INVESTIGATION OF USAF AIRCRAFT ACCIDENT

24 MAY 1993

F-16C SN 90-0832

AIR FORCE MATERIEL COMMAND

Lockheed Ft Worth Company
Ft Worth, Texas

Investigator:
Colonel Edward L. Daniel

NUCLEAR REGULATORY COMMISSION

Docket No. _____ Official Exh. No. 152

In the matter of PTS

Staff _____ IDENTIFIED ✓

Applicant ✓ RECEIVED _____

Intervenor _____ REJECTED _____

Other _____ WITHDRAWN _____

DATE 7/11/84 Witness _____

Other _____

FORMAL REPORT OF INVESTIGATION

19 August 1993

I. AUTHORITY AND PURPOSE

A. At the direction of the Commander, Air Force Materiel Command (AFMC/CC Letter, 20 July 1993), an AFR 110-14 investigation of a major aircraft accident involving F-16C, SN 90-0832, was conducted at the Lockheed Ft Worth Plant and Carswell AFB, Ft Worth, Texas. (Tab Y)

Accident Investigator:
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Legal Advisor:
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Wright-Patterson AFB, OH

Technical Advisor:
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B. This investigation was conducted to preserve available evidence and provide a factual summary of the accident which occurred near the town of Mineral Wells, Texas, on 24 May 1993, resulting in total loss of the aircraft and fatal injuries to the pilot, Mr Joseph W. Dryden, Jr.

II. SUMMARY OF FACTS

A. History of Flight

1. Mission Description

The flight, designated by the aircraft radio call sign "Roket 4" (sic), was conducting a mission known as a "Company 1" flight which was the initial functional check flight of a brand new aircraft off the Lockheed production line (Tab K). Mr Dryden's mission was to complete an initial company Acceptance Check Flight (ACF, or "Company 1") profile in accordance with the company's contractual procedures outlined in publication 16PP098K, *"Contractor Production Flight Procedures and Tolerances Document for F-16 Aircraft."* The flight took off from Carswell AFB, Texas, at 0923 Central Daylight Time on 24 May 93, with a planned recovery at Carswell AFB (Tab K) after an estimated 1 hour and 5 minutes flight time. After conducting multiple flight test points enroute and in the "GD North" airspace (designated airspace north of Carswell AFB between 31,000 ft and 50,000 ft [Tab K]), Mr Dryden proceeded to VR-118 (a visual low level route depicted in DOD AP/1B) (Tab K) to conduct both lower altitude test points and aircraft radar tests with another F-16. The other aircraft, piloted by Lockheed test pilot Mr Steve Barter using radio call sign "Roket 3," was another F-16 conducting a similar "Company 1" profile (Tab V). Roket 3 first checked his radar at the planned 5,000 ft altitude, using Roket 4 as his low altitude target. Normal procedures dictated the low altitude target fly at 1,000 ft above the ground (AGL). The two aircraft then switched roles, with Roket 4 at 5,000 ft checking his radar against a 1,000 ft target. Roket 3 then asked to switch rolls again, as his radar had not passed its checks and Mr Barter wanted to re-evaluate it on another pass. To set up these passes, each aircraft flew to opposite ends of the VR-118 area (Northeast and Southwest ends). At the completion of each pass, each aircraft would proceed to their individual

