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STATEMENT OF AUTHORITY AND PURPOSE

OFFICE OF THE SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

By order of the Commander, Headquarters Seventeenth Air Force, Colonel Daniel B. Cecil, Vice Commander, 601st Air Base Wing, Sembach Air Base, Germany, was appointed by orders, dated 17 February 1994, to conduct an investigation into the crash of an F-16C and F-16D aircraft which occurred on 26 January 1994 at Wright-Patterson AFB, Ohio. Captain Michael J. Andersen, 52nd Fighter Wing, 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. By order of the same commander, Major Robert H. Johnston, 191st Fighter Group (ANG), was detailed technical advisor and Air National Guard representative, by orders dated 25 February, 1994.

MATTER INVESTIGATED

This is an accident investigation of an aircraft mishap involving F-16C and F-16D (Serial Numbers 87-0270 and 87-0389 respectively) both assigned to the 52nd Fighter Wing/23rd Fighter Squadron, Spangdahlem Air Base, Germany. Both aircraft experienced problems while attempting takeoff from Wright-Patterson Air Force Base, Ohio at 1503 hours, Eastern Standard Time, 26 January 1994. The object of the investigation was to obtain and preserve all available relevant facts and evidence pertaining to the accident and to investigate the circumstances leading to the accident for use in claims adjudication, evaluation, litigation, disciplinary action, adverse administrative proceedings, or other purposes deemed appropriate by competent authority. Colonel Cecil conducted the investigation under the authority of AFR 110-14, and was guided by the general procedures outlined in AFR 120-3.

SUMMARY OF FACTS

I. History of Flight

On 26 January 1994, Fast 01, a flight of two F-16s attempted a formation takeoff on runway 05L at Wright-Patterson AFB, Ohio. The lead aircraft, F-16C numbered 87-0270 was piloted by Captain Anthony N. Zaccaro and the wingman was Lieutenant Mark J. Bortiatynski, solo pilot of a two seat F-16D, numbered 87-0389. The aircraft were making an afterburner takeoff and operated as expected through rotation.

At lift off, the lead aircraft pitched nose down such that the nose was at a lower pitch than normal for being on the ground. The aircraft did not respond to nose up commands by the pilot so Capt Zaccaro ejected successfully. The aircraft apparently bounded a few feet into the air and was airborne when the seat separated. The plane came down in the grass off the left side of the runway. It slid along the ground first striking a runway distance marker sign and then hitting a small equipment building with its right wing. It continued across a taxiway and came to rest in a grassy area

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Contractor _____ Witness _____
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within the airfield boundary. During this slide, the gear struts failed, fuel cells ruptured and a big fire trailed and engulfed the aircraft when it stopped.

Concurrently, the second aircraft pitched nose down, but this command was so aggressive it blew the nose tire and broke the nose strut. In this condition the aircraft was unflyable. It was tracking straight down the runway and responded to brake pressure so Lt. Bortiatynski completed an abort and successfully egressed after sliding to a stop. When this aircraft hit the runway, the centerline fuel tank split and the fuel was ignited which left a large trailing fireball.

Base fire fighters were on the ramp due to a previous emergency, they observed the two fireballs and were on scene in less than a minute. Both fires were suppressed quickly. There were no deaths associated with the accident and no damage was done to private property. News media agencies from up to 75 miles surrounding the base inquired. The Aircraft Systems Center Public Affairs Office responded.

II. Mission

The 52nd Fighter Wing, Spangdahlem Air Base, Germany, recently replaced their F-16C and D, block 30, big inlet aircraft with a newer version. The mishap aircraft were the older models being delivered to the 419th Fighter Wing, Hill Air Force Base, Utah. The flight was authorized by an air tasking order published by the 2nd Air Delivery Group, Langley Air Force Base, Virginia. The original flight was Spangdahlem Air Base, Germany, to Hancock Air National Guard Base, Syracuse, New York; then to Sioux City, Iowa and Hill Air Force Base, Utah.

