AIRCRAFT ACCIDENT INVESTIGATION

1. AUTHORITY:

Under the provisions of Air Force Instruction (AFI) 51-503, on 1 Dec 97, the Twelfth Air Force Commander, Lieutenant General Lansford E. Trapp, Jr., appointed Colonel (Col) Stephen E. Bozarth to conduct an aircraft accident investigation after F-16C, aircraft serial number 85-1564, crashed near Sidney, Texas (Y-2). Minor damage was caused to private property by aircraft fire on impact and vehicular movement to and from the accident site (P-2). The investigation was conducted at Naval Air Station (NAS) Ft Worth Joint Reserve Base (JRB) from 3 Dec through 21 Dec 97. Technical advisors were Major (Maj) Andrew Lade (legal), Maj Thomas Walker (medical), Captain Joan Fournier (maintenance) and Mr Greg Chaffee (technical) (Y-3, Y-4, Y-5, Y-6).

2. PURPOSE:

An aircraft accident investigation is convened under AFI 51-503. The investigation is intended to gather and preserve evidence for claims, litigation, disciplinary actions, adverse administrative proceedings and all other purposes other than safety. In addition to setting forth factual information concerning the accident, the investigating officer (IO) is also required to state his opinion concerning the cause or causes of the accident (if there is clear and convincing evidence to support that opinion) or to describe those factors, if any, that in the opinion of the IO substantially contributed to the accident. This investigation is separate and apart from the safety investigation conducted under AFI 91-204. This report is available for public dissemination under the Freedom of Information Act (5 U.S.C. 552) and AFI 37-131.

3. SUMMARY OF FACTS:

a. History of Flight: On 6 Nov 97, Col Thomas A. Dyches, the mishap pilot (MP), was piloting the first of two aircraft in a formation, call sign Spad 23, on a continuation air-to-air basic fighter maneuver (BFM) training sortie. The wingman for this mission was Spad 24, Lt Col Kevin E. Pottinger. The flight took off from NAS Ft Worth JRB at 1244L, flew directly to the Hornet East military operating area (MOA) for the employment phase of the mission and was scheduled to return to NAS Ft Worth JRB. On the fourth Basic Fighter Maneuvers (BFM) engagement, the mishap aircraft (MA) departed controlled flight and settled in an inverted deep stall from which it did not recover. The MP successfully ejected and was rescued by local residents and the Comanche County Sheriff. The MA impacted inverted in a pasture, caught fire and was totally destroyed. Damage to private property included burned pasture land. Furthermore, the property owners were inconvenienced due to required access to the accident site through their driveway and response team encampment in their pasture north of accident site (BB-3-3). The MP was transported to Comanche (County) Community Hospital where he was examined and released for transport to the Dyess Air Force Base

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NUCLEAR REGULATORY COMMISSION

Docket No _____ Official Exh. No. 196.

In the matter of PPL

Staff ✓ IDENTIFIED ✓

Applicant _____ RECEIVED _____

Intervenor _____ REJECTED _____

Cont'g Off'r _____

Contractor _____ DATE 7/1/02

Other _____ Witness _____

Reporter EH

Acute Care Clinic. Spad 24 returned to NAS Ft Worth JRB after he verified the MP had successfully ejected from the MA and witnessed the aircraft impact the ground. The regional county and local Ft Worth media gave moderate coverage of the mishap (CC).

b. **Mission:** The mission was briefed and flown as a high aspect BFM continuation training sortie. BFM training missions are designed to apply aircraft handling skills to gain proficiency in recognizing and solving range, closure, angular and turning room problems in relation to another aircraft. BFM objectives include attaining a position from which weapons may be employed, denying the adversary a position from which weapons may be launched or defeating weapons employed by the adversary. High aspect setups are the most advanced proficiency profiles in which the two fighters visually maneuver away from each other to visual limits (normally 3-6 miles) then turn toward each other with pre-briefed safety separation criteria. These missions are characterized by aggressive maneuvering in the vertical and horizontal planes of motion. The pilots continually seek maximum performance from their aircraft to out maneuver each other. These missions often result in low speed, nose-high maneuvering. On this mission, the pilots alternated the roles of red and blue fighters to meet their training objectives. The red fighter, the "training aid" for the blue fighter, simulated a threat aircraft such as a MIG-21 or MIG-29 while the pilot of the blue fighter employed his F-16 aircraft against the representative threat.

c. **Briefing and Preflight:**

(1) The MP departed his duty location at approximately 2015 hours the day prior to the mishap. On 6 Nov 97, after approximately 9 hours of sleep, he reported for duty at 0830 hours (V-3-3). The mishap pilot was originally scheduled as part of a 4 v 2 air-to-air mission (four fighters perform as blue defenders against two fighters replicating red threat attackers). Configuration problems with the six aircraft made the original mission impractical. Therefore, squadron supervision, together with the effected flight leads, changed the mission to three independent 1 v 1 BFM sorties. This change occurred approximately 2 hours prior to the scheduled flight briefing time (V-3-2, V-4-2, V-6-1). Col Dyches concurred with the decision and agreed to lead Spad 23 flight of two. Col Dyches coordinated the mission scenario with Spad 24 telephonically, prepared his personal line-up card in his office and then reported to the squadron for the briefing. Col Dyches used the squadron's briefing guide supplemented with his personally developed line-up card for the mission briefing. Col Dyches was well prepared and presented a very high quality briefing (weapons school caliber) which covered all mission specifics (V-4-5). Col Dyches had briefed and flown this scenario on numerous occasions and felt very comfortable with it (V-3-3).