starting points to begin the next pass. After reaching their starting points (and upon the other pilot's radio call), the two aircraft would reverse direction (to point at one another) and establish appropriate altitudes to begin the next data pass. Various aircraft data recorders indicated that while setting up for these radar data passes, the mishap pilot varied his altitude between 200 ft and 5,000 ft above the ground (Tab O). Although there was no way to determine the exact reason for this maneuvering, it was presumed the pilot was obtaining additional "Company 1" flight data, as specified in the contractor's document number 16PP098K. Upon reaching their starting points for the third and final radar pass, Roket 3 (the interceptor) asked Roket 4 (the target and mishap aircraft) to reverse his course in order to begin the pass (Tabs N and V). Roket 4 acknowledged, and his crash survivable data recorder indicated at that point he rolled inverted at approximately 2,100 ft above the ground at approximately 260 knots indicated airspeed, and pulled the nose of the aircraft down in a precise and constant split-S maneuver (Tabs A, J, O and V). At the start of this maneuver, Roket 3 also asked Roket 4 to check his TACAN in the air-to-air mode. After the nose of the mishap aircraft passed through the vertical, and at approximately 620 ft above the ground and 40 degrees nose low, the mishap pilot initiated ejection (Tab J). Analysis (Tab J) indicated the ejection system functioned properly, but the altitude at which ejection was initiated did not allow sufficient altitude to prevent the pilot from hitting the ground at a velocity which proved fatal. Additional analysis of the mishap pilot's parachute, parachute risers, and burns to his exposed skin (Tabs J and Z) also indicated he went through the fireball generated by the crash of his aircraft. At some point the fireball burned through his parachute risers and some panels of his parachute, possibly further preventing adequate deceleration of the pilot prior to his fatal impact with the ground. The aircraft impacted in an open field, very near a house under construction, and was destroyed (Tabs A, P and S). There was minimal collateral damage and there were no other injuries (Tabs A and S).

2. Significant Facts Surrounding the Accident

a. Personnel

Aircraft Commander: Mr Joseph W. Dryden, Jr, was designated on the DD Form 175 (Military Flight Plan) as the mission pilot, as approved by the Government Flight Representative on a DLA Form 644 (Request for Flight Approval) on 3 May 1993 (Tab K). Mr Dryden had a total of 2,069.8 flying hours in the F-16, and had accumulated 7.4 F-16 flying hours during the 30 days prior to the accident, 15.3 flying hours in the previous 60 days, and 26.0 hours within the previous 90 days. He had approximately 8,000 hours total flying time. (Tab G)

b. Mishap Aircraft

This mishap occurred on the first flight of a Block 50 F-16C model aircraft, serial number 90-0832 (Lockheed sequence number CC-32), which was powered by a General Electric F110-GE-129 engine. Aircraft and flight data for this flight was recorded and recovered from a Crash Survivable Flight Data Recorder (CSFDR, which recorded both the performance of aircraft systems throughout the flight as well as aircraft flight parameters), from a Seat-Mounted Flight Data Recorder, from stored memory within the flight control computer, from a voice tape carried by another aircraft (Roket 3), and from data recorded by Ft Worth Center (the local air traffic control facility). The level of detail contained in all this memorized data (Tabs J and O), together with the recorded voice communications (Tab N), provided a complete summary of the flight profile, flight parameters, and performance of key aircraft systems. An engineering team assembled by the F-16 System Program Office thoroughly reviewed both the aircraft remains and recorded data and found that, except for the cockpit vertical velocity indicator, the aircraft was properly functioning at the time of the mishap (Tab J). In addition, a specialist team was assembled to evaluate the aircraft's escape system. They concluded the aircraft's ejection system functioned as designed, and the pilot was fatally injured due to an out-of-envelope ejection. (Tab J)

c. Mission Control

At the time of the mishap, both Roket 3 and Roket 4 were working under their own control in designated airspace where visual flight rules applied. The flight was also being monitored by the Ft Worth Center air traffic control facilities. This method required individual pilot monitoring of navigation, other aircraft, and flight safety parameters.

d. News Media

The initial news release of this accident was made by the Carswell AFB Office of Public Affairs on 24 May 93.

B. Mission

The mishap aircraft, radio call sign "Roket 4," was on a scheduled and approved initial contractor acceptance check flight, typically referred to by the aircrews as a "Company 1" flight. The pilot was following the procedures outlined in the contractor document 16PP098K, *"Contractor Production Flight Procedures and Tolerances Document for F-16 Aircraft,"* written under Contract No. F33657-84-C-0247.

