-16C aircraft which occurred on 11 August 1993 off the coast of Croatia. Major James E. Arnold, Headquarters Seventeenth Air Force, Office of the Staff Judge Advocate, was detailed by the same orders as the Legal Advisor to accompany Colonel Cecil throughout the course of the investigation.

b. By order of the Commander, Headquarters Seventeenth Air Force, Technical Sergeant Dean M. Fligg and Technical Sergeant Grant D. Schaber, both of the 52nd Operations Group, Spangdahlem Air Base, Germany were appointed by orders, dated 22 September 1993, to act as technical advisors under the direction of the investigating officer, Colonel Cecil.

c. The investigation was conducted under the authority of AFR 110-14, and was guided by the general procedures outlined in AFR 120-3.

d. Matter Investigated

1. This was a Class A aircraft accident investigation involving F-16C serial number 86-0343 assigned to the 23rd Fighter Squadron, 52nd Fighter Wing, Spangdahlem Air Base, Germany deployed to Aviano Air Base, Italy. The aircraft was a Block 30, big inlet, F-16C powered by an F110-GE-100 afterburning turbofan engine.

2. The crash site was approximately 137 nautical miles southeast of Aviano Air Base, Italy.

2. SUMMARY OF FACTS

a. History of Flight

1. The 23rd Fighter Squadron, Spangdahlem Air Base, Germany, equipped with F-16C aircraft, was tasked to support Operation DENY FLIGHT flying from Aviano Air Base (AB), Italy (IT). Unit tasking was to provide flight operations in Bosnia-Herzegovina.

2. On 11 August 1993, Cobra 21 and 22, a flight of two F-16Cs, took off from Aviano AB, IT on a daylight DENY FLIGHT mission. The mission was a Close Air Support (CAS) training sortie. Air refueling and work with the Forward Air Controller (FAC) were accomplished without incident. During the return flight to Aviano, Cobra 22, the mishap aircraft, experienced an engine malfunction with indications of an engine stall. The pilot attempted to clear the stall and restore engine power by shutting the engine down and restarting. Despite four successful air restarts, in several modes, the engine no longer produced sufficient power to sustain flight. The pilot ejected over an island off the coast of Croatia, survived, and was rescued by a British Sea King helicopter. The aircraft crashed into the water beyond the island and was destroyed on impact. The debris was subsequently recovered from the water. There was no private property damage due to the impact.

3. News agencies from Croatia, Italy, Germany and Slovenia inquired about the crash. An initial news release was made by the AFSOUTH Public Information Office, Naples, Italy. Two follow-up news releases were published by 401st Fighter Wing Public Affairs Office. These three news releases apparently satisfied media curiosity.

b. Mission

1. Cobra 21 and 22 flew in support of Operation DENY FLIGHT phased air operations to prevent non-UN authorized flights over Bosnia-Herzegovina. In particular the mission involved close air support practice in conjunction with a ground forward air controller.

c. Briefing and Preflight

1. The preflight briefing was thorough and complete.

2. Preflight, start, and taxi were all done in accordance with established procedures.

d. Flight Activity

1. Following is a chronology of the mission (all times approximate):

- 0800 - Mission brief
- 0935 - Engine start
- 1000 - Takeoff
- 1030 - Air-to-air refueling
- 1050 - Entered mission area
- 1135 - Began exit of mission area just south of Bihac, Croatia
- 1143 - Emergency began

2. Takeoff, departure, air refueling, and operations in the assigned area of responsibility (AOR), near the town of Banja Luka, Bosnia, were flown as briefed.

3. The flight egressed the AOR, line abreast, with a separation of nearly 1 mile at an altitude of approximately 26000 feet. Airspeed was about 350 knots. Cobra 21, the flight lead, directed a power increase. As Cobra 21 selected afterburner, he saw Cobra 22 drop back and begin to lose altitude. Cobra 22 radioed that he had an engine problem. Cobra 21 crossed in front of and a little above Cobra 22 to put himself on the left side. Cobra 21 reports that he never saw any smoke, parts or any other indication of a problem, just a smooth glide with accompanying altitude loss. (Tab V)

4. When Cobra 22 selected afterburner he heard a loud "bang" or "boom" which was accompanied by a jolt. He thought it sounded like a compressor stall. (Tab V)

5. Cobra 22 moved the throttle out of afterburner and the cockpit gauges looked fairly normal. Engine revolutions per minute read 85% (RPM=85%). Very shortly thereafter the RPM began to oscillate accompanied by a whirring noise. The RPM fell below 60% and the fan turbine inlet temperature (FTIT) increased. Cobra 22 shut the engine down and attempted a restart, which was successful. Everything appeared normal

until engine RPM reached approximately 85% when the oscillation recurred and the FTIT increased (indications of an engine stall). (Tab V)

