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**AFR-110-14**  
**USAF AIRCRAFT**  
**ACCIDENT**  
**INVESTIGATION**  
**BOARD**

**27 SEP 93**  
**GILA BEND RANGE, AZ**

**F-16C AIRCRAFT**  
**S/N 86-0253**

**944FG**  
**302FS**

**INVESTIGATION OFFICER**  
**JOSEPH R. CASPERS, COL, USAF**

**HQ**  
**12TH AIR FORCE**

PFS 159  
Exh. ~~158~~

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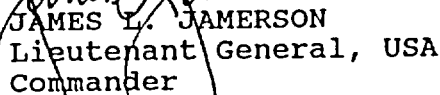
08 Dec 1993

FROM: HQ 12 AF/CC  
5340 E. GAFFORD WAY, SUITE 132  
DAVIS-MONTHAN AFB AZ 85707-4250

SUBJ: Aircraft Accident Investigation: 27 Sep 93, F-16C,  
SN86-0253 and 86-0212, 944 FG (302 FS), Luke AFB AZ

TO: HQ 12 AF/JA

Subject aircraft accident investigation is approved.

  
JAMES L. JAMERSON  
Lieutenant General, USAF  
Commander

57694

CERTIFICATION

I certify that the documents contained in this report are the originals or true copies of the originals.

  
JOSEPH R. CASPERS, Colonel, USAF  
Investigating Officer

AFR 110-14  
AIRCRAFT ACCIDENT INVESTIGATION  
FORMAL REPORT OF INVESTIGATION

**1. AUTHORITY AND PURPOSE:**

a. The Commander, Twelfth Air Force (ACC) appointed Colonel Joseph R. Caspers, under Air Force Regulation 110-14, to investigate and determine the facts and circumstances surrounding the aircraft accident involving F-16C aircraft 86-0212 and F-16C aircraft 86-0253, that occurred on 27 September 1993, on Range 4, Barry M. Goldwater Range Complex, Arizona (TAB A-1) Major Gary S. Allard, 58 Training Squadron, Luke AFB, AZ, provided technical operations advice (TAB Y-2); Major Glen K. Nagasawa, 58 Medical Group, Luke AFB, AZ, provided technical medical advice (TAB Y-3); Major Donald G. Tyson provided technical legal advice (TAB Y-4); and MSgt Charles H. Shannon, 310 Fighter Squadron, Luke AFB, AZ, provided technical maintenance advice (TAB Y-5) The purpose of the investigation is primarily to obtain and preserve available evidence for claims, litigation, disciplinary and administrative actions, and for all other purposes deemed appropriate by competent authority.

b. This investigation was conducted to determine the facts and circumstances surrounding the mid-air collision between F-16C, 86-0212, call sign Devil 1, and F-16C, 86-0253, call sign Devil 2, and the subsequent crash of F-16C 86-0253 on Range 4 of the Barry M. Goldwater Range Complex. The incident occurred at approximately 12:29 hours (TAB AA-3), Mountain Standard Time (MST), 27 September 1993 (TAB A-1). Aircraft F-16C 86-0212 received substantial damage to the right wing and right aft fuselage (TAB M-1) but recovered at Gila Bend Air Force Auxiliary Field (AFAF). Aircraft F-16C, 86-0253, crashed on Range 4 of the Barry Goldwater Range Complex and was destroyed (TAB M-1). The pilot of F-16C 86-0212 received no injuries The pilot of F-16C 86-0253 broke a bone in his left ankle (TAB X-1)

**2. SUMMARY OF FACTS:**

a. History of Flight:

Four F-16C aircraft, call sign Devil 1 through 4, took off from Luke AFB, AZ at 11:48 MST, on 27 September 1993 (TAB K-1, G-3,4). They were to conduct surface attack training on Range 4 of the Barry M. Goldwater Range Complex. At 12:29 MST, while rejoining over Range 4, Devil 2 collided with Devil 1. Due to the impact Devil 2 lost control and ejected from Aircraft 86-0253. Devil 1 declared an emergency and recovered Aircraft 86-0212 into Gila Bend AFAF with substantial damage (TAB V-1, 2,3,4). The wreckage from Aircraft 86-0253 and parts of Aircraft 86-0212 all landed within the confines of Range 4 approximately 3 NM northeast of Range 4's main tower (TAB R-1,2). Maj James Leslie, the pilot of Devil 2, ejected successfully while receiving minor injuries during his parachute landing fall (PLF). Initial news releases were provided to the public by the 58th Fighter Wing, Public Affairs Office, Luke AFB, AZ (TAB AA-6).

