

STATEMENT OF AUTHORITY AND PURPOSE

**AUTHORITY:** An investigation of the F-16C (S/N 87-0309) mishap which occurred at Indian Springs Air Force Auxiliary Field, Clark County, Nevada on 14 February, 1994 was conducted at Nellis Air Force Base (AFB), Nevada. Lt Col James D. Deaux was appointed by the Commander, USAF Weapons and Tactics Center (USAFWTC), to conduct an AFR 110-14 investigation of the accident under authority of USAFWTC/CC letter, dated 14 March, 1994 (TAB Y). The investigating officer is assigned to the 414th Training Squadron, 57th Wing, at Nellis AFB, Nevada. The legal advisor was Captain Kirk Foster assigned to USAFWTC/JA.

**PURPOSE:** The purpose of this accident investigation was to obtain all available evidence for use in claims, litigation, disciplinary actions, adverse administrative proceedings, and for all other purposes in accordance with AFR 110-14.

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## SUMMARY OF FACTS

**1 HISTORY OF FLIGHT:** On February 14, 1994, Captain Thomas H Lewis III, the mishap pilot, was scheduled to fly an F-16 (S/N 87-0309) as Thunderbird Six, the Opposing Solo, on a standard Thunderbird training mission with five other pilots assigned to the USAF Air Demonstration Squadron. Thunderbird One, the Commander/Leader of the team, was Lieutenant Colonel Stephen J. Andersen. Major Darryl L. Roberson was number two. The squadron Flight Safety Officer was Captain Matthew E. Byrd, number three. Number four was Major James J. Evanko and the Lead Solo pilot was Captain Peter M. McCaffrey, number five. After a normal Thunderbird departure from Nellis Air Force Base (AFB), the two Solo pilots rejoined the four-ship Diamond formation enroute to Indian Springs Air Force Auxiliary Field, the practice show site, located on the southern edge of Range 65 South. The departure, ingress to Indian Springs, and initial portion of the practice demonstration were unremarkable. Approximately thirteen minutes into the show profile, Captain Lewis entered the Solo maneuver known as the "spiral descent" during which the mishap occurred. Upon arriving at the designated show center, Captain Lewis had planned to execute a nose low, right rolling spiral through two and one-half 360 degree turns, and recover approximately 1,000 feet above ground level (AGL) proceeding toward the west (TAB V - 28). For an unknown reason, Captain Lewis executed an additional 360 degree spiral, for a total of three and one-half turns, and attempted to complete the maneuver with insufficient altitude for recovery (TAB N - 5, V - 2). The aircraft impacted the ground in a near wings level attitude, tail first, with the nose above the horizon but still descending, at 36-35 12 degrees North latitude, 115-40.95 degrees West longitude (TAB R). No ejection attempt was made and Captain Lewis received serious back and leg injuries (TAB X). There was no loss of or damage to private property (TAB P) and news media interest was handled by the USAF Weapons and Tactics Center Public Affairs Office.

**2. MISSION** The mission was a standard six-ship Air Demonstration Training Sortie (ADTS-23X) flown as a "high" show, or unlimited profile in preparation for the upcoming Thunderbird show season. The final phase of show season preparation requires the six aircraft team to orchestrate individual show maneuvers while flying as three separate entities: the four-ship Diamond, the Lead Solo, and the Opposing Solo. As the Opposing Solo, Captain Lewis was to perform several individual maneuvers, followed by rejoining with the other Solo for two-ship demonstration maneuvers, and eventually, rejoining with the remaining five aircraft for six-ship Delta formation demonstration maneuvers. Other mission profiles include the "low" and the "flat" show, which are optional shows predicated on the existing weather conditions at the show site (TAB V - 21). The current team had been practicing the same show sequence since January, in preparation for the season opening demonstration in March, 1994. The pilots considered the mission to be routine in that the complexity and sequence of show maneuvers were normal for a high show profile, and the identical profile had been flown approximately four hours earlier in the morning mission to Indian Springs.

