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AIRCRAFT ACCIDENT INVESTIGATION

AUTHORITY: Under the provisions of Air Force Regulation 110-14, the Ninth Air Force Commander appointed Lt Col Andy C. Denny to conduct an aircraft accident investigation (AAI) of the F-16CG (SN 89-2110) accident which occurred on the approach end of runway 05 at Homestead AFB, Florida (Tab Y-1). The investigation was conducted from 1 June 1992 to 15 June 1992. Technical advisors were: Maj Randall G. Bundy (Legal), Capt (Dr) Barbara R. Bucknam (Medical), and 1Lt Greg Franklin (Maintenance). Mrs. Lydia Sanchez (GS-8) served as Court Reporter and provided Administrative Support (Tab Y-1 thru Y-5).

PURPOSE: An aircraft accident investigation is convened under AFR 110-14 to collect and preserve all relevant evidence for possible use in claims, litigations, disciplinary actions, adverse administrative proceedings, or for any other purposes deemed appropriate by competent authority. The investigation is to obtain factual information, and it is not intended to determine the cause of the accident. In addition, the aircraft accident investigation board cannot make conclusions and recommendations. This report is available for public dissemination under the Freedom of Information Act (5 U.S.C. 552) and AFR 12-30.

SUMMARY OF FACTS

1. History of Flight: On 24 April 1992, Captain Mark A. Merkel was scheduled to perform a Functional Check Flight (FCF) on an F-16CG aircraft, serial number (SN) 89-2110. The engine had recently been changed and an FCF was required because of a "zero-time AFTC" (afterburner fan temperature controller) (Tab U-3, V-1-2, V-6-1). Capt Merkel used the call sign dedicated to FCF mission profiles of "Boomer 01." The takeoff from Homestead AFB, Florida, was scheduled for approximately 1130 EDT. The actual takeoff was 1135 EDT (Tab A-1). Shortly after takeoff, the aircraft experienced a loss of power. At approximately 1140 EDT, the aircraft impacted in the overrun of runway 05 at Homestead AFB. The aircraft departed the runway and slid to a stop on its belly in the grass between the parking ramp and the runway. A post-crash fire ensued. The pilot received burns to 21% of his body and a fractured spine (Tab X-1) prior to being rescued by fire department personnel (Tab A-1). The ejection sequence was not initiated (Tab V-1-4). The aircraft was damaged beyond economical repair (Tab D-1, M-1). News media inquiries were handled by the Homestead AFB Public Affairs Office (Tab Z-1).

2. Mission: Boomer 01 was to fly the FCF stereo flight plan or profile. An afterburner (AB) takeoff was planned with a "zoom" climb to a position high above the field where engine checks are performed. The aircraft would then fly a route over the water where it would perform supersonic flight and further aircraft systems checks. The flight would normally conclude with an Instrument Landing System (ILS) approach and landing checks. The flight would

PFS Exh. 137

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NUCLEAR REGULATORY COMMISSION

Docket No. _____ Official Exh. No. 137
In the matter of PPS
Staff _____ IDENTIFIED
Applicant RECEIVED _____
Intervenor _____ REJECTED _____
Other _____ WITHDRAWN _____
DATE 7/1/02 Witness _____
Clerk J

takeoff from and return to Homestead AFB. This would have been Capt Merkel's second FCF mission since his training was completed in February 1992 (Tab T-1). He had flown the exact mission the day before for another aircraft (Tab V-6-1).

3. Briefing and Preflight: Capt Merkel indicated in his testimony that he had the required crew rest and was well rested (Tab V-1-2). He was medically qualified to fly (Tab X-1). 308 Fighter Squadron personnel stated that he seemed very alert and eager to fly the FCF (Tab V-12). Capt Merkel received a briefing from the Quality Assurance (QA) Noncommissioned Officer (NCO) on the purpose and procedures for the FCF, including minor discrepancies with the aircraft (Tab V-6-1). He also received the required briefings from 308 FS personnel, a supervisor and the duty desk controller (Tab V-1, V-6, V-11, V-12). Ground operations were conducted without any unusual occurrences or deviations (Tab V-1-2, V-6-1, V-7).