C. Planning, Briefing, and Preflight

1. There were no indications to suggest that crew rest was less than either required or adequate, and several interviews indicated that the mishap pilot was in good spirits (Tab V). In fact, witnesses stated that Mr Dryden was very happy about his recent successful European business trip, and excited about the amount of flying he would be doing in the near future. (Tab V)

2. As this sortie was intended to be primarily single-ship, following the guidelines listed in Lockheed company document 16PP098K with which all company pilots were thoroughly familiar, no preflight briefing was required. After filling out the necessary preflight documentation and discussing the radar test portion of the mission with Roket 3, the mishap pilot reported to the aircraft and evaluated the aircraft maintenance forms with the crew chief. All preflight procedures were normal. (Tab V)

D. Flight Activity

1. Roket 4's planned mission was typical of many previous F-16 contractor pilot flown test missions. On this flight, however, some data points appeared to have been conducted at fairly low altitude during the outbound portion of setups for the low altitude radar tests, and the final split-S maneuver was initiated from an unsafe altitude. Otherwise, no other significant deviations were noted in the various flight and aircraft data recorders than what could be reasonably expected during this mission.

2. Air-to-ground, ground-to-air, and air-to-air communications throughout the flight were normal and satisfactory. The communications between the mishap aircraft, FAA control facilities, and the other radar test/target aircraft (Roket 3) were typical for this test mission. However, it was noted that just prior to the mishap Roket 3 asked the mishap pilot to "...go air-to-air 92" (Tab N), which was a request for him to select frequency 92 and the Air-To-Air Transmit/Receive mode on his TACAN. Audio and flight data recordings indicated the mishap pilot acknowledged this request with a "Roger" (Tabs N and O) after he had begun the split-S maneuver, approximately wings level inverted and 20 degrees nose low. In addition, the contractor pilots normally switched their radar to standby when acting as a target (Tab V). However, aircraft data also showed that after this acknowledgement, the mishap pilot kept constant pressure on the control stick and moved the throttle. It was deemed possible, although unlikely at the aircraft's altitude and attitude, that he momentarily removed his hand from the

throttle to adjust the TACAN through the cockpit's Up Front Control panel, or the radar through one of the cockpit's Multi-Function Displays.

3. The weather was clear in the mishap area, and navigational facilities were operational at the time of the mishap. The terrain around the mishap area, and for many miles in all directions, was very flat and dry with no visual illusions. (Tabs K, S, V, and Z)

4. Approximately 5 minutes prior to accident, and for a period of about 2 1/2 minutes thereafter, the mishap pilot appeared to be flying below 1000 ft above the ground (Tab O). It was unclear why this much time was spent at low altitude, as only one or two data points would require momentary flight below this altitude. However, the primary period of interest was the last two minutes leading up to and including the accident. A significant amount of data was available from multiple recorders onboard the mishap aircraft, as well as recorded radio transmissions. Extensive analysis revealed that the aircraft was functioning properly, and with the exception of a possible erroneous reading cockpit vertical velocity gauge (which is always unreliable and not used during maneuvering flight), onboard instrumentation was accurately portraying flight parameters to the pilot. At the conclusion of the second radar pass, the mishap pilot proceeded to the northeast corner of the VR-118 area to set up for another pass. In the general vicinity of the mishap area he then performed a series of heading reversals and smooth, controlled maneuvers, varying his altitude between 200 ft and 4,000 ft above the ground (AGL), and his calibrated airspeed (KCAS) between 185 and 290 knots. Although it was not possible to be completely certain of the exact purpose of this maneuvering, it was presumed the pilot was obtaining additional data required for this "Company 1" flight. The other aircraft, Roket 3, then radioed he was ready to begin the next radar pass (which required the target, Roket 4, to be on a southwesterly heading at 1,000 ft above the ground), and to reverse his turn to the southwest. At this time, 13 seconds prior to impact and in wings level flight on a true heading of 040 degrees and approximately 2,100 ft above the ground at 260 KCAS, the pilot began a rapid and controlled left roll, stopping at the inverted position. This was quickly followed by a pull down through the vertical with maximum aft stick force. At approximately the same time, Roket 3 asked the mishap pilot to check his TACAN in "air-to-air 92." Approximately 4 seconds prior to impact, the pilot released the control stick and initiated the ejection sequence, which occurred at approximately 620 ft above the ground (AGL). Aircraft and pilot/seat separation were successful, and data analysis indicated the pilot probably obtained first parachute inflation at approximately 220 ft AGL, but within the fireball of the aircraft which impacted below him. The heat burned through some panels in the parachute and through the parachute risers, separating the pilot from his chute, and he fatally impacted the ground in the prone position with an estimated g-force of 40 to 50. (Tab J)