6. Cobra 22 was now below 20000 feet in altitude so he attempted a restart with the jet fuel starter (JFS) on. The JFS is a small gas turbine which operates on aircraft fuel and drives the engine through the accessory drive gearbox. It provides torque when required to maintain engine RPM, is used to start the engine on the ground, and to assist in engine airstart. He placed the aircraft fuel system in secondary (SEC) mode. SEC transfers fuel control from the afterburner fan temperature control, which is the critical component in primary, to the main engine control. This action bypasses some automated features to isolate malfunctions which may have been causing the engine problem. In SEC the RPM decayed to approximately 45% and the FTIT increased to about 950 degrees. (Tab V)

7. At about 17000 feet, Cobra 22 reselected primary mode and attempted a third restart. Again RPM increased to 85%, then began to decay, while FTIT increased. After this restart attempt, altitude was down to 10 - 12000 feet. Cobra 22 looked for the best place to eject and punched off his tanks as he crossed the coastline. He tried one more restart, in primary mode, with the same results as before. (Tab V)

8. Cobra 21 recommended to Cobra 22 that he aim the aircraft toward the water just off the coast of an island and time his ejection so that he would land on the island. (Tabs V and N)

9. At 1152, approximately 10 minutes since the emergency began, Cobra 22 ejected, at 1700 feet, at an airspeed of approximately 210 knots. (Tabs N and O)

e. Impact

1. The coordinates of the crash site are N 44.26.2 E 14.54.5. Impact with the water occurred at 1152 local on 11 August 1993. The aircraft was at about 200 knots, 8 degrees angle of attack, 5 degrees left bank, and 10 degrees nose down. (Tabs A and O)

f. Ejection Seat

1. Ejection was initiated and occurred within the performance envelope. No deficiencies were noted.

g. Personal and Survival Equipment

1. All inspections were current. The PRC-112 survival radio was used and no difficulties were encountered.

h. Rescue

1. The crash occurred at 1152 local. The first rescue call was made by Cobra 21 to the Airborne Early Warning aircraft at approximately 1151.
2. Cobra 22 was located at 1308 local time by the British 845 Squadron deployed to Split, Croatia.

i. Crash Response

1. Two British Sea King helicopters flew from Split, Croatia in response to the rescue call. The transit time from Split to the rescue site was approximately 45-50 minutes. Response time therefore was no more than 20 minutes from notification to launch. The Sea Kings returned to Split. An EC-130 from the 7th Airborne Command and Control Squadron (ACCS), deployed to Aviano AB, IT, diverted to Split, picked up Cobra 22 and returned him to Aviano. There were no problems encountered during crash response.

j. Maintenance Documentation

1. All aircraft forms were made available and reviewed. Although some forms documentation errors were noted, no discrepancies were found relative to the mishap and there were no indications of chronic maintenance problems. There were five delayed discrepancies annotated on the aircraft AFTO Form 781K and seven on the engine AFTO Form 781K, with none being relative to the mishap. Preflight and servicing requirements were documented prior to the mishap flight. All inspections were current. The last 150 hour phase (No. 3) was completed 16 July 1993 at 1642.0 airframe hours and the aircraft was flown 43.5 hours prior to the mishap. The last 75 hour borescope inspection was accomplished on 9 August 1993, with no defects noted. The aircraft flew 2 sorties for 3.7 hours since the borescope inspection. The engine had a total of 2919.1 hours with 133.8 hours since it came from jet engine intermediate maintenance where the low pressure turbine was replaced and TCTO 647 was accomplished. Recent work on the engine included: replacing the engine hydraulic pump; removing and replacing the engine oil hydraulic pump filter and filter bowl assembly. This work took place on 28 July 1993.

k. Maintenance Personnel and Supervision

1. All maintenance personnel and supervisors performed duties in accordance with technical data. Preflight/postflight and walk-around inspections were completed with no discrepancies noted. On-the-job training records (AF Forms 623) were reviewed. All training and certifications were completed satisfactorily.

l. Engine Oil, Fuel and Hydraulic Inspection Analysis

1. All engine oil records were within standards. Fuel and hydraulic inspections were also normal.

m. Airframe and Aircraft Systems

1. All aircraft systems, other than the engine and the Emergency Power Unit (EPU), appeared to be operating normally throughout the flight.