(2) Col Dyches briefed that the red fighter would maintain an altitude of 15,000 feet mean sea level (MSL) and 400 knots until the merge. The blue fighter was cleared to maneuver once he could make a visual identification (VID - eyeball recognition of the type of aircraft) of the red fighter, normally at a range of about 1.5 – 1.0 nautical miles (nm). Col Dyches briefed the following restrictions for simulating the red fighter: the

MIG-21 would be limited to military (MIL) power (full power setting up to but not including afterburner); the MIG-23 would be limited to Category III flight limitations (reduces maneuvering angle of attack upper limit from 25 degrees to 16-18 degrees which restricts turn performance) by changing the stores configuration switch in the cockpit to Cat III from Cat I; and the MIG-29 would have no performance limitations but would have to wait until the blue fighter had crossed behind his 3/9 line (aft of a perpendicular line extending from the midpoint of the longitudinal axis of the aircraft) before he could maneuver (V-3-6).

(3) Col Dyches was experiencing several significant stresses that were influencing his life (V-3-7+). On the day of the mishap, this stress may have been manifested during two incidents; neither incident was a factor in the mishap. First, he failed to put on his positive pressure breathing vest which is required to be worn during flights when high G-forces are expected (V-3-9). Second, he flew the first 19 minutes of the mission, including the G-warm-up exercise and the first engagement, with the stores configuration switch in Cat III (aircraft mode in which the flight control computer limits the allowable aircraft maneuvering) (J-20, V-3-11). For this mission and aircraft configuration, the appropriate setting was Cat I that would have allowed unlimited maneuvering except during the MIG-23 simulation when the switch was to be in Cat III. Step #10 of the F-16 before takeoff checklist requires the pilot to confirm the position of this switch during ground checks prior to takeoff. This was a minor oversight and in no way jeopardized flight safety. From a human factors perspective, Col Dyches had a lot going on in his life that could have distracted him (V-3-6). He had been successfully coping with these distracters for a sustained period of time and there were no significant events immediately preceding the mishap (V-3-8). Those who had contact with the MP on the day of the mishap said he was well prepared, in good spirits and ready to fly the mission (V-4-5, V-5-1).

(4) Col Dyches was given the wrong aircraft tail number by the supervisor of flying (SOF) and had completed his preflight walk-around of Aircraft 85-1444 when the assigned pilot showed up and told Col Dyches about the error. Col Dyches then reported to Aircraft 85-1564 and resumed his routine. Subsequent preflight and ground operations were uneventful (V-3-9, V-4-8, V-7-1, V-8-1, U-3-3).

d. Flight:

(1) The flight profile included single ship takeoff, rejoin, systems checks, tactical warm-up exercises (roll slides, G-warm up) and tactical formation enroute to the working area. In the Hornet East MOA (formerly Brownfield MOA located approximately 120 nm southwest of NAS Ft Worth JRB), the two fighters alternated the roles of red and blue fighters to meet their training objectives (V-3-10, V-4-3).

(2) Events from takeoff through the third BFM engagement were routine. During the BFM engagements, both pilots aggressively maneuvered their aircraft horizontally and vertically to gain turning room. The vertical maneuvering resulted in the slow speed

warning horn on several occasions (this tone alerts the pilot to a slow speed condition based upon aircraft pitch attitude and airspeed. It is designed to activate at approximately 200 knots with a 90 degree pitch attitude (aircraft pointing straight up) and decreases to 100 knots with a 45 degree pitch attitude) (J-46). Both pilots reacted properly during each instance by unloading (decreasing aircraft G-forces by relaxing back stick pressure) the aircraft and maneuvering to the nearest horizon to correct the low speed condition prior to resuming the engagement.

(3) After the third engagement, the MP directed Spad 24 to remain in a fighting wing position (administrative position that provides maneuvering flexibility to the flight lead with little monitoring required of wingman) so he could "do some checks on the airplane for just a minute" (N-6, V-3-13). During the previous engagement, Col Dyches perceived that the aircraft buffeted (shook) more than normal for a clean configuration (V-3-13). Additionally, he felt it was unusual that he was unable to maneuver to a position of advantage against Spad 24, because Spad 24 was limited to MIL power, while the MP was able to use maximum (MAX) afterburner. The MP thought the approximately 56% additional power in MAX above military power should have provided a noticeable performance advantage as he had seen on previous similar missions. Because of the buffet and the lack of a performance advantage, Col Dyches wondered if his leading edge flaps (LEFs) were functioning properly (V-3-13). Col Dyches' checks revealed no caution or warning lights and included a smooth application of 4-5 Gs during left and right turns. During the turns, the MP observed the LEFs smoothly deflect downward and felt they were functioning satisfactorily. After approximately one minute, Col Dyches stated that there was apparently nothing wrong with his aircraft (N-7, V-3-13, V-4-18).