The original flight of four had separated into two flights of two aircraft. Each flight had landed in different places prompting a change in itinerary. The mishap pilots flew from Hancock Field, New York to Wright-Patterson Air Force Base, Ohio on 25 January, 1994. They intended to go to Tinker Air Force Base, Oklahoma, but a fuel transfer problem in the F-16C prompted a divert. The flight on 26 January, 1994 was planned to land at Carswell Air Force Base, Texas enroute to Hill Air Force Base, Utah.

III. Briefing and Preflight

The pilots arrived at base operations just before 0800 Eastern Standard Time on 26 January 1994, following adequate crew rest. The pilots briefing included all aspects of the intended flight including a formation takeoff.

The two F-16s had been parked outside overnight on the ramp at Wright-Patterson AFB. It had been raining on and off until about 0100 Eastern Standard Time the morning of the mishap and the temperature had remained below freezing. Neither aircraft had been protected by covers on any of their air data probes. Air Force Reserve 906th Fighter Group maintenance personnel had replaced the left wing fuel tank on the lead aircraft, F-16C (87-0270). Only

normal refueling and postflight/preflight checks had been done on the wingman's airplane, F-16D (87-0389).

The pilots arrived at the planes about 1410 Eastern Standard Time, secured their personal items in the right wing travel pods, and conducted preflight checks. Both pilots checked the angle of attack probes located on both sides of each aircraft nose cone during these preflight inspections. All four probes were free to rotate and the slots appeared clear of obstructions. Lead's aircraft had also been inspected by a 906th Fighter Group crew chief during idle time earlier in the day.

IV. Flight Activity

After an uneventful engine start, the two aircraft were ready for departure. They called for clearance and taxied at about 1440. They were ready for takeoff at about 1450. Lead had left his aircraft forms in the transient maintenance flightline truck so the flight exited the runway and maintenance secured the forms in his right wing travel pod. They were cleared back on the runway and then for takeoff.

The two pilots ran their engines up, checked all their instruments and cycled their flight controls. Satisfied, they released brakes together and selected afterburner. Acceleration was quick as expected and the aircraft were slowly rotated nose up to achieve flight. When the weight on wheels switches extended, the flight control computers "woke up" to false angle of attack inputs and responded as designed.

Aircraft 87-0270 "saw" 21.38 degrees angle of attack and firmly pitched the nose down such that the aircraft was most likely accelerating on the three tires without closing the weight on wheels switches. This would be consistent with the excessive nose down attitude seen by the pilot and the lack of any parts of his aircraft on the runway.

Aircraft 87-0389 "saw" 30.52 degrees angle of attack which was more severe. The resultant pitch down was sharp enough to fail the nose strut and rupture the centerline tank.

V. Impact

Aircraft 87-0270 impacted the ground just west of the runway (coordinates: N39.49.5 WB4.02.2). It was going about 250 knots when it landed in a flat attitude just beyond a runway light and continued across the grass and a taxiway until it came to rest after sliding about 4000 feet. The aircraft incurred about \$2,600,000.00 in damages.

Aircraft 87-0389 slammed to the ground about 4000 feet down the runway and slid about one mile before stopping. This aircraft incurred almost \$200,000.00 in damages.

VI. Ejection Seat

Ejection was initiated and occurred within the ejection seat's design operating envelope. No deficiencies were noted.

VII. Personal and Survival Equipment

The emergency locator transmitter (ELT) operated normally during the brief parachute descent, but failed when it struck the ground. ELT was not used to locate either the aircraft or the pilot. No other deficiencies were noted.

VIII. Rescue

The mishap occurred at 1503 Eastern Standard Time. Tower personnel made an immediate call on the crash phone. All appropriate base agencies responded in a timely manner.

IX. Crash Response

After ejection, Captain Zaccaro landed on the runway and was rescued by the base operations supervisor. Lieutenant Bortiatynski ran from his aircraft towards the West Ramp, was picked up by personnel from the 906th Fighter Group and delivered to the base operations supervisor's vehicle while it was still on the runway just shy of taxiway C. Both pilots were driven to base operations where they were picked up by medical people and transported to the hospital.

