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OFFICE OF THE SECRETARY
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USAF AIRCRAFT
ACCIDENT INVESTIGATION
BOARD

19 MARCH 1991

DEPLOYED LOCATION

F16C AIRCRAFT
S/N 88-0453

388 TFW
421 TFS

INVESTIGATION OFFICER

RICHARD M. PEDERSEN, LT COL, USAF
58 TTW
LUKE AFB AZ

COPY NUMBER 1 OF 11
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INVESTIGATORY COMMISSION

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DEPARTMENT OF THE AIR FORCE

HEADQUARTERS TWELFTH AIR FORCE (TAC)

BERGSTROM AIR FORCE BASE TX 78743-5002

OFFICE OF THE COMMANDER

17 May 1991

SUBJECT Aircraft Accident Investigation: F-16C, SN 88-0453, 388 TFW
(421 TFS), 19 Mar 91, Operation Desert Shield/Storm

TO JA

Subject aircraft accident investigation is approved.

A handwritten signature in cursive script, appearing to read "Watt", is positioned above the typed name.

WALTER T. WORTHINGTON
Major General, USAF
Commander

Readiness is our Profession

57141

AFR 110-14

AIRCRAFT ACCIDENT INVESTIGATION
FORMAL REPORT OF INVESTIGATION

1. AUTHORITY AND PURPOSE:

The Commander, Twelfth Air Force (TAC), appointed Lieutenant Colonel Richard M. Pedersen, under Air Force Regulation 110-14, to investigate and determine facts and circumstances surrounding the aircraft accident involving F-16C aircraft, S/N 88-0453, which occurred on 13 March 1991 at a deployed location (TAB Y-1). Captain Douglas P. Podkin, 4th Tactical Fighter Squadron, Hill Air Force Base, Utah, provided operational technical advice (TAB Y-2); Captain Lawrence M. Gatti, 4th Aircraft Maintenance Unit, Hill Air Force Base, Utah, provided maintenance and life support technical advice (TAB Y-3); and Captain Timothy A. Hursh, USAF Hospital, Hill Air Force Base, Utah, provided medical technical advice (TAB Y-4). The purpose of the investigation is to obtain and preserve available evidence for claims, litigation, disciplinary and administrative actions, and for all other purposes deemed appropriate by competent authority.

2. SUMMARY OF FACTS

A. History of Flight:

Four F-16C aircraft, Spider 31, 32, 33, and 34, took off from a deployed location during Operation Desert Shield/Desert Storm on 13 March 1991, at 0711Z. While proceeding on a routine flight plan during a local training mission, Spider 32 experienced minor electrical problems followed by an A system hydraulic failure. Spider 31 escorted Spider 32 as he declared an emergency and started an immediate turn back toward their departure base. At this time, Spider 33 and 34 split from Spider 31 and 32, as briefed, and continued to the working area to fly an alternate mission. As Spider 31 rejoined on him, Spider 32 reported an overheat light in addition to his A system hydraulic failure. Spider 31 advised Spider 32 that he was trailing smoke. Spider 32 experienced an increasing number of electrical problems in addition to several landing gear malfunction indications. Approximately four to five minutes after the first indication of a problem, Spider 32 lost all electrical power. His aircraft pitched up slightly and entered four to five uncommanded descending barrel rolls to the left. After attempting

to unsuccessfully regain control of his aircraft, the pilot of Spider 32, Captain Leonard S. Dick, ejected from F-16C aircraft 88-0453. The aircraft crashed in a remote area of the host nation and was destroyed. Captain Dick ejected successfully and was picked up by a rescue helicopter of the host nation.

B. Mission:

The mission was a combined 2v2 intercept flight lead upgrade and instrument check for Spider 31. The objectives were to successfully accomplish a previously attempted incomplete two-ship flight upgrade ride and also accomplish an AFR 60-1 instrument check during the recovery to the deployed location. Spider 31 was flown by Captain Karl Heinz. He was the upgrading flight lead and examinee. Spider 32 was flown by the mishap pilot, Captain Leonard Dick, who was the lead element Instructor Pilot (IP) and the Standardization/Evaluation Flight Examiner (SEFE.) Spider 33 was flown by Lieutenant Colonel William Scott. Spider 34 was flown by Lieutenant Bruce Hamilton. Spider 33 and 34 would provide the targets for Spider 31 and 32 during the intercept portion of the mission and then would fly a separate recovery.