(4) The fourth engagement was the mishap engagement. (The maneuvering for the following engagement was recreated from witness testimony and review of the head-up display (HUD) video tapes (recording of what the pilot sees directly in front of him outside the aircraft with selected instrumentation and/or weapons displays superimposed to increase situational awareness) from the MA and Spad 24). The aircraft began the engagement with over 6 nm separation. Spad 23, the MA, was the red fighter (limited adversary) and maintained 15,400 feet MSL and 400 knots as per the flight briefing. Spad 24, the blue fighter, descended to 12,300 feet MSL and accelerated to 450 knots. Spad 24 informed Spad 23 of his VID at approximately 1.6 nautical miles at which time Spad 23 declared "MIG-21" (limited to MIL power) (N-7). Prior to maneuvering, Spad 23 passed almost directly over Spad 24 in the opposite direction with 3,000 feet altitude separation. At the merge, Spad 24 pulled straight up into the vertical to gain turning room above Spad 23 while Spad 23 completed a right downward slicing turn then reversed back to the left into a nose high climb. During this entire sequence, like all BFM engagements, the MP maneuvered relative to Spad 24. As Spad 24 went high to gain vertical turning room to allow him to maneuver to a position of advantage on the MA, Spad 23 maneuvered into the vertical as well to deny Spad 24 the advantage he was seeking. Due to the MP's MIL power restriction as the MIG-21, however, he didn't have the power to go as high. The MP wanted to establish a pitch attitude (angular relationship

between the length of the aircraft and the horizon) 10-15 degrees less nose-high than Spad 24 which he felt he could maintain in MIL power (V-3-16). Therefore, Col Dyches, now below Spad 24 with a slight lateral offset, made two small flight path corrections to get directly below Spad 24 to make visual acquisition by Spad 24 more difficult. The MP's attention was focused outside the cockpit during this maneuvering, but he was aware he was approximately 60 degrees nose-high and slowing (V-3-26).

(5) Approximately 15 seconds after maneuvering began, the slow speed warning horn sounded at 150 knots. (The nominal nose position for the low speed warning horn coming on at this speed is 67 degrees nose high (J-46). The exact pitch angle could not be determined since air-to-air weapons symbology was displayed on the HUD which does not include the pitch indications). The MP stated he could not recall hearing the low-speed warning horn, therefore, the MA continued to slow to a critically slow speed due to the nose-high pitch attitude (V-3-16). Col Dyches then felt the aircraft buffet (shake), which he believed was a precursor to a departure (see note below).

> Note: An aircraft departs (stops flying controllably) when there is insufficient airflow over the control surfaces for them to be effective. Airspeed, therefore, is a critical factor in departure susceptibility during maneuvering. A departure is a loss of aircraft control that is characterized primarily by uncommanded aircraft motions or failure of the aircraft to respond to control inputs (J-57).

(6) The MP then observed the MA pitch up, uncommanded, then the nose unexpectedly move to the right. Recognizing an out of control situation, the MP reacted properly when he released the controls and reduced the throttle to idle in accordance with (IAW) F-16C/D-1 Flight Manual guidance (known as the Dash 1--operating directive that contains the necessary information for safe and efficient aircraft operation) (J-48+, V-3-17). The aircraft departed controlled flight and settled into an inverted condition with zero airspeed (deep stall) at approximately 15,500 feet mean sea level (MSL). The MA had a slow to moderate yaw rotation (nose right rotation in the horizontal plane as seen from cockpit, inverted). The MP terminated the engagement and declared he was "hung up" (in a deep stall). Spad 24 advised Spad 23 that his altitude was approximately 15,000 feet MSL (approximately 13,500 feet above ground level(AGL) (R-3)) (N-15). At this point, the aircraft was descending at an average rate of 11,200 feet per minute (J-22).

(7) Basically, the MP lost control because the MA got critically low on airspeed and momentarily stopped flying (departed). More specifically, the available data does support a departure with right nose movement based upon recorded right roll inputs that include a corresponding yaw rate component. The data also shows significant side-slip prior to departure. Further, F-16 flight testing at Edwards AFB has shown a nose-right tendency (side-slip) during nose-high, extremely slow speed flight. In the case of the MA, the extremely low airspeed and nose-high situation exacerbated the impact of side-slip motion and resulted in a yaw departure (AA-2).

(8) The Dash 1 recognizes that the flight control computer (FLCC) may be ineffective at providing adequate departure protection during nose-high, decreasing speed maneuvers, therefore allowing the aircraft to depart and possibly enter a deep stall (J-52).