X. Maintenance Documentation

The majority of the forms for aircraft 87-0270 were destroyed in the mishap. The aircraft was in route to its transfer base, therefore historical Form 781 series documents were in a transfer package on board the aircraft. However, the current Form 781 series documents were somewhat intact. The aircraft forms were reviewed, no discrepancies were found relative to the mishap and no indications of chronic maintenance problems. There was one delayed discrepancy annotated on the aircraft Form 781K and four engine time compliance technical orders on the engine Form 781K, with none being relative to the mishap. Preflight and servicing requirements were documented prior to the mishap flight. All inspection items on the aircraft and engine were current.

All forms for aircraft 87-0389 were available and reviewed. Although forms documentation errors were noted, no discrepancies were found relative to the mishap and there were no indications of chronic maintenance problems. There were two delayed discrepancies and one time compliance technical order on the aircraft Form 781K and two engine time compliance technical orders on the engine Form 781K, with none being relative to the mishap. Preflight and servicing requirements were documented prior to the mishap flight. All inspection items on the aircraft and engine were current.

XI. Maintenance Personnel and Supervision

Preflight/postflight checks were accomplished by transient maintenance personnel.

Although probe covers were available in the travel pods of these aircraft, F-16s routinely remained overnight at Wright-Patterson AFB without covers. Also, these aircraft were not initially expected to remain overnight. The result was that no probe covers were installed on these F-16s.

XII. Engine Oil, Fuel and Hydraulic Inspection Analysis

All engine oil, fuel and hydraulic samples were normal.

XIII. Airframe and Aircraft Systems

Both airframes were intact and all aircraft systems were operating at the time of the incident. However, when the weight of each aircraft was relieved from its wheels, the flight control computers were fed angle of attack information that could not have existed in that flight regime. The flight control systems responded as designed for the input information they received. A limited discussion of the system design and pilot procedures is necessary to understand what happened.

The F-16 flight control system is a computer-controlled, fly-by-wire system that hydraulically positions control surfaces. Electrical command signals to the flight control computers are initiated by applying force to the stick and rudder pedals. These signals are processed by the computers along with signals from the air data system, flight control rate gyros, and accelerometers. The processed signals are transmitted to the hydraulic actuators which position the flight control surfaces to give the commanded response.

The computers use angle of attack information from one of three possible sources. Two cone shaped rotating air data probes are located on each side of the nose cone. These have inlet slots situated on the probes such that the probe will rotate easily to align itself into the relative wind. A side mounted fuselage air data probe also samples local angle of attack by comparing relative pressures at the various air ports located on the front of the probe.

All three of these probes are connected to instruments which convert input mechanical position or differing air pressures to electrical signals. These are then routed through a central signal selector process and into the flight control computers. Therefore, if two probe values are both at one extreme or another, the central value will be extreme and this value will be the one used by the flight control computers to position the flight control surfaces.

The pilots check the cone shaped angle of attack probes for freedom of movement and alignment during the preflight check. The alignment reference is

at a position which generates an extreme high angle of attack signal. Pilots routinely release these probes at the alignment check position and proceed to the next step on the checklist. Normally the probes quickly rotate to a mid range in response to breezes across the airfield. However, if either of the air slots are blocked, the probes will not respond properly to the relative wind. The flight manual warns that icing of the angle of attack probes may cause loss of control of the aircraft.

The air data probes are electrically heated automatically anytime the aircraft is airborne. There is also a probe heat switch in the cockpit which, if selected, energizes the probe heaters for deicing on the ground. The flight manual instructs the pilots to leave the probe heat switch off if icing conditions are not anticipated. If probe heat is selected too soon before takeoff when icing conditions are anticipated, the probes may become hot enough to shut off their heaters.