C. Preflight and Briefing:

(1) All flight members had adequate pilot rest for the mission. Captain Dick was in the squadron only a brief period the day prior. He left the squadron at 1300 Local (L) the day prior and returned at approximately 0800L the day of the accident (TAB V-5).

(2) Mission preparation for the sortie was thorough. Captain Dick met Captain Heinz in the squadron the day before to review the mission (TAB V-5).

(3) The flight briefing started on time and was normal. Captain Heinz briefed all required items during the coordination brief for the entire flight. He specifically covered what he wanted Spider 33 and 34 to do when they were flying as targets for Spider 31 and 32. Captain Heinz listed three basic scenarios he wanted to see. He then asked Spider 33 and 34 what they wanted to see from Spider 31 and 32. After asking Spider 33 and 34 if they had any questions, he cleared them off to do their own element briefing while he completed his two-ship brief with Captain Dick (TAB V-2, V-5).

D. Flight:

(1) Ground operations up to and including engine start for

Spider 31 flight were normal. Taxi, marshalling, and arming were also normal and uneventful for the flight. All checks and tests were accomplished in accordance with appropriate rules and regulations. The flight received clearance for the route of flight as filed (Tab V-2, V-5).

(2) Spider 31 flight departed the deployed location using single ship, 20 second takeoff spacing. On departure, they rejoined to route 2 + 2 formation, one to two nautical miles in trail. The flight accomplished a leak and panel check, and then a weapons system check (Tab V-2, V-5). This is standard procedure for tactical missions. All checks were good with systems performing normally. Nav aids were good and communications were normal with the controlling agencies. The flight leveled off at FL 22,000 feet enroute to the working area (Tab V-5).

(3) About seven minutes after takeoff, climbing through 19,000 to 20,000 feet, heading southbound, holding 300-350 knots, the Stores Management System (SMS) failed in Captain Dick's aircraft. He turned the SMS off, cleared the Pilot Fault Lists (PFLs), and turned the SMS back on. It reset normally. About one minute later, the SMS failed for the second time. Within a few seconds, the fault warning system advised him of an oil/hydraulic malfunction. System A hydraulics began fluctuating between zero and 1,000 psi. Captain Dick informed Spider 31 of his emergency and began a left turn to recover at the departure base. He took the lead and Spider 31 assumed a chase position on him (TAB V-5).

(4) During the turn, Captain Dick detected an overheat caution light and a Central Air Data Computer (CADC) light (TAB V-5). As the flight points at the deployed location, the flight changed to the Supervisor of Flying (SOF) frequency. During the radio change, Captain Dick noted the landing gear warning horn going off. As Spider 31 rejoined to chase position he noted some unknown fluid over the top of the right wing, and a stream of smoke coming from the right-hand side of the aircraft on the belly side (TAB V-2). Spider 31 transmitted a call to Captain Dick to inform him of gray colored smoke coming from the jet (TAB V-2). Captain Dick acknowledged the radio call and informed Spider 31 about his gear horn. A couple of seconds later, the red light came on in the gear handle (TAB V-5). Spider 31 crossed underneath and began to see puffs of smoke coming from between the ventral fins, which soon became a stream of smoke (TAB V-2).