E. IMPACT

The aircraft impacted at 1012 hours Central Daylight Time on 24 May 93, at coordinates N3259.5, W9802.2, 283 degrees magnetic and 31 nautical miles from Carswell AFB, Texas. This was in Parker County, approximately 3 nautical miles northwest of the small town of Witt, Texas. At impact the aircraft was in a 44 degree dive at 248 knots calibrated airspeed, with 5 degrees left bank and a positive 10 to 11 degrees angle of attack. The altimeter was properly set at 29.94, and with the possible exception of the cockpit vertical velocity indicator, all cockpit instruments appeared to be working normally. The impact crater was within 120 ft of a house actively under construction (Tab R), and aircraft debris scattered southwesterly and across a dirt road. Civil engineers from Carswell AFB were tasked to clean up and restore the crash site, and by 28 Jul 93 had neutralized any excess toxins and had returned the area to its natural state. (Tabs Z and AA)

F. EJECTION SEAT

The F-16C aircraft was equipped with an Advanced Concept Ejection Seat (ACES II) which used ballistic gas and explosive transfer lines to initiate the ejection sequence. The seat had three modes of operation (known as Modes I, II and III) determined by a recovery sequencer

which received inputs of static and dynamic pressure to determine altitude and airspeed. At altitudes between sea level and 15,000 ft with speeds up to 250 knots, the seat would operate in Mode I which would provide a short period of time (1.8 seconds) between seat rocket catapult firing and inflation of the pilot's recovery parachute. Based upon the location of the aircraft's canopy and ejection system components recovered for analysis by a team of escape system specialists (Tab J), the escape system functioned as designed. Multiple engineering analyses on this ejection indicated the pilot initiated ejection either right at or outside the safe ejection envelope (Tab J). However, the fireball from the aircraft impact burned through his parachute risers and some parachute panels, further preventing a safe recovery. (Tabs J and Z)

G. PERSONAL AND SURVIVAL EQUIPMENT

Both personal and survival equipment inspections were current. The pilot was wearing approved equipment, and also carried his own personal minimum survival kit in his g-suit pocket. Although the parachute risers and sections of the parachute canopy were burned through (and this may have been a factor in the fatal impact), these items were not designed to withstand the intense heat generated by the aircraft's fireball.

H. RESCUE

This aircraft crash occurred at 1012 hours Central Daylight Savings Time. There were several civilians constructing a house approximately 120 ft from the impact, and both they and one or two unknown individuals driving past on a nearby dirt road were first on the scene. One of these unknown individuals attempted to administer CPR to the mishap pilot. Simultaneously, a telephone call was made from another nearby home to the local civilian paramedics. These paramedics arrived at the accident site approximately 24 minutes after the crash (18 minutes after they received the call), and pronounced the pilot dead. Shortly after losing radio communications with the mishap pilot, the pilot of Roket 3 saw smoke from the crash site at approximately 1016 hours CDT. He immediately notified his company operations at the Lockheed plant at Carswell AFB, who in turn initiated their emergency crash response plan. Carswell AFB medical personnel were in turn notified by this response, and arrived at the crash site approximately 1 hour and 15 minutes later. Under the existing response procedures, this was considered a normal response time due the distances involved. Through courtesies extended by Mr Ross Perot, the first government and contractor personnel were transported from Carswell AFB to the accident site by one of Mr Perot's helicopters based at Alliance Airport, Ft Worth. Bell Helicopter provided a second helicopter shortly thereafter.