> Note: The F-16 is a computer controlled, four-channel redundant, fly-by-wire system that hydraulically positions control surfaces. The pilot generates electrical signals through the stick and rudder pedals. The flight control computer (FLCC) combines pilot inputs along with aircraft motion and flight conditions to command position of the flight control surfaces. The processed electrical signals are transmitted via wiring to hydraulic actuators that supply manual outputs to the control surfaces (J-52).

The Dash 1, Section 5, Low Speed Operating Limitations, directs that the pilot initiate recovery from a low speed situation no later than at activation of the low speed warning horn (J-51). Review of the MP's HUD video showed that the MP continued to maneuver after the low-speed warning horn sounded as he did not recall hearing the warning horn. Col Dyches stated he was completely surprised by the departure of the aircraft as he had flown the aircraft in this regime "hundreds of times" and had never experienced any problems (V-3-15).

(9) The critical action procedures (CAPs) (memorized time-critical procedures used when referral to a checklist is impractical) for an out of control situation as outlined in the Dash 1 are shown below. In the event of a departure from controlled flight, the Dash 1 directs the pilot to accomplish as much of the following as required to effect recovery (J-49+). All pilots practice out of control recovery procedures routinely in the simulator. These procedures are assessed and documented during simulator emergency procedures evaluations completed as part of periodic flight proficiency checkrides. The MP successfully completed his simulator evaluation on 3 Sep 97 (T-2).

1. **Controls – Release**
2. **Throttle – Idle** (minimum operating engine power setting)

If in an inverted deep stall:

3. **Rudder – Opposite yaw direction**

If still out of control:

4. **MPO switch – OVRD** (over-ride) **and hold** (see note below)
5. **Stick – Cycle in phase**

Note: During an inverted deep stall, the FLCC drives the horizontal tail to a full trailing edge up position to increase the potential for the aircraft to self recover; however, the full horizontal tail deflection commanded by the FLCC is insufficient to effect recovery (J-59). Engaging manual pitch over-ride (MPO) bypasses some inputs within the FLCC and allows the

pilot to over-ride the flight control computers to manually reinforce the natural up and down pitch motions of the nose (pitch rock) of the stalled aircraft (J-48).

The MP had already complied with the first two steps of the CAPs (V-3-17, J-14). Col Dyches was now pinned upside down with his head crunched against the canopy (head forced to the left) due to the continuous force of one negative G (V-3-12).

(10) He next assessed whether he was rotating or not to determine if he needed to apply rudder to stop the rotation to comply with step #3 of the CAPs. When Col Dyches focused his attention outside at the horizon to determine if he was rotating, he did not recognize any rotation (V-3-17). Due to the MP's contorted body position, perceived time compression, and recognition that he had made a conscious assessment of any yaw motion, this was the last time he knowingly looked outside. The HUD video shows the MA yawing to the right, with occasional pauses in rotation. After a pause, typically lasting approximately 1 second, the MA would resume a slow-moderate right yawing rotation. Roll oscillations were mild, although the bank angle tended to be left wing down (approximately 10-15 degrees). The pitch angle oscillated between the horizon and somewhat nose low (AA-3).

(11) Without detecting rotation, he never engaged the rudder as a means to stop the yaw rotation. Given his assessment of the situation, not applying rudder was the logical course of action and was in compliance with Dash 1 procedures. Furthermore, stoppage of the yaw rotation would have had little impact on the G-forces inhibiting the MP's ability to engage the MPO switch.

(12) Col Dyches then dedicated all of his efforts exclusively to engaging the MPO switch, step #4 of the CAPs (V-3-17+). This spring loaded switch, located on the extreme far forward portion of the left console panel, is protected from inadvertent actuation by two metal guards (J-45). This switch is used to enable the pilot to manually control the horizontal tails to aid in a deep stall recovery. For most pilots, when engaging the MPO switch, even during routine ground checks, the left arm must be fully extended with a possible slight left twist or slight forward lean to reach the switch. Despite all his efforts, Col Dyches could not reach the MPO switch because he was pinned against the canopy with continuous negative G forces (V-3-17). This contorted position with his body lifted approximately one inch off the seat increased the distance required to reach the switch. Col Dyches tried pushing off the canopy to force himself back into the seat. This proved partially successful as he further tightened his lap belt that he feels he wears relatively tight anyway (V-3-18). He also tried to gain leverage off the "towel rack" (a rail on the inside right side of the canopy) without success. The MP said he "jammed" his thumb against one of the guards once during his effort to reach the MPO switch (V-3-18). At no time during the mishap sequence did the flight control computer ever receive an OVRD signal from the MPO switch (J-22). According to the Dash 1, "without use of the MPO switch, pitch stick commands have no effect" (J-59). Unable to engage the MPO switch, the MP could not effectively pitch rock the MA as required to recover.