4. Flight: After receiving his clearances for his FCF profile, Boomer 01 was cleared for takeoff at 1134:16 EDT (Tab N-2). After performing the required engine run-up checks, Boomer 01 released brakes for takeoff at approximately 1135:18 EDT (Tab N-3). The local air traffic controller in the Tower said that he saw "a great big puff of smoke come out of his tail whenever he took off" (Tab N-3). The AB takeoff began normally, but approximately mid-field after lift-off, the pilot received indications that the aircraft engine control had auto-transferred from primary engine control (PRI) to secondary engine control (SEC). Cockpit indications included the sensation of losing AB thrust, the nozzle indicator showed the nozzles had closed, and the Master Caution light and a SEC light came on the caution light panel (TAB V-1-3, V-1-5). Instead of continuing the planned "zoom" climb, Boomer 01 started a gradual right climbing turn to the south, notified Miami control that he was leaving their frequency, and contacted the Supervisor of Flying (SOF, Wyvern) on his frequency (V-1-3). His call to the SOF occurred at 1135:58 EDT (Tab N-3). Boomer 01 notified the SOF that he had the auto-transfer to SEC and that the engine seemed to be running fine right then. The SOF offered to read the checklist procedures to him if he would like (Tab N-3, V-1-3, V-2-2). Boomer 01 requested the SOF to read the checklist. The SOF read him the appropriate engine malfunction procedures for an auto-transfer to SEC. Together, they decided that the best plan was to orbit over the field while Boomer 01 burned down fuel, thus reducing the landing weight (Tab N-4, V-1-4, V-2-3). At this time, 1138:05 EDT, the Tower controller broadcast the inflight emergency information over the "Crash" net (Tab N-4). Boomer 01 had maneuvered the aircraft up to approximately 6000 feet mean sea level (MSL) and about one mile from the approach end of runway 05 on a heading near runway heading (Tab O-13, V-1-4). Capt Merkel now realized that the engine RPM (revolutions per minute) had decreased below 90% and continued to decrease (Tab V-1-4). He quickly informed the Tower and SOF at 1139:12 EDT that his "motor had stopped" (Tab N-5, V-1-4, V-2-3). From his position, he judged that he could not fly the normal flame out pattern that he had practiced many

times nor could he simply continue straight ahead and land safely (Tab V-1-4). He decided to maneuver his aircraft to the right in a turn away from the runway to lose some altitude, then turn back toward the runway and attempt a landing (Tab V-1-4). This maneuver was successful in losing the required altitude but, in doing so, his airspeed also decreased, making a successful landing impossible (Tab V-1-4). His approach to the runway was from a tight right base turn that developed into a high sink rate. Capt Merkel was unable to prevent the aircraft from landing hard in the overrun (Tab V-1-4, V-2-3). He considered ejecting from the aircraft during that final turn to landing, but chose not to because of uncertainties about being in a favorable ejection envelope (Tab V-1-4). The aircraft impacted the overrun surface at approximately 1139:39 EDT.

5. Impact: The aircraft impacted the surface 100 feet short of the runway threshold (Tab C-1). The airspeed and vertical velocity at impact are undetermined (Tab J-36) since the impact did not leave visible impact marks on these and other instruments (Tab J-36). The impact area diagram is at Tab R-1. Upon impact, the landing gear collapsed (Tab V-1-4), and the aircraft slid on its belly at an angle (approximately 30 degrees) to the left of runway heading (Tab R-1). The aircraft departed the runway surface approximately 300 feet from the threshold (Tab R-1). As it slid across the grass, the nose turned back to the left, pointed away from the runway (R-1, V-3-5). Fire and smoke erupted from the aircraft with the worst conditions existing near the rear of the aircraft (Tab V-2-3, V-3-5, V-8, V-9, V-10). The aircraft came to rest approximately 1300 feet from the runway threshold and pointed approximately 75-80 degrees to the left of runway heading (Tab R-1). Capt Merkel was able to raise the canopy normally from inside the cockpit but had some difficulty with his emergency ground egress (Tab V-1-5). His foot got caught between the instrument console and the seat (Tab V-1-5).