(5) The flight was level at 22,000 feet, 300-320 knots, pointed toward the deployed base. Captain Dick was unable to

silence the gear horn and was uncertain of any more radio transmissions due to the horn (Tab V-5). He began to get some random electrical BUS cycling and attempted to stores jettison. The stores jettison was unsuccessful. Captain Dick stated that there were no electrical lights on at all then. He could hear the electrical BUS cycling and the Multi-Function Displays (MFDs) were flashing with the on/off flags coming into view on the Altitude Direction Indicator (ADI). The Heads Up Display (HUD) was blank and trying to come back on. While pointing at the recovery base, he began to descend. Moments later he heard a final, audible click. At that point, everything electrical shut down (TAB V-5). From approximately 22,000 feet, 300-320 knots, the jet began about a two and a half G left-hand barrel roll that began with a slight pitch up (TAB V-2, V-5). Captain Dick noted that the Emergency Power Unit (EPU) was not on or running. He turned the EPU switch on, giving it five or six seconds, but never got any response. At that time, he noted an aircraft battery fail light and one other light next to it, either the aircraft battery to Flight Control system (FLCS) or FLCS relay light, but he is uncertain. Those were the only two lights operating (TAB V-5).

(6) The aircraft continued the uncommanded barrel rolls while losing altitude after each cycle. During his descent, Captain Dick switched the FLCS to Digital Backup (DBU) in an attempt to regain flight controls. This was unsuccessful. He also checked the engine and found it to be both running and responsive to throttle inputs. At that time, he noticed that both A and B system hydraulics were at zero psi. He did not know when he lost B system hydraulic pressure. He also attempted speed brake actuation unsuccessfully during the descent. Captain Dick stated that he was approximately 45 degrees nose low, 45 degrees left bank, approximately 310-330 knots, passing through 9800 feet when he initiated ejection (TAB V-5).

E. Impact:

Aircraft 88-0453 impacted the ground west-southwest of the 388th TFW deployed location on 13 March 1991, approximately 1130L. Spider 31 witnessed the aircraft fall like a leaf after ejection and flat plate into the ground (Tab V-2).

F. Ejection:

Captain Dick initiated the ejection at approximately 9800 feet and approximately 310-330 knots indicated airspeed. The time of ejection is shortly after 1127L, 0727Z. Captain Dick lost his

helmet during the ejection. After opening shock, Captain Dick completed a post-ejection checklist finding no further problems. At approximately 50 feet off the ground, he jettisoned his seat kit, and subsequently completed a normal parachute landing fall (TAB V-5). All life support inspections were up to date (TAB U).

G. Personal and Survival Equipment:

After an uneventful parachute landing fall, Captain Dick located his seat kit 10-20 yards away and removed the hit and run kit. He removed and turned on the survival radio then selected Guard frequency. Hearing only the transmission from his personal locator beacon, he returned to the hit and run kit, located the personal locator beacon, and switched it off. He then made contact with Spider 31 on the survival radio. Captain Dick stated when he opened the seat kit he noticed some of the water pouches were broken (TAB V-5). All items in the seat kit had current inspection dates (TAB U-13). No other failures of personal life support or survival equipment were noted (TAB V-5).

H. Rescue:

The time of the crash was approximately 1130L, 0730Z (TAB A). The first call for rescue came from the Supervisory of Flying, Captain William Craig, sometime between 1127L and 1130L (TAB V-1). Captain Dick established contact with Spider 31 and discovered his position was unknown. He retrieved the compass from the hit and run kit and vectored Spider 31 to his position. Captain Dick stated that after a ten minute wait he saw a host nation Search and Rescue (SAR) helicopter overfly the aircraft wreckage, then fly to his exact position. He was flown back to the deployed base in the SAR helicopter. No evidence was found to suggest a problem with the joint rescue effort (TAB V-5).

I. Crash Response:

Captain Craig was supervisor of flying at the time of the mishap and heard Captain Heinz report a good chute after ejection. Upon hearing this radio transmission, he immediately launched the host nation SAR helicopter (TAB V-1). Captain Dick saw the SAR helicopter overfly the aircraft wreckage and suspected they were having difficulty locating his exact position. He was situated between some rather tall sand dunes. Shortly thereafter, the SAR helicopter approached Captain Dick's exact position and landed (TAB V-5).