(13) Throughout the deep stall, Spad 24 monitored the MA and called his altitudes in thousands of feet as they descended (N-15). As Spad 23 descended through 6,000 feet MSL (approximately 4,500 feet AGL), having been inverted and struggling to recover for about 60 seconds, he ejected approximately 32 minutes after takeoff (J-24).

(14) The Dash 1 directs pilots to eject at least 6,000 feet AGL during deep stalls or other uncontrolled flight (J-49). The Dash 1 guidance is included to direct the pilot to transition from trying to recover the aircraft to saving his own life and successfully ejecting within the designed ejection envelope. Based upon my 24 years of flying experience, his delay to eject is similar to other pilots who have struggled trying to correct an emergency situation that could save the aircraft.

(15) Following ejection, the MA stabilized in a slightly nose-high orientation without any yaw rotation and little forward velocity (V-3-21). It impacted in a private pasture approximately 85 miles southeast of Dyess AFB and 110 miles southwest of NAS Ft Worth JRB.

e. Impact: The MA impacted the ground on 6 Nov 97 at 1316L, about 32 minutes and 43 seconds into the flight (J-24). The MA crashed in a pasture at 31°56.59' N and 98° 44.68' W and was destroyed on impact (A-2, S-3). Examination of the impact site revealed the aircraft impacted in an inverted level attitude, with little or no forward velocity, and little or no evidence of yaw rotation (J-16). Burned pasture land was confined to an area 240 feet by 400 feet (BB-2). The impact site was approximately 2,000 feet from a private residence and 2,600 feet from a school playground (BB-2). Soil samples were collected from the impact site to assess environmental impact (BB-6). Follow-up testing by the 7th Civil Engineering Squadron at Dyess AFB is expected (DSN 461-5619, Commercial 915-696-5619). The property owners have expressed intent to file a claim against the U. S. government (P-2).

f. Egress System:

(1) The MP initiated ejection seat sequence slightly below 6,000 feet MSL (4,500 feet AGL) (V-3-20). The ejection was witnessed by Spad 24 and Mr Tony Norville, who was watching the sequence from the school yard adjacent to the crash site (V-4-14+, V-9). The MP was concerned that his inability to attain a proper position in the ejection seat would result in physical injury upon ejection; however, he did not delay ejection based upon this concern (V-3-24). The MP did not notice anything unusual about the ejection sequence.

(2) The MP attempted the four-line jettison (procedure in which the pilot cuts four pre-selected parachute lines to provide better steering capability for the parachute) but was unable to locate the red four-line jettison release lanyards. He tried to pull the parachute risers down to locate them without success; apparently, he was looking too

high up the riser for the lanyards (V-3-21). Post-flight analysis of the parachute showed both lanyards clearly visible and neither had been activated (J-8).

(3) During descent, the MP noticed the wind blowing from the north and saw that he could either land in a clearing or in a grove of trees. Concerned the wind might drag him across the open field through trees and fences, he elected to land in the trees. Approaching the trees, rather than "getting small" as recommended in life support training, he elected to assume a straight-legged position with his legs parallel to the ground and bent at the waist in a "jack-knife" position prior to landing in the trees (V-3-22). Just prior to landing, the MP pulled on the rear risers in an attempt to flare the canopy. He then landed comfortably in a tree. The wind billowed his parachute and began to throw the MP off balance. The MP disconnected the risers at the harness quick releases, but the survival kit, which was caught in the trees, was tangled in the parachute risers and continued to tug at him. Therefore, he elected to slip out of his harness and left it in the tree. A local farmer came up to the MP and asked if he was OK and if he could assist him down out of the tree. During this time, the MP secured the hit and run survival kit and, with the assistance of the farmer, climbed down the tree (V-3-23, V-9-1).

g. **Personal and Survival Equipment:** Personal and survival equipment inspections were up to date (U-4). The MP attempted to contact Spad 24 on his survival radio but the transmitting survival beacon, which was still on his harness in the tree, blocked his radio transmissions on 243.0 (ultra-high frequency {UHF} common emergency frequency) despite the close proximity of Spad 24 who was circling the downed pilot. The MP unsuccessfully attempted contact with Spad 24 on 282.8 (primary UHF rescue frequency) (V-3-23).

h. **Rescue:**

(1) When the mishap pilot ejected at 1316L, Spad 24 observed the MA impact and watched the MP land in the trees. Because the parachute canopy was draped over the tree, he was unable to visually determine the status of the MP (V-3-22, V-4-16). Spad 24 successfully contacted Spad 11 on VHF (inter-flight communication radio), advised him of the situation and passed him the coordinates for the crash site (V-4-16, N-16). Spad 24 departed the crash site after approximately five minutes because he had reached the minimum fuel for recovery and passed the responsibilities for search and rescue coordination to Spad 11. During his return to base, at approximately 1326, Spad 24 contacted the supervisor of flying (SOF) and relayed the basic information that Spad 23 had crashed, that Spad 11 was coordinating the rescue efforts on-scene and that his status was unknown (N-21, V-4-17). The squadron initiated the mishap response checklist at 1330 (O-5).