6. Ejection Seat: Analysis of the Aces II ejection seat indicated the ejection sequence was not initiated. Evidence revealed that the seat was functionally and mechanically sound prior to impact (Tab U-15, U-18).

7. Personal and Survival Equipment: All inspections were current (Tab U-15, U-18). Survival equipment was not used.

8. Crash Response: The Air Traffic Control Tower broadcast over the Crash hotline that there was a F-16 inflight emergency with an estimated time of arrival of 15 minutes. This call was made at 1138:05 (Tab N-4). All parties acknowledged receipt and understanding of the information and immediately began their response to their predetermined positions near the runway. Before responding units were in position, the aircraft crashed on the approach end of runway 05 at 1139:40. The Tower personnel broadcast another message at that time identifying exactly where the aircraft was located (Tab N-5). The first vehicle to reach the crash scene was manned by SSgt Wade and SSgt Leggett. The other vehicles were judged to be 30-45 seconds behind the first vehicle

(Tab V-3-3). SSgt Wade quickly analyzed the situation and realized that the pilot was in great danger since the aircraft was burning. Even though he had not yet donned his protective suit (he was wearing his normal Battle Dress Uniform or BDU's), he rushed to the cockpit to assist the pilot. The pilot was having some difficulty exiting the cockpit even though the canopy had opened normally with the cockpit canopy switch (Tab V-1-5). SSgt Wade assisted the pilot out of the cockpit and eventually dragged him clear of immediate danger from the fire. Meanwhile, the other crash and rescue vehicles arrived, including the ambulance. The pilot was turned over to the medical personnel who treated him immediately and transported him to the base hospital. The fire department personnel continued to extinguish the flames of the burning aircraft and fairly quickly brought the situation under control (Tab V-3-7). Testimony from the Supervisor of Flying (Tab V-2-7), the pilot (Tab V-1-6), and the Tower Supervisor (Tab V-9) applauded the crash and rescue response personnel for doing a great job. SSgt Wade testified, "I've never in my life seen people work so hard and so together" (Tab V-3-8).

9. Maintenance and Documentation: A review of the AFTO 781 series aircraft forms revealed that for a functional check flight the aircraft was properly configured, serviced, inspected, and released for flight by qualified maintenance personnel (Tab U). A summary of AFTO 781A entries, to include significant maintenance actions during the 30 days prior to the mishap can be found at Tab H-1 thru H-5. There were no overdue inspections (Tab H-5), time change items (Tab H-6), or time compliance technical orders (Tab H-6). A thorough review of the maintenance records of aircraft 89-2110 revealed no discrepancies related to the accident (Tab U).

10. Maintenance Personnel and Supervision: According to maintenance documentation, aircraft 89-2110 was properly serviced, inspected, and prepared for flight by qualified maintenance personnel (Tab U). There is no evidence of maintenance malpractice associated with this crash. Training records were reviewed and all personnel involved in the preflight and launch were qualified and current.

11. Fuel, Hydraulic, and Oil Inspection Analysis: The aviator's breathing oxygen test report (Tab J-17), the fuel test report (Tabs J-9 thru J-16), and the oil analysis records (Tab J-8) were all satisfactory. Hydraulic fluid samples taken after the mishap failed tech order requirements and were not satisfactory for use (Tab J-1, J-2, J-4 thru J-7). However, according to the mishap pilot's testimony, there was no indication of a hydraulic problem (Tab V-1).

12. Air Frame and Aircraft System:

a. Flight Controls and Related Systems: There is no evidence which indicates that a flight control related problem was a factor in this accident. The pilot did not mention any difficulty with the flight controls or any related systems in his testimony (Tab V-1-1 thru V-1-7).

b. Engine: The engine was examined by a specialist from Tinker AFB Air Logistics Center (ALC). His report is at Tab J-20 thru J-25. His determination was:

- (1) The engine had transferred from PRI to SEC mode.
- (2) The engine was flamed-out at impact.
- (3) The engine turbo-machinery, engine systems and engine controls were functional at ground impact.