I. CRASH RESPONSE

Local law enforcement and fire suppression officials arrived at approximately the same time as the local civilian paramedics, approximately 24 minutes after the crash. Due to the lack of base helicopter support and the driving distance involved, Carswell AFB medical, security, and fire department officials arrived approximately 1 hour and 15 minutes after the crash. No difficulties were identified in either the rescue or crash response efforts. Local civilian as well as Lockheed, DPRO, and Carswell AFB medical, operations, fire, security, civil engineering, command post and public affairs personnel took appropriate actions after this mishap. There were no avoidable delays, and actions conformed to the *"Joint DPRO Fort Worth Division Aircraft Emergency Plan,"* government and contractor document number FZM-2174-11.

J. MAINTENANCE DOCUMENTATION

1. Maintenance discrepancies open: The only open write-up in the aircraft forms was a flaw in the skin of one panel, which was not related to the accident.

2. Time Compliance Technical Orders (TCTOs) completed/open: There were three open TCTOs on the aircraft, and eight on the engine. None of these were overdue, and none were related to the accident.

3 Scheduled inspections completed/outstanding: All scheduled inspections had been completed on time.

4. Oil Analysis Records: All readings from the oil analysis samples were within established acceptable standards.

5. Time Change Requirements: There were no time change requirements due on any part of the aircraft.

6. Equipment Review Report: No component inspections were performed which showed any outstanding discrepancies.

7. There were ten unscheduled maintenance actions performed between 10-24 May 1993. All were completed satisfactorily and passed operational checks. None contributed to the accident.

8. Maintenance procedures/practices/performance related to accident: None of the actions performed by maintenance technicians appeared to be related to the accident.

K. MAINTENANCE PERSONNEL AND SUPERVISION

1. Preflight servicing performance/supervision: The preflight was conducted on 23 May 93, to prepare the aircraft for its scheduled flight that day. The flight was later cancelled due to weather conditions. Ground checks were performed by Mr. Dryden so that if the weather cleared, the aircraft could be launched more quickly. All ground checks were normal, but there were three minor discrepancies that Mr. Dryden stated he would write up after the flight. These were a stiff TACAN control knob, a horizontal situation indicator index marker not straight, and a left hand upper eyebrow light out. These are not problems that would ground the aircraft until repaired. The preflight was certified as complete, and the aircraft was cleared for flight by the Defense Plant Representative Office of Quality Assurance on 23 May 93 at 0845 hours The preflight was valid for 48 hours from time of verification, and therefore was still valid at the takeoff time on 24 May 93. The pilot and maintenance crew conducted an additional walk-around inspection immediately prior to the flight on 24 May 93, with no discrepancies noted.

2 Adequacy of training and experience: All personnel who launched the aircraft were properly trained for the task. Other personnel involved with the maintenance and management of aircraft 90-0832 were competent and experienced in aircraft maintenance.

3. Maintenance practices/performance related to accident: No maintenance practices conducted on aircraft 90-0832 were related to the accident.

L. ENGINE, FUEL, HYDRAULIC AND OIL INSPECTION ANALYSIS

1. Engine inspection data: No engine inspections were overdue.

2. Fuel test report data: Fuel samples taken from the truck which serviced aircraft 90-0832 with JP-4 were analyzed and found to be normal.

3. Hydraulic fluid test reports: All hydraulic fluid evaluations indicated normal used hydraulic fluid. Both A and B systems were sampled from the actuators in the left and right side of the aircraft.

4. Oil Test Report: The oil inspection was performed at the proper time, and results were normal.

M. AIRFRAME AND AIRCRAFT SYSTEMS

1. Component and accessory systems operation testing/reports: All systems on the aircraft were recorded by aircraft computers as operating normally at the time of the accident, with the exception of the cockpit Vertical Velocity Indicator (VVI). The reading captured on the VVI at time of impact did not correlate with the readings taken from the flight data recorder. This instrument is not normally used by the pilot during maneuvers, and its failure was judged to not be related to the accident.