The flight control computer uses angle of attack information for limiting demands on the airframe. A very high angle of attack may produce loss of control of the aircraft. The flight control system is programmed to command a nose down pitch rate in such cases. Since the information is for limiting in-flight demands on the aircraft to remain within airframe capabilities, the flight control computers are supplied a nominal value (13.5 degrees) when the aircraft weight is on its wheels.

The landing gear weight on wheels switches, located on both main landing gears and on the nose landing gear, operate as a function of landing gear strut extension to allow or terminate various system functions. When the switch on the right main landing gear strut opens, the flight control computers are no longer supplied the nominal value and are provided angle of attack central values from the air data probes.

In this case when the switches opened, lead's central value angle of attack was 21.38 degrees and the wingman's central value was 30.52 degrees. The conical probes were not responding to the relative wind, but the computers were not designed to understand this failure in this block of aircraft. The computers believed flight conditions could produce a departure/spin so they commanded the noses down.

XIV. Operations Personnel and Supervision

The mission was tasked and authorized by 2nd Air Delivery Group Coronet East 077 Air Tasking Order, Aircraft Transfer. The flight briefing was conducted by Capt Zaccaro and no supervisors were present. The mission was coordinated by telephone with the 2nd Air Delivery Group and the supervisor of flying at the 138th Fighter Squadron, Syracuse, New York.

XV. Pilot Qualifications

Captain Zaccaro has flown over 1000 hours as a military pilot, approximately 850 hours in the F-16 of which 140 were in combat. He was qualified and capable of flying the tasked mission.

Lieutenant Bortiatynski has flown about 430 hours as a military pilot, approximately 220 in the F-16. He was qualified and capable of flying the tasked mission.

XVI. Medical

Both pilots were medically qualified for flight duty and had a current flight physical.

The findings of the post mishap flight surgeon's exam and toxicology report revealed nothing which would have adversely affected either pilot's performance. No one was injured in the mishap.

XVII. NAVAIDS and Facilities

There were no Notices To Airmen at Wright-Patterson Air Force Base on 26 January, 1994.

XVIII. Weather

The weather at the time of the mishap was 1500 feet broken, 4200 feet overcast, 7 miles visibility. The wind was 050 at 12 knots. The temperature was 26 degrees F, there was no precipitation and the runway was dry.

The flight manual cautions pilots, "If takeoff or first 2 minutes of climb will be in icing conditions, probe heat must be on at least 2 minutes prior to takeoff." A previous weather briefing had forecast moderate mixed icing 2200 feet to 5200 feet and light rime icing 5200 feet to 8200 feet. These remarks were omitted on the latest weather forecast given to the pilots.

XIX. Directives and Publications

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

a. Regulation and Manuals

1. AFM 51-12, Weather for Aircrews
2. AFM 51-37, Instrument Flying
3. AFR 55-17, Flight Delivery of Aircraft
4. AFR 55-27, Air Force Life Support Program
5. AFR 60-1, Flight Management

6. ACC/ANG 60-2, Aircrew Standardization and Evaluation Program
7. AFR 60-5, Air Traffic Control
8. AFR 60-16, General Flight Rules
9. ACC/ANG 51-50, Tactical Aircrew Training
10. ACC/ANG 55-44, Life Support Program
11. ACC/ANG 55-116, F-16 Pilot Operational Procedures
12. ACC Sup 1 to AFR 60-16
13. DOD Flight Information Publications; General Planning, Area Planning, Enroute and Terminal IFR Publications
14. 2 ADG Msg dated 161836Z Dec 93, Coronet East 077 Air Tasking Order, Aircraft Transfer
15. 138th Fighter Squadron Cross Country Guide

b. Technical Orders

1. 1F-16C-1, F16C/D Flight Manual
2. 1F-16C-1CL-1, F-16C/D Checklist
3. 1F-16C-6WC-1-11, Basic Postflight/Preflight, Launch, Recovery, and end of Runway Inspection

STATEMENT OF OPINION

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 those conclusions or statements.

Icing of the conical angle of attack probes caused loss of control of each aircraft immediately after rotating for takeoff.


DANIEL B. CECIL, Colonel, USAF
Accident Investigating Officer