(2) Spad 11 notified the Ft Worth Federal Aviation Administration (FAA) regional air route traffic controller about the mishap. The FAA then contacted the SOF about the downed pilot and suggested contacting the local sheriff on 911 (N-19, V-6-1, V-10-1). The SOF concurred and asked the controller to make the call. The Comanche

County Sheriff had already received a 911 call about the mishap immediately after impact and responded to the accident site (DD-2).

(3) The MP borrowed a cell phone from the local farmer and contacted his mother, who lives in the Ft Worth area, and the SOF to advise them of his status (V-3-23, O-3, V-10-2).

i. Crash Response:

(1) First personnel to respond were local civilians who observed the mishap, the local sheriff and fire department. The Comanche County Sheriff received a 911 call immediately after the crash advising the location of the incident. Caller reported a plane had crashed on Gary Hall's property, the pilot had ejected and was fine (DD-2). They alerted the fire department who responded to put out the grass fire and an ambulance who did a quick assessment of the MP (V-3-23). Since the MP was not injured during ejection, he was the initial on-scene commander. When the local authorities arrived, he cautioned them about explosive hazards (chaff, flares, ejection seat, gun ammunition), hydrazine (hazardous liquid fuel for the aircraft emergency power unit) and composite material hazards, and made sure no one was downwind of the crash site (V-3-23). Both 7th Bomb Wing (BW) personnel from Dyess AFB and 301st FW NAS Ft Worth personnel provided response teams. Col Vidrine, Commander, 7th Support Group, Dyess AFB, was designated the on-scene commander. The 7 BW arrived on-scene at approximately 1630 hours and the 301 FW personnel arrived on-scene approximately one hour later (O-10, V-10-2). The response personnel secured the accident site, joined the sheriff locating the seat and canopy, checked for indications of hydrazine in the air, and located the hydrazine tank and chaff and flare modules that were still attached to the MA. Due to a few hot spots around the crash site and limited available daylight, the response group decided to wait until the next day to secure the hydrazine canister and resume search activities. The response group spent the night in the local church. Due to the mishap site location, all response personnel and support vehicles had to drive through the driveway in front of the residence of Mr Hall, the landowner (V-9-2, BB-3-1, BB-4-2).

(2) Examination of the wreckage revealed no gun ammunition was loaded in the MA (J-17). The gun ammunition had been downloaded on 22 Sep to accommodate an end of year inspection. Due to a mishap at another base, Headquarters Air Combat Command (the parent command for all fighters in the United States) directed that the guns would not be fired. Therefore, ammunition had not been reloaded into the aircraft. Further inspection revealed that no local wing aircraft had ammunition loaded. This fact came as a surprise to the operations squadron (V-4-8). Analysis shows the shift in the center of gravity due to removal of the gun ammunition was minimal and was well within the bounds of normal operating limits (U-6).

j. Maintenance Documentation: A complete review of Core Automated Maintenance System histories, aircraft forms, and oil analysis records for the previous 90 days was completed. The aircraft had flown 11 consecutive "Code-1" (problem-free) sorties and

there was no indication of any pending mechanical, electrical, hydraulic, engine, or flight control failure (U-5, H-4+, U-8, V-7, V-8, V-11). The review further identified no overdue aircraft or engine inspections, time-change components, or time compliance technical orders (TCTOs) (H-3+). TCTO 1F-16-2040, Non-Destructive Inspection of Leading Edge Flap Drive System Torque Shaft, was completed 14-22 Oct 97. It appears to have been in accordance with all appropriate directives and is properly documented with no defects noted during the inspection (U-5). The combined basic post-flight and pre-flight inspection and an aircrew preflight were completed on the morning of 6 Nov 97, with no abnormalities noted (U-3-3, V-7, V-8, V-3-9).

k. Maintenance Personnel and Supervision: All maintenance personnel were properly trained. In accordance with AFI 36-2201, no AF Forms 623 (on-the-job-training records) are maintained on Master Sergeant John Schultz, the assigned crew chief for the MA. However, the special certification roster and squadron supervisors identify him as a highly qualified and trusted individual (U-9, V-11). He has been assigned as Primary Crew Chief on MA since it arrived at the unit in August 1996. The 457FS/MA provides appropriate maintenance supervision on the flight line and the Quality Assurance (QA) Flight performs regular evaluations on personal performance and maintenance practices (V-11). MSgt Schultz has passed all QA evaluations in the last 12 months (U-10). No maintenance procedure or practice was found to have contributed to the mishap.

l. Engine, Fuel, Hydraulic and Oil Inspection Analysis: Fluid samples taken from oxygen, fuel, hydraulic, and oil servicing equipment were found to be within limits on all tests (O-26+, U-7). Oil samples taken from the MA augmentor actuator and gearbox filters after the accident also tested with no out-of-limit findings (O-42+). Fuel on-board the MA was believed to have been completely consumed in the fire; therefore, it was not tested. There was no indication of fluid contamination found.

m. Airframe and Aircraft Systems:

(1) No indication of a pending failure or malfunction was detected by maintainers or previous pilots (V-11, U-8). All maintenance repairs and inspections appear to have been accomplished according to technical guidance. Furthermore, with the exception of the LEFs that are discussed below, analysis of the aircraft wreckage and the MP statement show no indication of any system failures (J-11+, J-16+, V-3).