b. Mission:

The mission was scheduled as a 4 ship surface attack sortie to accomplish required events for each of the 302nd squadron pilots (TAB V-1,2,3,4). The primary objective of the mission was to increase weapons delivery proficiency in five different events. The secondary objective was to validate weapons parameters for the units new "War Books." Devil 1 was flown by Capt Rick Lantz. Devil 2 was flown by Maj Jim Leslie. Devil 3 was flown by Capt Joe McDaniel and Devil 4 was flown by Col Dick Hall (TAB K-1).

c. Briefing and Preflight:

All flight members had adequate crew rest for the mission. The preflight briefing started at 10:10 MST and was briefed in detail by Capt Lantz using a 302nd Fighter Squadron Briefing Guide. The briefing guide contains all applicable items required by existing regulations. All members of the flight indicated they clearly understood the objectives, the general flow of the mission, and had no questions by the conclusion of Capt Lantz's briefing (TAB V-1,2,3,4). All pilots arrived at their jets IAW briefed times and began preflight inspections. Preflight, engine start and taxi were all normal (TAB V-1,2,3,4,11,12,22,23). Devil 3 had a minor aircraft problem that was attended to in the arming area (TAB V-1), but delayed the planned take-off eight minutes. All other events prior to take-off were normal.

d. Flight Activity:

(1) Devil Flight was filed and cleared for an AZAR ARSON stereo flight plan. At 11:48 MST, they accomplished single ship afterburner takeoffs with 15 seconds between aircraft. They rejoined to 2-plus-2 enroute to Range 4. The SID (standard instrument departure) was terminated as they approached the Goldwater Range Complex and Devil Flight checked in with Range Operations.

(2) Devil flight checked on with Range 4 at 12:04 MST (TAB AA-8) and gave the Range Control Officer (RCO) a brief overview of the planned events. Devil Flight each expended 6 BDUs (practice bombs) and 100 rounds of 20mm TP (inert 20mm ammunition) flying the five briefed weapons deliveries. At the conclusion of the "Hot" weapons events Devil Flight safed-up all their switches and egressed the conventional range pattern to the west. (TAB V-1,2,3,4)

(3) Devil 1 told the RCO that Devil Flight would be doing dry SAT (surface attack tactics) attacks under flight lead control on the NUKE circle (target for nuclear weapons deliveries) for the next ten minutes. Devil 1 and 2 set up for a 6000' line abreast element attack. (20 degree/20 degree HI) on the NUKE circle, ingressing from the west and actioning north into the wing man for a southeasterly tip-in with a southerly egress. Devil 3 and 4 set up for their own 6000' line abreast element attack (45 degree pop-up delivery) ingressing from the same direction with greater than 5 miles spacing from the lead element (TAB V-1,2,3,4). At the termination of the first attacks, Devil 1 & 2 then 3 & 4 flowed back right to west to set up for the second attack.

(4) Devil 1 element and Devil 3 element swapped attack parameters for the second attack however the formation, ingress direction, and spacing remained the same (TAB V-1,3,4). At the termination of Devil 1's simulated weapons delivery, he started a climbing left hand turn for the 2-plus-2 rejoin as briefed (TAB V-1,2). At the termination of Devil 2's attack, he called off target with lead in sight. Devil 2 began his rejoin and executed an acceleration maneuver to gain closure on Devil 1. As Devil 2 continued, he recognized the need for, and executed, an overshoot to a position high on Devil 1's right wing. From there, he executed a rolling maneuver to a position low on Devil 1's left wing, and subsequently loses sight of Devil 1. Devil 3 asks Devil 1's position to effect the 2-plus-2 rejoin (TAB V-1,2,3,4). Devil 1 responds with his turn direction, position over the range, and heading (TAB N-1). He then told Devil 3 of his intent to reverse his direction of turn and also called out his position from Devil 3. Within 2 seconds of the end of this radio call, MA2 struck MA1.

e. Impact:

(1) Aircraft 86-0212 (MA-1) and 86-0253 (MA-2) were involved in a mid-air at approximately 12:29 MST on 27 September 1993 (TAB A-1). During the rejoin over the range, MA-2's left stabilizer struck the right wing tip of MA-1. The force of the impact on MA-1 bent the right wing, outboard of the flaperon, up 90 degrees. It also ripped off the outboard 2.5 feet of the leading edge flap assembly and the missile rail which struck the fuselage on the aft right side as it departed the aircraft. MA-2 had the left horizontal stabilizer assembly, the left speedbrake and approximately 60 percent of the augmentor nozzle assembly broken off at impact. (TAB J-1,2,3,4)

(2) Immediately after impact, Capt Lantz, in MA-1, noticed a strong right rolling tendency which he was able to counteract with full left trim and partial stick deflection. He declared an emergency and performed a controllability check as he headed for Gila Bend. He determined he had full control as long as he maintained over 165-170 knots (TAB V-1). He flew a descending right turn to a modified straight-in to Runway 35, landing at a higher than normal but controllable airspeed. He stopped the aircraft with brakes and shut down and egressed the aircraft at the direction of the Fire Chief. (TAB V-1)

(3) Maj Leslie, in MA-2, felt a thump similar to jet wash and noticed many system warning lights illuminate. MA-2 pitched up to a near vertical attitude immediately after impact (TAB V-2, AA-7) due to the loss of the left horizontal stabilizer. Maj Leslie assessed his situation as he fought to regain control of the aircraft. In the near vertical attitude MA-2 ran out of airspeed, started a descent and then entered a flat spin rotating to the right. Maj Leslie attempted but could not exit the flat spin and subsequently ejected from the aircraft. (TAB V-2)

f. Ejection:

The pilot of MA2, F-16C 86-0253, ejected at approximately 5300 feet above mean sea level (MSL) and landed on Range 4 of the Barry M. Goldwater Range Complex (TAB V-2).

g. Personal and Survival Equipment:

- (1) All personal and survival equipment inspections were current (TAB AA-1).
- (2) No personal/survival equipment difficulties were noted inflight, or during ejection (TAB V-2).
- (3) The visor on MP2's helmet was not properly fitted to the current oxygen mask in accordance with Technical Order 14P3-4-151, paragraph 5-18, b. (TAB AA-2, AA-12).

h. Rescue:

- (1) The accident occurred at 12:29 MST on 27 September 1993 (TAB A-1).
- (2) The first call was made by Devil 1 at 12:29 MST on the Range 4 control frequency to Devil 3 (TAB N-1). The Range 4 tower controllers heard the call at the same time (TAB V-6).
- (3) Gila Bend AFAF crash recovery personnel were notified and responded (TAB V-5). The first personnel to the crash site were two employees of JB Industries (JBI). They found the pilot (MP2) on his feet and ambulatory (TAB V-7). The pilot was transported to the Gila Bend AFAF medical aid station by the JBI employees. A Blackhawk helicopter from Western Army Aviation Training transported both MP1 and MP2 to Luke AFB. (TAB V-5)

i. Crash Response:

- (1) Personnel from Gila Bend AFAF responded to secure the crash site (TAB V-5)
- (2) No delays were encountered in responding to the crash site.
- (3) No difficulties were encountered in the rescue effort. (TAB V-5, V-2)

j. Maintenance Documentation:

A thorough review of maintenance documentation dating back 60 days revealed no significant irregularities or deficiencies (TAB AA-1).

k. Maintenance Personnel and Supervision:

A review of maintenance personnel and supervision records and training was not required. (TAB AA-1)

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

There were no significant irregularities or deficiencies in these areas (TAB AA-1).



m. Airframe and Aircraft Systems:

Based on the technical and engineering evaluations of materiel, all components and accessory systems appear to have been operating normally (TAB J-1).

n. This mission was authorized by Maj Kevin Henabray on a computer generated local flight clearance form, order number 206 (TAB K-1). Squadron supervisory personnel were in the squadron, but were not present for Devil 1 flight's briefing. The 944 FG commander was Number 4 in Devil 1 Flight and did attend the briefing. The mission was thoroughly and adequately briefed (TAB V-1,2,3,4).

o. Crew Qualification:

(1) Capt Lantz is an experienced fighter pilot with 2018.4 total flying hours and 1844.4 total fighter hours in the F-16 A/B/C/D and AT-38. He has logged 672.6 hours as an Instructor Pilot (IP), all of which has been in the F-16. He was qualified and current in the F-16C and training records indicate his proficiency status was good. His 30-day/60-day/ 90-day totals are 7.8 hours/14.8 hours/23.7 hours (TAB T-1). Capt Lantz was trained and qualified to fly the mission IAW current guidance (TAB T-1).