2. The cockpit Vertical Velocity Indicator was manufactured by Clifton Precision. It has been sent to Lockheed Fort Worth Company for shipment to the vendor.

3. None of the maintenance actions performed while the aircraft was in final assembly or on the Lockheed flight line were related to the accident, as all systems were functioning properly at the time of the accident.

N. OPERATIONS PERSONNEL AND SUPERVISION

The authority for the conduct of flight for Roket 4 rested with the Government Flight Representative (GFR), who was in this case assigned to the Lockheed Defense Plant Representative Office. The designated GFR had both contractor flight crewmember and flight approval authority, as established in DLAM 8210.1/AFR 55-22V1, and DLAM 8220.3. The mishap pilot had been approved on 12 Mar 84 by the then current GFR as a "contractor F-16 experimental test pilot," and as a "contractor F-16 instructor pilot" on 11 Dec 84 (Tab G). This particular flight was approved by the current GFR on 3 May 93 (on a Defense Logistics Agency Form 644) for any period between 1-31 May 93 (i.e., as soon as the aircraft was available), as specified in the government approved contractor Flight Operations Procedures document (Tab K). All appropriate preflight documentation was signed and filed (Tab K). As this was a well defined and basically a single ship sortie, there were no briefing requirements other than to let the potential radar target pilot know when to meet in the assigned airspace, and this was accomplished. It was noted, however, that the contractor pilots were only bound by low altitude limitations specified in the Federal Aviation Regulations (FAR 91.303[d], no aerobatic flight maneuvers below 1,500 ft above the ground [AGL]). Except in specially approved circumstances, however, military pilots cannot perform aerobatic maneuvers below 5,000 ft AGL (AFMC and ACC Supplements to AFR 60-16, and DLAM 8220.3). On at least 2 occasions during the last 3 minutes of flight, Mr Dryden's maneuvers exceeded both these limits. At approximately 500 ft AGL during a 15 degree climb at 48 minutes and 30 seconds after takeoff (48:15), Mr Dryden initiated a left roll to the inverted position, pushed forward on the control stick to a negative-g state, and apexed this maneuver at approximately 1,400 ft AGL. At 51:12, Mr Dryden initiated a split-S maneuver from approximately 2,100 ft AGL, which could neither be completed by 1,500 ft AGL nor prior to ground impact at 51:21. (Tab O)

O. CREW QUALIFICATIONS

Mr Dryden was fully qualified and current to fly the F-16C, and a review of his training and qualification records revealed no deficiencies (Tabs G and AA). He was the outstanding graduate in his USAF Undergraduate Pilot Training class in 1963, the outstanding graduate in the USAF Fighter Weapons School in 1969, and the outstanding graduate in the USAF Interceptor Weapons School in 1975. In addition, Mr Dryden was considered by many to be one of the most highly experienced and knowledgeable F-16 pilots in the world, and had published numerous articles about the F-16 regarding system operation and safety (an example is included in Tab AA). He had flown these types of jet aircraft for 30 years, had nearly 8,000 hours total flying time with 2,069.8 hours in the F-16, and had flown 7.4, 15.3, and 26.0 hours

in the F-16 during the previous 30, 60, and 90 days, respectively (Tab G). Neither the Government Flight Representative, the Federal Aviation Administration, nor the Lockheed pilots indicated there were any records of administrative actions, accidents, or incidents involving Mr Dryden (Tabs V and AA). All available aircrew training documentation on Mr Dryden (going back to 1983) evaluated his flying performance as either correct and skillful, or exceptionally skillful. (Tab G)