J. Maintenance Documentation:

A complete review of all manual and automated aircraft maintenance records and forms on F-16C, 88-0453, was performed. There were no overdue Time Compliance Technical Orders (TCTO) or time change items (TAB U-3). Review of oil analysis records reflect no adverse metal wear trends (TAB U-9). All scheduled maintenance had been accomplished (TAB U-1). The aircraft was accepted by the 388th TFW in December 1989. The last 150 hour phase inspection was performed on 12-13 February 1991 at the deployed location. This was an abbreviated combat phase combined with a 75 hour hourly post-flight and borescope inspection. No discrepancies were noted. The 781K reflected nine delayed discrepancies. Only the temporarily repaired V-band clamps on the A system and B system hydraulic pumps involve systems that failed during the accident (TAB U-7). The sixty-day maintenance history revealed only one major system malfunction, an augments no light before takeoff on 21 January 1991. The flame sensor was cleaned and the repair was effective (TAB U-8). A pre-flight inspection was performed on the night of 12 March 1991 with no discrepancies noted (TABs V-6, U-4). The exceptional release was signed by the night shift production superintendent (TAB U-4). Captain Dick accepted the aircraft and its forms in that condition (TAB V-5).

K. Maintenance Personnel and Supervision:

- (1) Pre-flight inspection was correctly performed the night before the day of the accident for F-16C, 88-0453 (TAB U-4).
- (2) Review of all training records and individual testimony (TABs V-6, V-7, V-8, V-10) revealed flightline and end-of-runway personnel were trained and qualified for their tasks (TABs U-11, V-6, V-7, V-8, V-10).

L. Engine, Fuel, Hydraulic, and Oil Inspection Analysis:

- (1) The intake inspection was conducted in accordance with Technical Orders (TOs) and directives the night before the accident. A review of engine records revealed no significant trends or improper maintenance actions.
- (2) Fuel test report data was normal (TAB U-10).
- (3) Hydraulic fluid test results were normal (TAB U-9).
- (4) Engine oil test report results were normal (TAB U-9).

(5) Liquid oxygen test results were normal (TAB U-10).

M. Airframe and Aircraft Systems:

The mishap aircraft was completely destroyed on impact. Several parts were recovered from the crash site and were shipped back to the U.S. from the deployed location. Examination and analysis of those parts revealed the following:

(1) Both hydraulic reservoirs had their pistons trapped at the bottom of the reservoir indicating that there was no fluid present at impact (TAB J).

(2) Evidence of inflight fire on or around the A system hydraulic reservoir, A system hydraulic pump line, A system hydraulic pump, EPU turbine assembly, and standby generator was inconclusive (TAB AA-2).

(3) Examination of the EPU turbine assembly indicate that the EPU was activated and running for an undetermined time in flight, but was not running at impact (TAB AA-2).

(4) Laboratory examination of EPU hydrazine tank burst disk shows inconclusive evidence of firing (TAB J).

(5) Post-crash analysis of main and standby generator armatures indicates they were spinning at impact (TAB J).

(6) Analysis of flight control Integrated Servo Actuator (ISA) positions indicate left and right flaperons 1.4 degrees trailing edge up, rudder 0 degrees deflection, right horizontal tail 2.9 degrees trailing edge up, and 3.9 degrees trailing edge up at impact (TAB J).

(7) Data from the Crash Survivable Flight Data Recorder (CSFDR) and Seat Data Recorder (SDR) indicated an A system hydraulic pressure loss, pitch rate gyro failure, erratic landing gear indications, EPU air command, standby generator failure, and FLCS D branch failure (TAB J).

N. Operations Personnel and Supervision:

This mission was authorized by Lieutenant Colonel Thomas Rackley on 388 TFW Form 10, dated 12 March 1991 (Tab K). Captain Heinz gave the coordination briefing for the 2V2 AI, and then the flight briefing for the element and his instrument check subject to

Captain Dick's evaluation. These were performed using the 421 TFS deployed briefing guide. Squadron supervisory personnel were in the squadron, but were not present during the actual flight brief. This is normal. The mission was thoroughly and adequately briefed (TAB V-5).

O. Pilot Qualifications:

(1) Examination of pilot flight records revealed the mishap pilot was qualified and current in accordance with current regulations and directives to fly the mission (TAB T).