Following the accident, the Master Fuel Panel and Fuel Quantity Control Unit along with other components were sent to ALC for analysis. The analysis reports are at Tab J-18 and J-19. No malfunctions or defects were found.

c. Instrument Systems: An analysis of the instruments and associated cockpit components at the Tinker AFB ALC is at Tab J-36 thru J-38. Nothing was noted that indicated instrument failure prior to impact or loss of input signal.

13. Operations Personnel and Supervision: The mission was conducted under authority of the 31 Fighter Wing and 308 FS (Tab K-1 and K-2). All supervisor briefings and actions were accomplished (Tabs V-11 and V-12).

14. Pilot Qualifications: Captain Merkel was current and fully qualified to perform the scheduled mission (Tab T-1). He had completed his FCF training program in February 1992 (Tab T-2), and flown an FCF profile mission on the day prior to the accident (Tab V-6-1). His flying experience is as follows:

F-16A/B	1029.9
F-16C/D	76.1
AT-38A/B	463.9
(AT-38A/B IP)	(365.7)
Student Time	<u>177.8</u>
Total Time	1747.7

Hours/Sorties

Last 30 days	5.2/4
Last 60 days	9.0/7
Last 90 days	28.1/19

(Tab G-1)

As an FCF pilot, Capt Merkel was classified as an MS or Mission Support pilot. Due to necessary sortie management, he flew at a reduced rate but still maintained every currency required (Tabs G-2 thru G-11, and V-4-1).

15. Medical: Capt Merkel was medically qualified for flight at the time of the accident. His flight physical was current, and he was properly cleared to

fly (Tab X-1). The toxicology specimens analyzed at the Armed Forces Institute of Pathology were negative for alcohol, drugs, or illegal substances (Tab X-1). Capt Merkel sustained major physical injuries. The extent of injuries consisted of 21% total body surface area second and third degree burns, and a T-12 vertebral compression fracture of the spine (Tab X-1).

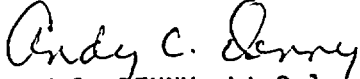
16. Nav aids and Facilities: All applicable nav aids were in operation. There were no NOTAMS applicable to this accident (Tab W-3).

17. Weather: Scattered clouds (2800 feet), visibility 7+ miles, winds 090 degrees at 10 knots, altimeter 30.09 (Tab W-1). The pilot stated that weather was not a factor in the accident (Tab V-1-7).

18. Directives and Publications:

TACR 51-50, Tactical Fighter/Reconnaissance Aircrew Training
TACR 55-116, F-16 Pilot Operational Procedures
T.O. 1F-16CG-1, Flight Manual
T.O. 1F-16CG-1CL-1, Flight Manual Checklist
T.O. 1F-16CG-6CF-1, Acceptance and Functional Check Flight Procedures Manual

There is nothing to indicate any deviation from the directives.


ANDY C. BENNY, Lt Colonel, USAF
AFR 110-14 Investigation Officer

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Glossary

GLOSSARY

Note: Acronyms, jargon, and terms are explained in the context in which they appear in this report. The application of these definitions is not universal and may be limited to this report.

AB	- Afterburner
A/C	- Aircraft
ADG	- Accessory Drive Gearbox
ADI	- Attitude Director Indicator
ADO	- Assistant Deputy Commander for Operations. Serves as DO in absence of DO.
AF	- Air Force
AFB	- Air Force Base
AFISC	- Air Force Inspection Safety Center
AFR	- Air Force Regulation
AFTC	- Afterburner Fan Temperature Control
AFTO	- Air Force Technical Order
AGL	- Above Ground Level
ALC	- Air Logistics Center
ALC/MMET, MMIRIA	- Air Logistics Center/office symbols
AOA	- Angle of Attack: Angular difference between aircraft longitudinal axis of the aircraft and flight path.
Arming Area	- Waiting area next to runway where aircraft are armed and checked.
ATC	- Air Traffic Control; Air Training Command
AVTR	- Aircraft Video Tape Recorder
BDU	- Battle Dress Uniform
Boomer 01	- Mishap aircraft call sign.