P. MEDICAL

Mr Dryden was medically qualified for flight duty. In accordance with company procedures, he had received a semiannual morale and psychological review in Feb 93 (Tab G), and was evaluated as having a stable psychological disposition and high morale. Witnesses also testified he was very pleased with a European business trip from which he had recently returned, and was excited about an increased flying schedule due to several aircraft coming off the production line (Tab V). His last physical was on 7 Jan 93 (Tab G), and his only limitation was a requirement to wear glasses during flight. Ground personnel testified that he was wearing his glasses during ground operations (Tab V), and as these glasses were found near the body after the accident, there was no reason to believe he was not wearing them during the flight. Mr Dryden apparently hit the ground in a prone position and on his right side, as he had several fractures to his right hip, several broken ribs on his right side, and a crack on the right side of his skull. A post-mortem toxicological examination revealed nothing unusual. (Tab AA)

Q. NAVAIDS AND FACILITIES

Navaids and facilities normally required for these company flown acceptance check flights were operational during the mishap. (Tabs V and O)

R. WEATHER

The weather in the accident area was clear with unrestricted visibility, and was not considered a factor in this mishap. (Tabs V and W)

S. DIRECTIVES AND PUBLICATIONS

1. Directives and Publications Applicable to the Mission

a. Air Force Regulation 55-22, *"Contractor's Flight and Ground Operations" (3 Apr 79)*

b. Contractor written/government approved *"Flight Operations Procedures"*

c. Contractor Document 16PP098K, *"Contractor Production Flight Procedures and Tolerances Document for F-16 Aircraft"*

d. Technical Order 1F-16CJ-1, *"F-16C/D (Blocks 50 and 52) Flight Manual"*

e. Technical Order 1F-16CJ-1-1, *"F-16C/D (Blocks 50 and 52) Supplemental Flight Manual"*

f. Technical Order 1F-16CJ-1-2, *"F-16C/D (Blocks 50 and 52) Supplemental Flight Manual"*

g. Technical Order 1F-16C/J-34-1-1, *"F-16 C/D (Blocks 50 and 52) Avionics and Nonnuclear Weapons Delivery Flight Manual"*

h. Federal Aviation Regulations (FARs)

(Note: The only specific low altitude limitations governing Lockheed contractor flight operations were those contained in the FARs. This is not unusual, as most Air Force contracts only require civilian contractor pilots to abide by the AFR 55-22 *current on the date the contract was signed.*)

2. Known or Suspected Deviations From Directives/Publications

a. Federal Aviation Regulation Part 91, Subpart D, Paragraph 91.303(d):

"No person may operate an aircraft in aerobatic flight--Below an altitude of 1,500 feet above the surface;...For the purposes of this section, aerobatic flight means an intentional maneuver involving an abrupt change in an aircraft's attitude, an abnormal attitude, or abnormal acceleration, not necessary for normal flight." (Tab AA)

The pilot's final split-S maneuver was initiated at approximately 2,100 ft above the surface, and could not be completed above 1,500 ft above the surface. (Also see discussion at end of paragraph N, page 7.)

III. STATEMENT OF OPINION

DISCLAIMER

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.

The fact that this type of accident occurred at all was very surprising to all concerned. As a short synopsis, one of the most knowledgeable and experienced F-16 pilots in the world took a properly performing, brand new F-16 on a clear day over flat terrain and performed a split-S maneuver into the ground. The following areas were evaluated:

Possible Aircraft Malfunction: As a result of multiple on-board data recorders and extensive evaluations by highly qualified engineers, it was determined that "the aircraft was performing within design limits up through the time of impact" (Tab J). Pilots who had flown with Mr Dryden all agreed that he was very smooth and precise on controlling the aircraft, and data plots of his control inputs during this flight up to his ejection also reflected this. It was apparent his intent during the final split-S maneuver was to reverse direction and descend to 1,000 ft above the ground to properly establish his aircraft as a low altitude target for another F-16. Coupling these facts and the precision with which the split-S maneuver was performed, all indications were the maneuver was intentional, not an aircraft malfunction.