**3. BRIEFING AND PRE-FLIGHT:** All team members had adequate crew rest for the mission. Sufficient time was available between the two missions on 14 February for debriefing the first sortie, and briefing for the mishap sortie. The briefing included discussion of the show site visual references, high show profile sequence of events, individual maneuvers for the Diamond formation and each of the Solos, forecast weather, NOTAMs (Notices to Airmen), and a notional emergency procedure in accordance with applicable regulations and local directives (TAB V - 2). A military flight plan for the mission was filed on a Nellis AFB Form 175, which served as the local flight clearance and Daily Flight Order (TAB K). Standard Thunderbird aircraft pre-flight inspections, "marchdown", strap-in, engine start, power-on checks, taxi, and takeoff were normal with no discrepancies.

**4 FLIGHT ACTIVITY:** The six-ship took off at 1227 PST as two entities, Thunderbird One, leading the four-ship Diamond, followed approximately 20 seconds later by the two-ship of Solos, Thunderbirds Five and Six. The rejoin enroute to Indian Springs and radio check-in with the tower and the Ground Safety Observer (GSO), Major Michael D. Major, the team Logistics Officer, were normal. The GSO provided the flight with required radio checks, weather advisories, and the corrected altimeter setting for referencing ground level at Indian Springs (TAB V - 35). This setting allows for ease in calculation of actual above ground level (AGL) altitudes, while reading above mean sea level (MSL) altitudes on the cockpit altimeter for show maneuvers. During the sequence of demonstration

maneuvers, the six-ship works together as three separate entities: the Diamond four-ship, Lead Solo, and Opposing Solo, sequencing their maneuvers in order, so as to arrive over show center approximately 30 seconds apart. The profile sequence leading up to the mishap was as follows (TAB V - 25).

<u>Sequence</u>	<u>Maneuver</u>	<u>Entity</u>	<u>Crowd View</u>
1	Cloverloop Opener	Delta (six-ship)	Overhead
2	Inverted Pass	Opposing Solo (MP)	right to left
3	Inverted to Inverted Pass	Lead Solo	left to right
4	Banana Pass in Review	Diamond (four-ship)	right to left
5	Knife-edge Pass	Opposing Solo (MP)	left to right
6	Eight-point Roll	Lead Solo	right to left
7	Diamond Roll	Diamond (four-ship)	left to right
8	Spiral Descent (mishap maneuver)	Opposing Solo (MP)	right to left

Practice of the show sequence requires teamwork and timing, and develops a rhythm whereby each successive aircraft or formation achieves a "timing window" for arriving at show center 30 seconds behind the preceding maneuver. Minor timing errors are common and relayed by radio call to successive team members so that adjustments can be made to compensate for the error. Thunderbird One had called late five seconds preceding the "diamond roll" maneuver, which immediately precedes the "spiral descent" by Captain Lewis. Captain Lewis acknowledged this call as he was setting up for the "spiral descent" maneuver, and attempted to make the appropriate timing correction (TAB N - 4, V - 2). However, as the Diamond formation cleared show center, Captain Lewis began the "spiral descent" approximately eight seconds earlier than normal, as compared to previous practice missions, in that the Diamond was late five seconds and he remained three seconds earlier than expected (TAB AA - 6). Captain Lewis entered the maneuver at the required altitude and began the spiral turns at, or near, show center. After the usual two and one-half turns in the "spiral descent" maneuver, Captain Lewis proceeded to enter another spiral turn, which subsequently placed him and his aircraft below the maneuver minimum check altitude, and in a position from which recovery was impossible (TAB V - 2). The recovery portion of the maneuver appeared normal until approximately 0.8 seconds prior to ground impact, at which time full afterburner power was selected and full back stick pressure was applied in an apparent attempt to avoid ground impact (TAB O - 43). Because of the time compression caused by the Diamond's late completion of the "diamond roll" and Captain Lewis' early entry in the "spiral descent", the initial portion of the mishap maneuver went unobserved by the GSO, whose attention was still on the Diamond formation. He did not perceive the extra (last) spiral as being unusual until the ground appeared in his peripheral vision, as he watched the completion of the maneuver. Therefore, an "abort" or termination call was not made by the GSO (TAB V - 10, 35). The aircraft impacted the ground at approximately 1241 PST, roughly 14 minutes into the flight. The GSO terminated the show sequence and initiated the crash response and rescue effort.