(2) There were indications of anomalies in the leading edge flap operation: the pilot perceived a possible LEF problem in-flight with greater than expected buffeting on this aircraft; he took the time to determine if the LEFs were operating normally following the third engagement but decided they were and continued the flight; and the wreckage indicated an anomalous LEF setting of -2° when 0° was expected (J-30, AA-4). The power drive unit was destroyed on impact and no determination could be made if there was in fact any malfunction (J-30). However, due to the nose-high pitch attitude and extremely slow speed of the MA just prior to departure, a possible LEF malfunction was

not a factor in the departure and resultant inverted stall (AA-4). Also, there were no indications of a flight control malfunction on the recorded data (J-20+).

n. **Operations Personnel and Supervision:** Lt Col Pottinger, 457FS Operations Officer, authorized the mission. Col Sluder, 301FW Vice-Commander, was the acting SOF prior to the flight briefings. He provided the required briefings to each of the pilots (V-3-2, V-5). Col Dyches briefed his flight using the squadron's mission briefing guide augmented with his personal line-up card. All aspects of the flight were thoroughly briefed (V-3-7, V-4-3+).

o. **Pilot Qualifications:** The MP was current and fully qualified to perform the scheduled mission (T-2). The MP is a highly experienced pilot with over 3,350 hours total time in fighters since 1971. He has over 1,100 hours in the F-16, is a graduate of the Fighter Weapons Instructor School and maintains instructor/evaluator status. He was current in all training events (G-8+).

30 / 60 / 90 Day Flying Summary (G-2)
30 Day 9 sorties / 12.9 hours
60 Day 15 sorties / 20.9 hours
90 Day 20 sorties / 26.5 hours

p. **Medical:** Col Dyches was medically qualified to fly (X-2). Toxicology specimens contained no alcohol, elevated carbon monoxide or illegal substances (X-2, X-3). Col Dyches was transported by ambulance to Comanche Community Hospital where he was examined. The attending doctor documented only minor abrasions for the MP resultant to ejection (X-5). Col Dyches was transported to the Dyess AFB Urgent Care Clinic by base ambulance where he was admitted for 24 hours of observation. No problems noted by the attending physician (X-6).

q. **Navaids and Facilities:** There were no Notices to Airmen (NOTAMS) affecting Spad 23's flight operations (K-4).

r. **Weather:** Forecast weather for NAS Ft Worth JRB was for a few clouds at 3,000 feet and scattered clouds at 25,000 feet with northerly winds gusting to 18 knots. In the MOA, the forecast included scattered clouds from 7,000 to 35,000 feet (K-5+). Actual weather at NAS Ft Worth JRB was clear skies (W-2). Weather was neither a factor in Spad 23's mission nor the mishap (V-3-8, V-4-7).

s. **Governing Directives and Publications:** There were no known or suspected deviations from regulations, directives or publications relevant to this accident.

Primary regulations relevant to this investigation are:

MCI 11-F16, F-16	Operational Procedures
T.O. 1F-16C-1, F-16	Flight Manual
1F-16C-6WC-1-11	Combined Preflight/Postflight, End-of Runway, Thruflight,

	Launch and Recovery, Quick Turnaround, Basic Postflight, and Walkaround before First Flight of Day Inspection Workcards
1F-16C-2-27JG-80-1	Flight Control System Leading Edge Flap Maintenance Guidance

t. **Additional Information:** This is the second mishap in 12 months when the position of the MPO switch has been cited as causal to an F-16 crash (data obtained solely from aircraft accident report obtained from HQ AFSC/JA). On 27 Nov 96, the Springfield ANG lost an aircraft which departed inverted. After the 15 seconds required to initially engage the MPO switch, and the resultant six pitch rock cycles required because the MP's finger repeatedly slipped off the switch (38 additional seconds), the engine seized from oil starvation of the number three bearing. That pilot, also, was left with no choice but to abandon the aircraft (DD-3).

STEPHEN E. BOZARTH, Colonel, USAF
Accident Investigating Officer

OPINION AS TO THE CAUSE OF THE ACCIDENT

UNDER 10 U.S.C. 2243(d) ANY OPINION OF THE ACCIDENT INVESTIGATOR 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.