a. A second stage fan blade failed and was released from its place in the fan disc. No pieces remained in the disc dovetail slot. (Tabs I and J)

b. Crash survivable data revealed that at or near takeoff, the pressure regulator valve opened uncommanded. The EPU turbine turned up to 140%, causing damage. The EPU failed for over a minute during the emergency. Because the Jet Fuel Starter (JFS) system was operating, hydraulic and electrical power were available from primary sources. The aircraft was controlled throughout flight until ejection. (Tabs I and O)

c. The fan blade pieces were sent to General Electric Support Service, 1601 N. Mill Rd, Vineland, NJ 08360. The pressure regulator valve was sent to Lockheed Ft Worth Co. P.O. Box 748, Fort Worth, TX 76101. (Tab I)

n. Operations Personnel and Supervision

1. The mishap sortie was tasked by COMFIVEATAF MSG 10 1600Z Aug 93 (NATO Secret) and properly authorized on USAFE Form 406, Consolidated Flight Authorization/Approval. The preflight briefing was given by Captain Christopher Jergens, the designated flight lead. The briefing was conducted using the approved squadron Bosnia CAS Briefing Guide. The briefing was thorough and complete. No supervisory personnel were present at the briefing.

o. Pilot Qualifications

1. Colonel Merten was the only person onboard and was the pilot in command of the aircraft.

2. Colonel Merten is a highly qualified and experienced pilot with over 4500 hours of flying time, including 48.8 hours of combat time. He has flown the T-33, T-37, T-39, F-4 and F-16. His total time in the F-16 was 1707.5 hours, including 783 hours as an instructor pilot.

p. Medical

1. Colonel Merten was medically qualified for flight duty, had a current flight physical and was not on Duty-Not-to-Include-Flying (DNIF) status.

2. The findings of the post mishap flight surgeon exam and toxicology report revealed nothing which would have adversely affected his performance as a pilot.

q. NAVAIDS and Facilities

1. Aviano facilities and NOTAMS had no affect on this mishap.

r. Weather

1. The forecast and actual weather was no ceiling and good visibility.

s. Directives and Publications

1. The following directives, publications and technical orders were applicable to the operation of the mission and the maintenance performed on the mishap aircraft:

a. Regulations and Manuals

1. AFR 60-1, Flight Management
2. AFR 60-2, Aircrew Standardization/Evaluation Program
3. AFR 60-16, General Flight Rules
4. AFM 51-37, Flying Training Instrument Flying
5. USAFER 51-1, Aircrew Ground Training
6. USAFEM 51-50, Vols I and VIII, Tactical Fighter and F-16 Aircrew Training
7. USAFER 55-44, Life Support Program
8. USAFER 55-27, Air Force Life Support Systems Program
9. USAFER 55-116, F-16 Pilot Operational Procedures; Spangdahlem AB Chapter 8 to USAFER 55-116
10. USAFER 66-5, Combat Oriented Maintenance Organization
11. DoD Flight Information Publication, General Planning
12. DoD Flight Information Publication, Area Planning, Special Use Airspace, Europe-Africa-Middle East
13. 52FW, In-flight Guide, Vol I, 6 Jan 93
14. Aviano AB "Pasta Tips," In-flight Guide, 1 Mar 93
15. COMFIVEATAF MSG 10 1600Z Aug 93 (NATO Secret)
16. COMFIVEATAF ACO 17 CH6 20 1500Z Jul 93 (NATO Secret)


2. Technical Orders

1. 1F-16C-1, F-16C/D Flight Manual
2. 1F-16C-1CL-1, F-16C/D Checklist
3. 1F-16C-6WC-1-11, Basic Postflight/Preflight, Launch, Recover, and End of Runway Inspection
4. 1F-16C-2-10JG-00-1, Aircraft Ground Safety Guide
5. 1F-16C-12JG-00-1, Aircraft Ground Servicing Guide
6. 1F-16C-34-1-1, Avionics and Non-nuclear Weapons Delivery Flight Guide
7. 1F-16C-34-1-1CL-1, Checklist Avionics and Non-nuclear Weapons Delivery Flight Crew Procedures
8. 1F-16C-70FI-0011, Power Plant Fault Isolation
9. 1F-16C-6, Scheduled Inspections and Maintenance Requirements
10. TO 1-1C-1-30(CL), Flight Manual, F-16 Crew Air Refueling Procedures with KC-135, KC-10, CH-11, 15 Jun 91

3. Statement of Opinion

a. Under 10 U.S.C. 2254(D) any opinions of the accident investigator 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 those conclusions or statements.

b. The crash of F-16C, serial number 86-0343, was caused by an engine hardware malfunction. (Tab J)


DANIEL B. CECIL, Colonel, USAF
Investigating Officer