**5. IMPACT:** At approximately 1241 PST on February 14, 1994, F-16, S/N 87-0309, impacted the ground in Range 65 South, 250 feet north of the runway at Indian Springs Air Force Auxiliary Field (TAB R). The aircraft was near wings level, 18 degrees pitch attitude (nose above the horizon), and traveling at approximately 235 knots calibrated airspeed at impact (TAB O - 42). The aircraft skidded approximately 1,250 feet on a westerly heading and came to rest near a drainage ditch northwest of the airfield runway (TAB S).

**6. EJECTION SEAT:** All inspections of the Aces II ejection system were current (TAB U - 16). Captain Lewis made no attempt to eject and remained in the seat throughout the crash sequence. Portions of the ejection seat separated from the aircraft during the final portion of the crash sequence. Captain Lewis was disconnected from the seat by rescue and emergency medical team personnel when they arrived at the crash site (TAB V - 51, 57).

**7. PERSONAL AND SURVIVAL EQUIPMENT:** All personal and survival equipment inspections were current (TAB T - 7, 8). Wreckage analysis indicated all cockpit pilot publications and personal items were stowed and secure at the time of the mishap. Since ejection was not attempted, neither were factors in this accident.

**8./9. RESCUE/CRASH RESPONSE:** The aircraft impacted the ground at approximately 1241 PST and the "crash net" (emergency radio and telephone hot line) was activated almost immediately (TAB N - 4, V - 25, 55). Crash response vehicles responded to the scene within minutes of the aircraft impact. The Indian Springs Assistant Fire Chief was the first to arrive at the aircraft and directed other fire-rescue and emergency medical personnel in the rescue effort. A request for medical airlift (helicopter) support was made by the tower at 1247 PST (TAB N - 1). After assessing Captain Lewis' injuries, emergency medical personnel cut his parachute risers and applied a "C-Collar" neckbrace before carefully removing him from the aircraft cockpit and placing him on a backboard support for transportation to a medical facility. An Indian Springs ambulance was called to the scene at 1304 PST, and transported Captain Lewis to University Medical Center (UMC) in Las Vegas, where he was admitted for treatment (TAB N - 3, V - 49). Thunderbird Three, Captain Byrd, landed at Indian Springs to assist in the initial safety investigation as the squadron Flight Safety Officer. The remaining four-ship orbited the area until 1250 PST and then returned to Nellis AFB for landing. The rescue and crash response was timely and efficient (TAB V - 10, 17).

**10. MAINTENANCE DOCUMENTATION:** A review of the aircraft forms showed no maintenance discrepancies or Time Compliance Technical Orders related to the accident (TAB H). A review of all scheduled major maintenance inspections was accomplished and all were found to be satisfactorily completed and current (TAB H, U, V - 38). No maintenance factors were related to the accident.

**11. MAINTENANCE PERSONNEL AND SUPERVISION:** All maintenance supervisors and personnel were well qualified and were not related to the accident.

**12. ENGINE, FUEL, HYDRAULIC, AND OIL INSPECTION ANALYSIS:** All pre-flight servicing was accomplished and properly documented (TAB H). Engine, fuel, hydraulic, liquid oxygen, and oil inspection analysis factors were unremarkable and not related to the accident (TAB J).

**13. AIRFRAME AND AIRCRAFT SYSTEMS:** The airframe and aircraft systems were operating normally and were not factors in the accident (TAB I, U).