(2) Maj Leslie is an experienced fighter pilot with 2778.9 total flying hours and 2575.3 total fighter hours in the F-16C/D, F-4D, A-7D and AT-38. He has logged 298.5 hours as an IP. He was qualified and current in the F-16C and training records indicate his proficiency status was good. His 30-day/ 60-day/90-day totals are 11.1 hours/17.0 hours/23.9 hours (TAB T-2). Maj Leslie was trained and qualified to fly the mission IAW current guidance (TAB T-2).

p. Medical:

Both pilots were medically qualified for flight at the time of the mishap, (TAB AA-2) Capt Lantz suffered no injuries. Maj Leslie suffered a fractured left talus (ankle) (TAB X-1)

q. Nav aids and Facilities:

All nav aids and facilities were operating and functional for the entire duration of Devil's flight (TAB W-5 thru 10).

r. Weather: /

The forecast weather for Gila Bend was clear of clouds with 7 miles of visibility. Light turbulence from the surface to 10,000 feet. Winds out of the southeast (130 degree) at 9 knots. No hazards were forecasted (TAB W-1 thru 5). The sun was approximately south and 56 degrees elevation.

s. Directives and Publications:

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

AFR 50-46	Weapons Ranges
AFR 60-1	Flight Management
AFR 60-16	General Flight Rules
MCM 3-3 Vol V	Combat Aircraft Fundamentals
TACR 51-50	Flying Training - Tactical Aircrew Training
MCR 51-50, Vol VIII	Flying Training - F-16 Pilot Training
AFR 55-79	Aircrew and Weapons Director Procedures for Air Operations
MCR 55-116	Operations - F-16 Pilot Operational Procedures
ACCR 60-2	Flying - Aircrew Standardization and Evaluation Program
T.O. 1F-16C-1	Flight Manual F-16

(2) There were no known or suspected deviations from the directives or publications by crew members or others involved in the mission except for MCM 3-3 Vol V, Combat Aircraft Fundamentals, MCR 55-116, F-16 Aircrew Operational Procedures, and AFR 60-16.

(a) Although not regulatory in nature, MCM 3-3, Vol V, provides guidance for consideration which addresses situations in which a wing man should leave formation (TAB AA-4, page 3-9, paragraph p(1)), as well as how to leave the formation (TAB AA-4, page 3-9, paragraph p(2)). MP2 disregarded the fundamental procedures and techniques in the MCM by not leaving formation when he lost sight of MA1 and by not leaving formation to avoid flying over or under MA1.

(b) MCR 55-116, paragraph 7-7, prescribes procedures to be used "upon losing sight of lead ...". MP2 attempted to remain in formation for not less than 8 seconds and not more than 14 seconds, with no visual contact on MA1.

(c) AFR 60-16 prescribes general flight rules which govern the operation of Air Force aircraft, and applies to U.S. Air Force Reserve units and members. Paragraph 5-1 prohibits the operation of an Air Force aircraft in a careless manner, so as to endanger life or property.

### 3. FINDINGS/FACTS, CONCLUSIONS, AND STATEMENTS OF OPINION:

Under 10 U.S.C. Section 2254(d), any opinion of the accident investigators as to the cause of, or 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.

a. This section will include the findings/facts, conclusions and statements of opinion of the AFR 110-14 Investigating Officer for the mid-air between Aircraft 86-0212 and 86-0253 (F-16Cs from

the 944 FG, 320 FS) and subsequent crash of Aircraft 86-0253 on Range 4 of the Barry M. Goldwater Range Complex.

b. The accident sequence for this mishap began as MA1 came off his last pass on Range 4 and began his left climbing turn for rejoin.

c. Findings and Causes are listed below:

FINDING 1: MP1 came off his last pass and began a left climbing turn for rejoin. (TABS N-1, V-1)

FINDING 2: MP2 came off his last pass and called that he had the lead aircraft (MA1) in sight. (TABS N-1, V-2)

FINDING 3: MP2 accelerated to gain overtake for rejoin on MA1. (TAB V-2)

FINDING 4: MP1 monitored MP2's rejoin. (TAB V-1)