1. The mishap pilot (MP) is a highly experienced, aggressive, and disciplined fighter pilot who had briefed and flown the mishap scenario on numerous occasions. He knew what to expect from each specific engagement and thoroughly briefed expected aircraft maneuvering techniques for both aircraft. During the mishap engagement, the MP performed as the adversarial fighter, the "training aid" for his wingman, Spad 24. As the adversary, the MP's aircraft was restricted from performing to the fullest as an F-16. However, it was being flown by a fighter pilot who was trained to exploit every possible tactical error or performance advantage he can to win an engagement and gain as much training from the opportunity as possible.

2. There is clear and convincing evidence that two factors were causal in this mishap: the mishap aircraft (MA) departed controlled flight and once departed, the MP was unable to reach the manual pitch override (MPO) which was required to recover the aircraft. The MA lost control (departed controlled flight) because it was flown into a very nose-high, extremely slow speed flight regime. During close-in air-to-air combat, pilots focus their attention outside of the cockpit on the other fighter. To help prevent the pilot from losing control during nose-high, slow speed maneuvering, a low-speed warning horn sounds based upon pitch attitude and airspeed. The published F-16C/D Flight Manual (known as the Dash 1) guidance regarding low airspeed limitations is that recovery should be initiated no later than activation of the low speed warning tone. During the mishap engagement, when the MP was maneuvering from below and behind Spad 24, the low speed warning tone sounded. In this case, the MP stated he could not recall hearing the warning horn sound which would have been his best indicator to start the recovery procedure (V-3-16). Instead, he continued to maneuver momentarily until he felt the aircraft buffet which he felt was the precursor to a departure; he then initiated his out-of-control recovery procedures by unloading the aircraft. During the mishap sequence, the MP was preoccupied with maneuvering against his wingman and felt comfortable maneuvering in a regime he had flown many times before—the MP temporarily lost situational awareness. Failing to recover the aircraft when the warning horn sounded allowed the airspeed to approach zero knots, making flight control surfaces like the tail, wing and rudder, ineffective and the aircraft departed.

3. During the previous engagements, when the low speed warning horn sounded, the MP initiated the proper recovery procedure. During the mishap engagement, the MP could not recall hearing the low-speed warning horn and initiated the recovery upon feeling the aircraft buffet. The delayed recovery attempt by the MP pilot allowed the aircraft to get critically slow and it departed controlled flight. There is no evidence or reason to believe the MP intentionally failed to initiate recovery when the warning horn sounded.

4. Once the aircraft departed, there is clear and convincing evidence that the inability of the MP to reach the manual pitch override (MPO) switch was causal to the MA's crash. During a departure, the flight control computer (FLCC) takes over and automatically drives the flight control surfaces to increase the potential for self-recovery; however, in an inverted deep stall, the inputs are insufficient. The pilot must engage the MPO to bypass the inputs from the FLCC in order to manually exaggerate the natural up and down pitch motions of the nose (pitch rock) and fly the aircraft out of the deep stall.

5. The MP could not reach the MPO switch for two reasons. First, the switch is placed far forward on the left console in the cockpit. Even during routine ground checks, it requires some body twist or lean to reach the switch. Second, during the mishap sequence, the inverted MP was pinned with his head forced to the left against the canopy and pulled slightly back off the ejection seat by the negative gravitational force. The MP struggled for nearly 60 seconds trying to engage the MPO switch before he ejected but simply could not get to it.

6. F-16 flight tests conclude that an aircraft configured similar to the MA could have recovered from the out-of-control departure with an altitude loss of approximately 5,000 feet. This assumes the pilot can engage the MPO in a single activation and completes the recovery in two pitch rocking cycles. This coincides with the Dash 1 guidance which states one or two pitch rocking cycles are usually sufficient to recover from an inverted deep stall. Based upon the altitude at which this mishap occurred, approximately 13,500 feet above ground level, the MA could have recovered if the MP could have reached the MPO switch.

7. This is the second mishap in 12 months when the position of the MPO switch has been cited as causal to an F-16 crash (data obtained solely from aircraft accident report obtained from HQ AFSC/JA). On 27 Nov 96, the Springfield ANG lost an aircraft which departed inverted. After the 15 seconds required to initially engage the MPO switch, and the resultant six pitch rock cycles required because the MP's finger repeatedly slipped off the switch (38 additional seconds), the engine seized from oil starvation of the number three bearing. That pilot, also, was left with no choice but to abandon the aircraft.

8. We have the finest trained fighter force in the world. To maintain this standard, superior training during which pilots aggressively maneuver their aircraft is required. Occasionally, when the aircraft gets very nose-high and extremely slow, it momentarily stops controlled flying. In most cases, it self recovers; in this instance, it did not. In order

for a pilot to assist the aircraft recovery, he must engage the MPO switch which was installed due to the unique flight characteristics of the F-16; in this case, he could not.

9. In conclusion, there is clear and convincing evidence that two factors were causal in this mishap. First, the MP flew the MA into a flight regime in which it departed controlled flight. Second, the pilot's inability to reach the MPO switch after the aircraft departed and settled into an inverted deep stall prevented the MP from recovering the aircraft.

STEPHEN E. BOZARTH, Colonel, USAF
Accident Investigating Officer