**14. OPERATIONS PERSONNEL AND SUPERVISION:** The mission was conducted under the authority of Nellis AFB Form 175, Daily Flight Order, signed by Major James J. Evanko, the Thunderbird Operations Officer (TAB K). Lieutenant Colonel Andersen, Thunderbird One, conducted the flight briefing in accordance with local briefing guides and applicable regulations (TAB V - 2, 10, 28). All required items were covered in the briefing and all flight members were aware of their individual flight responsibilities.

**15. PILOT QUALIFICATIONS:** Captain Lewis is an experienced fighter pilot with over 2,100 hours total flight time and over 900 hours in the F-16 (TAB G - 1). He was an Undergraduate Pilot Training instructor pilot in the T-37 aircraft prior to transitioning to the F-16 in May, 1990. Captain Lewis flew the F-16 while stationed at Ramstein Air Base, Germany, before coming to the Thunderbird team in October, 1993. He was qualified and current in the F-16 at the time of the accident. His recent flying experience is summarized below (TAB G - 4).

	<u>Sorties</u>	<u>Hours</u>
Last 30 days	34	37.9
Last 60 days	56	63.6
Last 90 days	84	97.0

Lieutenant Colonel Andersen (Thunderbird One) is an experienced fighter pilot and was qualified and current in the F-16 at the time of the accident. He is the Commander/Leader of the team and has over 2,100 hours total fighter time and 200 hours in the F-16.

Major Roberson (Thunderbird Two) is an experienced fighter pilot and was qualified and current in the F-16 at the time of the accident. He has over 2,400 hours total in fighter aircraft and over 200 hours in the F-16.

Captain Byrd (Thunderbird Three) is an experienced fighter pilot and was qualified and current in the F-16 at the time of the accident. He is the squadron Flying Safety Officer and has accumulated over 2,100 fighter hours with over 600 in the F-16.

Major Evanko (Thunderbird Four) is an experienced fighter pilot and was qualified and current in the F-16 at the time of the accident. He is the squadron Operations Officer and has over 2,600 hours total fighter time with over 1,200 in the F-16 aircraft.

Captain McCaffrey (Thunderbird Five) is an experienced fighter pilot and was qualified and current in the F-16 at the time of the accident. He flies in the Lead Solo position and has over 1,300 fighter hours, almost entirely in the F-16 aircraft.

Major Major (Thunderbird Seven) is an experienced fighter pilot and was qualified and current in both the F-16 aircraft and as the Ground Safety Observer at the time of the accident. He is the team's Logistics Officer and has over 1,600 hours in fighter aircraft with over 800 hours in the F-16.

**16. MEDICAL:** Captain Lewis was medically qualified to perform flying duties at the time of the accident as annotated on Air Force Form 1042 (TAB T - 3). The other flight members were also medically cleared to perform flight duties. Toxicology studies were examined and showed no abnormalities (TAB X - 16). Captain Lewis made no attempt to eject. Injuries sustained as a result of the aircraft's impact with the ground, included a fractured lower back, fractured lower left leg, left ankle and knee ligament tears, and a concussion. Due to the concussion and the trauma associated with the crash sequence, Captain Lewis continues to suffer from amnesia with respect to any details surrounding the mishap (TAB X - 1). The results of the post accident medical evaluations were not related to the mishap.

**17. NAVIGATIONAL AIDS AND FACILITIES:** No Notice to Airmen bulletins were issued for the local flying area, to include Range 65 and Indian Springs, that would have affected the mission.

**18. WEATHER:** The forecast weather for Range 65 South and the Indian Springs area on February 14, 1994 was for clear skies, with the possibility of scattered clouds at 20,000 feet, unrestricted inflight visibility, and winds out of the northeast at 8 knots with occasional gusts up to 17 knots. There was no forecast or reported turbulence, icing, or thunderstorms (TAB W). Weather was not a factor in this mishap (TAB V - 35, 55).