Possible Weather, Terrain, Optical Illusion, or Aircraft Avoidance Problems: All these items were considered but dismissed as possible causes. The weather in the mishap area was excellent with no obstructions to visibility (Tab V), and the terrain was flat but had color and visual differentiation to alleviate any depth perception or optical illusion problems. No other airborne traffic was noted by radar in the mishap area, and the split-S type maneuver performed does not reflect any typical maneuver pilots make to avoid other aircraft. In addition, no sudden and unexplained inputs were noted in the plots of aircraft flight control inputs which could be indicative of a sudden aircraft avoidance maneuver.

Possible Self-Inflicted Injury: For many reasons, this possibility was totally dismissed First, all witnesses testified Mr Dryden had a very stable personality, was in very high spirits

after recently completing an enjoyable European business trip, and was looking forward to an increase in flying activity. Second, he had no known professional, personal, or family problems. And third, it appears from the aircraft data traces that upon realizing the aircraft had been flown into a position from which recovery was impossible, Mr Dryden ejected in an attempt to save his life.

Possible Reckless Behavior: All pilots who had known and flown with Mr Dryden also ruled out this possibility. In fact, through both personal contacts and numerous articles he had published during the past 10 years, he was well known for his concentration on professional attitude, systems knowledge, flying techniques, and observation of both aircraft and written limitations. His last written article, published in the April 93 issue of the widely distributed Lockheed *Code One* magazine, was basically a safety article entitled *Don't Stretch The Limits* (Tab AA). His last paragraph in this article contained a good summary of both his philosophy, and unfortunately, his demise:

> *"...But for Pete's sake, realize just what the physical limits truly are and don't exceed them. If you do, at best, you're going to get caught. And you could very easily lose your life. The airplane has some fantastic flying characteristics. Learn to use them to the fullest and surely you can have fun and still remain within the airplane's physical limits. Step outside them, even briefly, and either way, you're toast."*

Possible Medical/Physical Problem: The results of a recent physical, an autopsy, and a post-mortem toxicology report ruled out any apparent medical problem. His only known physical limitation was a requirement to wear glasses while flying, and all indications were that he was complying with that requirement. In addition, the data showed his control inputs during the final maneuver were steady and appropriately changing, which would not be in concert with a pilot adversely effected by either "g" forces or any other sudden, debilitating physical problem.

Supervision: Government contracts involving flight activity by civilian contractor pilots have historically only limited these pilots to the relatively limited guidelines contained in AFR 55-22 (tri-command document), and additionally, only the version of 55-22 current on the date the contract was signed. This has typically resulted in military pilots and company civilian pilots, flying the same aircraft on the same type of missions at the same location, to be governed by significantly different criteria for both periodic training requirements and flight rules. For example, in this mishap the Lockheed pilot, by contract, was governed by AFR 55-22, dated 3 Apr 79 (which was not even the latest version of AFR 55-22). This required him to fly a minimum of 35 hours (or 30 sorties) each 6 months, and to log a minimum of 10 instrument approaches. In addition, his minimum altitudes for any type aerobatic maneuvering were only governed by the Federal Aviation Regulations, which state this type maneuvering will not be conducted below 1,500 ft above the ground. On the other hand, under DLAM '0.3, the DPRO military pilots at this location, flying the same aircraft on the same type missions, must fly a minimum of 50 hours each 6 months (vs 35), log 12 instrument approaches (vs 10), and must complete any unusual attitude maneuvering by a minimum of 5,000 ft above the ground (vs 1,500 ft). The fact that Lockheed contractor pilots were neither company nor government limited to certain flight restrictions placed on military pilots was deemed a factor in this mishap.

Momentary Complacency: After elimination of the other possible causes, momentary complacency, in this case not realizing that an intentional maneuver was being initiated from an insufficient altitude, provided the only reasonable explanation for this accident. This could have occurred due to some unknown distraction either inside or outside the cockpit, to include the possibilities of the pilot momentarily focusing on the TACAN controls when asked to do so by a pilot in another aircraft, or switching the aircraft's radar to the standby mode.

EDWARD L. DANIEL, Colonel, USAF
AFR 110-14 Accident Investigation Officer
Chief, AFMC Aircrew Standardization & Evaluation