FINDING 5: MP2 recognized excessive overtake and decided to overshoot. (TAB V-2)

FINDING 6: MP1 lost sight of MA2 while MP2 was outside MA1's flight path executing his overshoot. (TAB V-1)

FINDING 7: MP2 improperly attempted to control his overtake with a vertical climb while outside MA1's flight path and arrived at a position approximately 700 feet above lead, high on his wing line and nearly over his flight path. (TABS O-2, V-2)

FINDING 8: MP2 elected to do a vector roll to the left to reposition back to the inside and down the MA1 wing line (TABS V-1, V-2)

FINDING 9: MP1 regained sight on MA2 as he began his reposition maneuver from right to left above MA1. (TAB V-1)

FINDING 10: MP1 monitored the MA2 until it appeared to be in a controlled position low down his left wing line approximately 2000 feet away. (TAB V-1)

FINDING 11: DEVIL 3 called MP1 on the radio and asked for the position of the lead element (MA1 and MA2). (TAB N-1)

FINDING 12: MP1 responded to DEVIL 3's radio call and looked back to the target area to find DEVIL 3 and 4. (TABS N-1, V-1)

FINDING 13: MP2 maneuvered his aircraft under MA1 to a position out of MP1's field of

view where the sun caused him to lose sight of MA1. (Cause) (TABS V-2, AA-11)

FINDING 14: MP2 remained in formation without seeing MA1 and attempted to regain sight of lead for an extended period of time, not less than 8 seconds or greater than 14 seconds. (Cause) (TABS O-2, V-2)

FINDING 15: MP2 became disoriented while looking into the sun for MA1 and allowed his aircraft to climb to MA1's altitude. (Cause) (TAB V-2)

FINDING 16: MA2 struck MA1 causing damage to the right wing of MA1 and breaking off the left horizontal stabilizer of MA2. (Cause) (TABS A-1, J-4, J-5)

FINDING 17: MA2 departed controlled flight and was unrecoverable due to damage sustained in the impact with MA1. (TABS V-2, J-1)

FINDING 18: MP2 ejected from MA2. (TAB V-2)

FINDING 19: MA2 crashed on Range 4 of the Barry Goldwater Range Complex. (TAB R-1)

FINDING 20: MP1 recovered the damaged MA1 into Gila Bend AFAF. (TAB V-1)

d. Based on the available physical evidence and testimony, it is the Investigating Officer's opinion that although the accident sequence begins with the rejoin off the range, the actual causes for the accident revolve around MP2's failure to follow established guidance for required actions when a wing man loses sight of the flight lead while in formation and the physical phenomena of spatial disorientation.

e. The spatial disorientation begins when MP2 performs the rolling reposition. To perform this maneuver, he makes MA1 his sole attitude reference. As he maneuvers to a position below and left of MA1, he is looking through the top of the F-16 bubble canopy at MA1 against a blue sky background, and basically loses any peripheral reference from the horizon. As his aircraft moves to a position under and slightly forward of lead, this phenomena is exacerbated by two things:


(1) To maintain sight of MA1, MP2 must tilt his head further back which causes a tendency to fly up or in the direction one is looking (somatogravic effect).

(2) During this move under MA1, MP2 loses sight of MA1 in the sun. This effectively removes any visual attitude reference. This means that MP2's sole attitude reference is now coming from his vestibular and proprioceptive senses (This is commonly known as "seat of the pants" flying). In the absence of any visual reference, these senses are unreliable for perception of smooth movements of the aircraft. This is the reason that MP2 does not perceive his climb from his position approximately 1800 feet below MA1 up to MA1's altitude. Throughout this climb, MP2 believes he is basically in level flight and well below MA1. The spatial disorientation experienced by MP2 is Type 1 Spatial

Disorientation

f. Even with the spatial disorientation, this accident would not have occurred if MP2 follows guidance established in MCM 3-3 which details when a wing man should leave formation, and MCR 55-116 for lost wing man procedures. In addition, reference AFR 60-16, MP2 operated his aircraft in a careless manner by remaining in formation with MA1 for an extended/excessive time without visual contact.

g. These factors were causal in this accident in that they result in the mid-air that caused the damage to F-16C, 86-0253 and resulted in the loss of the aircraft.

  
JOSEPH R. CASPERS, Colonel, USAF  
Investigation Officer

1 Atch  
Memo for record

-P  
for t.  
when a wing  
spatial