**19. DIRECTIVES AND PUBLICATIONS:**

a Directives and publications applicable to the operation of the mission were:

- |                                       |   |
|---------------------------------------|---|
| 1. AFR 60-1                           | Flight Management                                 |
| 2. AFR 60-16                          | Flight Rules                                      |
| 3. AFR 50-46, Nellis AFB Supplement 1 | Weapons Ranges                                    |
| 4. ACC/MCR 51-50                      | Fighter Aircrew Training                          |
| 5. MCR 55-116                         | F-16 Pilot Operating Procedures                   |
| 6. Nellis AFB Regulation 55-1         | Local Operating Procedures                        |
| 7. 57 WG Inflight Guide               | Local Operating Procedures                        |
| 8. TO 1F-16C-1                        | F-16 Flight Manual                                |
| 9. TO 1F-16C-1CL-1                    | Pilot's Abbreviated Flight Crew Checklist         |
| 10. TO 1F-16C-6                       | Scheduled Inspection and Maintenance Requirements |
| 11. TO 1F-16C-6WC-1                   | Preflight/Postflight Inspection Workcards         |
| 12. TO 1F-16C-6WC-2                   | Phase Inspection Workcards                        |
| 13. TO 1F-16C-2-12JG-00-1             | Servicing   |
| 14. TO 1F-16C-2-10JG-00-1             | Aircraft Safety                                   |

- 15. TO 1F-16C-2-00JG-00-1
- 16. USAFADS Regulation 55-31
- 17. USAFADS Regulation 51-1

Job Guide Index  
Squadron Operating Procedures  
Aircrew Training Manual

b There were no known or suspected intentional violations from the directives and publications by crew members or others involved in the mission.

**20. STATEMENT OF OPINION (NOTE. UNDER 10 U.S.C 2254 (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)**

a The cause of this accident was that Captain Lewis executed one more spiral turn than planned during the "spiral descent" maneuver demonstration and subsequently descended beyond the point where sufficient altitude remained for recovery (TAB V - 2). The reason for this was indeterminable, however, there is no evidence the additional spiral turn was intentionally executed by Captain Lewis. Training manual guidance (USAFADSR 55-31) for execution of the "spiral descent" maneuver calls for entry at 7,500 feet AGL, completion of three and one-quarter spirals, and exit over the crowd (TAB AA - 5). However, after the Federal Aviation Administration banned overflight of spectators during aerial demonstrations, the maneuver was modified to incorporate only two and one-half spirals with a lowered entry altitude of 7,000 feet AGL. This procedure was approved for the Thunderbird demonstrations and has been practiced since the beginning of the 1993 show season (TAB V - 28). This accident board identified the following areas as possible contributing factors in this mishap:

(1) Distraction/Preoccupation: Captain Lewis may have become distracted while setting up for the "spiral descent" maneuver in that he became slightly "tight" (early) during the preceding maneuver where he perceived the normal fuel check call from Thunderbird One was late (TAB V - 2). This may have been partially caused by the Diamond formation being slightly "stretched" (late) in their set up and execution of the "diamond roll" maneuver. This was relayed to Captain Lewis as he positioned himself for the "spiral descent" (TAB V - 10, 21). Transcript and video evidence analysis from previous missions indicates that Captain Lewis was approximately eight seconds early to show center as he began the mishap maneuver (TAB AA - 6). He visually checked the position of the Diamond formation before beginning his maneuver, but may have been temporarily preoccupied with the unusually "tight" timing during the mishap maneuver. This is known as "Habit Pattern Interference" and can occur when a visual or aural input interrupts a normal sequence of events. This phenomenon could have caused Captain Lewis to lose count of the number of spiral turns he had actually completed (TAB AA - 4). Available evidence did not show external visual distractions or physical cockpit distractors, such as caution or warning lights, instrument malfunctions, or loose objects, to be contributing factors (TAB J - 37, V - 2).