(2) Captain Dick was an experienced instructor pilot with 1638 hours of flight time, 461 of those in the F-16C/D. Captain Dick's formal training courses were normal. He was proficient in all 421 TFS missions and had flown regularly during the last 30, 60, and 90 day periods. His tactical qualification was valid through August 1992 (TABs E and T).

(3) The flying experience for Captain Dick is as follows:

Total Time	F-16C/D	F-16A/B	I/P	30/60/90
1638	461	1148	860	15/35/51

P. Medical:

A complete review of Captain Dick's record reveals the following:

(1) He was medically qualified for flying duties at the time of the mishap. He had no current illnesses, was not on medications, and had no waivers (TAB X).

(2) The post-accident examination revealed only minor injuries resulting from the mishap. None of the examination results appear to relate to the accident (TAB X).

Q. Navigational Aids and Facilities:

Navigational aids and facilities were operational during the mission (TAB V-11).

R. Weather:

(1) Forecast weather at 0400Z/0800L was scattered clouds at 4000 feet, 8000 feet, and 25,000 feet, visibility 9000 meters with haze, and winds 120 at 9 knots (TAB W). The supervisor of flying,

Captain Craig, reported the weather as clear at the time of the accident (TAB V-1).

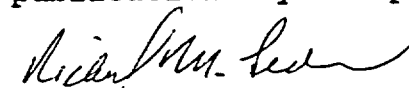
(2) Weather warnings and advisories: None (TAB W).

S. Directives and Publications:

(1) The following publications were applicable to the mission:

AFR 60-1	Flight Management
AFR 60-16	General Flight Rules
TACR 51-50	Flying Training-Tactical Fighter
TACR 51-50, Vol 6	F-16 Aircrew Training
TACR 55-116	F-16 Aircrew Operational Procedures
	Aircrew Standardization/Evaluation Procedures

(2) There were no known deviations from the directives or publications by the pilot or others involved in the mission.



RICHARD M. PEDERSEN, Lieutenant Colonel, USAF
Investigating Officer

FROM: SIB President

SUBJ: Disposition of SIB Materials

TO: Whomever It May Concern

The SIB convened to determine the cause of the 388 TFW(P) Mishap (F-16CG, 88-0453) and has released the following materials to 388 TFW Accident Investigation Board:

1. Miscellaneous aircraft parts.
2. All appropriate aircraft and engine records.
3. Crash site photographs.
4. Part I of the format report.
5. Personnel records.
6. Training records.
7. Flight evaluation folder.
8. List of witnesses.
9. Egress components/life support records.
10. Medical records.


JAMES E. SANDSTROM, Col, USAF
President, Safety Investigation Board

1st Ind, LTC Pedersen

TO: SIB

Acknowledge receipt of above listed items.

LIST OF NON-ORIGINAL DOCUMENTS

TAB DOCUMENT

K-1 388 TFW Form 10, Local Flight Clearance
On file in 421 TFS

R-1 Crash Survey
Full size original stored with evidence

T-2 Record of Evaluation
T-3 Temporary Flight Evaluation Certificate
T-4 Qualification Summary
T-5 Deployed Air Combat Training Program
T-6 Individual Physiological Training Record

Captain Dick has the originals and is required by regulation to keep them in his personal records.

U-9-2 Oil Analysis Record, Aircraft 453
U-9-3 Spectrometric Analysis
U-9-4 Oil Analysis Record, Oil Cart

On file with Headquarters Ogden Air Logistics Center,
Hill AFB, Utah

U-10 Fuel and Liquid Oxygen Analysis
On file with 388 TFW, RM/LGSF, Hill AFB, Utah

X-2 Post Examination Record
X-3-2 & Toxicological Examination
X-3-3
X-5 Annual Flight Physical, Form 1042
X-6 Form 1042 Grounding Captain Dick after Accident
X-7 Form 1042 Releasing Captain Dick to Fly

Captain Dick has the originals and is required by regulation to keep them in his personal records

Richard M. Pedersen

RICHARD M. PEDERSEN, Lieutenant Colonel, USAF
Investigating Officer