BRITE - Bright Radar Indicator Tower Equipment: A repeater radar display in the control tower which gives controllers the traffic situation beyond their line of sight.

CIVV - Compressed Inlet Variable Vane

Code One - A "Code One" flight is a flight without aircraft malfunctions.

DO - Deputy Commander for Operations

DTC - Data Transfer Cartridge - transfers flight planning computer data to aircraft.

EOR - End of Runway; also applies to the "last chance" maintenance inspection performed immediately prior to takeoff.

EPU - Emergency Power Unit

ER - Exceptional Release: A signature in the aircraft records which authorizes an aircraft to be flown.

EDT - Eastern Daylight Time

FCF - Functional Check Flight

FCIF - Flight Crew Information File

Flight Director - Instruments which provide pitch and bank attitudes and the navigation situation of the aircraft.

FP/IP - First Pilot/Instructor Pilot: Terms used in logging flying time.

FS - Fighter Squadron

FTIT - Fan Turbine Inlet Temperature

FW - Fighter Wing

High Key - A position above the field to start the SFO approach.

IFR - Instrument Flight Rules

ILS - Instrument Landing System: Designed to provide an approach path for exact alignment and descent of an aircraft on final approach to a runway.

JA - Judge Advocate

JFS - Jet Fuel Starter

JOAP (SOAP) - Joint (Spectrometric) Oil Analysis Program

L - Local Time

Lift - The aerodynamic force which opposes the force of gravity. Also as LIFT for Lead-in Fighter Training - initial training for new fighter pilots given at Holloman AFB, NM.

LMLG - Left Main Landing Gear

Low Key - Midway through the SFO pattern, abeam the field 3-4000 ft AGL.

LOX - Liquid Oxygen

MILITARY (MIL) - Maximum engine power setting without afterburner.

MQT - Mission Qualification Training: Ground and flight training given to pilots to qualify them to perform the unit's mission.

MR - Mission Ready: A fully qualified aircrew in the unit mission.

MSL - Mean Sea Level: Used in conjunction with an altimeter, refers to altitude above sea level.

MSS - Mission Support System - a flight planning computer.

NAVAID - Navigation Aid

NCOIC - Noncommissioned Officer In-charge

NOTAMS - Notice(s) to Airmen: A notice containing information on the establishment, condition, or change in an aeronautical facility, service, or procedure that may be a hazard to flight.

OR - End of runway waiting area.

Phase Inspection - Scheduled inspection done after a specific number of aircraft/engine operating hours.

PRI - Primary Engine Control

QA - Quality Assurance

Red Ball - Quick response maintenance assistance.

RPM	- Revolutions per minute
RTU	- Replacement Training Unit
SEC	- Secondary Engine Control
SFO	- Simulated Flame Out Approach
SN	- Serial Number
SOF	- Supervisor of Flying: An officer responsible for monitoring and supervising flying operations at a base. Works directly for DO when filling SOF position. SOF is an extension of the DO responsibility for overall operations.
STAN/EVAL	- Standardization/Evaluation Division in the Wing. This is the agency that normally gives flight checks and manages other standardizing systems in the wing.
SUP or super	- Squadron Flying Supervisor
TAC	- Tactical Air Command
TACM	- Tactical Air Command Manual
TACR	- Tactical Air Command Regulation
TCTO	- Time Compliance Technical Order
TDR	- Tear Down Report
TO	- Technical Order - a manual or reference document.
T/O	- Takeoff
UHF	- Ultra High Frequency
VFR	- Visual Flight Rules
VHF	- Very High Frequency
VMC	- Visual Meteorological Conditions
VTR	- Video Tape Recorder
VVI	- Vertical Velocity Indicator: A trend instrument which displays rate of climb or descent.
Wyvern	- Call sign for the Supervisor of Flying (SOF)
Z	- Zulu (i.e., Greenwich Mean Time)