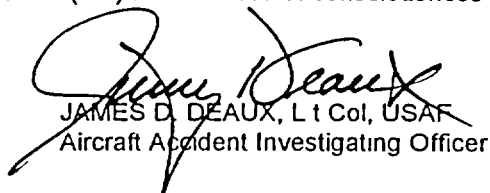
(2) Inattention/Complacency: Captain Lewis may have become comfortable with his visual perception of the ground environment to an extent where he was inattentive to the actual altitude or "turning room" remaining in the last portion of the maneuver. The team had repeatedly practiced the high show or unrestricted profile flown on 14 February, to include the sortie immediately prior to the mishap sortie, flown that morning. Indian Springs Air Force Auxiliary Field provided familiar visual references to which Captain Lewis had become accustomed, and he normally used visual "sight picture" references to accomplish the maneuver (TAB V - 2, 28). The maneuver typically has a completion altitude of approximately 2,000 feet AGL. The desired finishing altitude is 1,000 feet AGL, which requires the Solo pilot to decrease back stick pressure in the terminal phase of the maneuver, and smoothly descend to the desired altitude. Video evidence from previous missions showed repeated "high finishes" where a descent was required to reach the desired finishing altitude. Practice aborts of the "spiral descent" maneuver, flown during the training season, were initiated at higher altitudes, for safety considerations. Because of this, Captain Lewis had never actually seen the significantly lower altitudes encountered during the last portion of the mishap maneuver, and he may have lost situational awareness with reference to his actual height above the

ground. Although he possibly checked his cockpit altimeter at the "one-turn-to-go" point in the maneuver, he may have been referring to the gauge needle only, without reading the actual altitude display. On-board sensor data revealed his actual altitude above the ground at this "one-turn-to-go" checkpoint was 3,100 feet, nearly one thousand feet below the check altitude of 4,200 feet he normally sees (TAB AA - 6). The gauge needle would have appeared in a "normal" 12 O'clock position at either altitude, possibly reinforcing his apparent perception that the maneuver was progressing normally. The abort criteria described in USAFADSR 55-31 states, "If at anytime during the maneuver, it appears a low finish will occur, the Solo will abort the maneuver and initiate recovery" (TAB AA - 5). Whether Capt Lewis misinterpreted, or failed to check his altimeter during the maneuver, the required abort criteria was met during the last spiral turn and he failed to terminate the maneuver and recover the aircraft.

b. The Ground Safety Observer, Major Major, was tasked with watching the show sequence, annotating any critique areas for debriefing, and monitoring the safety of all six aircraft during their individual maneuvers. Since the six-ship is orchestrating the show sequence as three separate entities, Major Major's attention is divided and he must prioritize the aircraft or formation which is closest to the ground or in a critical phase of flight (TAB V - 10, 35). Because of the existing time compression between the finish of the four-ship's "diamond roll" and the initiation of Captain Lewis' "spiral descent", he was unable to observe the initial entry of the mishap maneuver, since his attention remained on the Diamond in the terminal portion of their "diamond roll". He detected a low finish during the final portion of the maneuver, but did not realize an extra turn had been completed until some time after the crash sequence, which he relayed to Thunderbird One (TAB N - 5). Had Major Major observed the initial portion of the mishap maneuver and the subsequent extra spiral turn, he may have been able to terminate the maneuver and possibly prevent the mishap.

c. Captain Lewis did not attempt to eject from the aircraft during the maneuver or the ensuing crash sequence. He most likely was unaware of his actual proximity to the ground until just prior to impact, when he selected maximum power and applied increased back stick pressure in an apparent attempt to avoid ground impact (TAB O - 43). Although successful ejection was possible during the majority of the maneuver and recovery sequence, Captain Lewis did not perceive the need to eject (TAB V - 2, 35) and, therefore remained in the aircraft throughout the crash sequence.

d. This accident board investigated evidence from the following areas and found them not to be contributing factors in this accident: aircraft airworthiness and maintenance, weather, the mishap pilot's physical condition, technical manual and regulation guidance, and gravitational force ("G") induced loss of consciousness

  
JAMES D. DEAUX, Lt Col, USAF  
Aircraft Accident Investigating Officer