

DOCKETED
USNRC

F-16C, SN# 84-1255, 97/06/20, FSPM, 030A

2003 JAN 17 PM 3: 58

OFFICE OF THE SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

AFI 51-503 ACCIDENT INVESTIGATION REPORT

AUTHORITY: Under the provisions of Air Force Instruction (AFI) 51-503, the Commander of Air Combat Command, General Richard E. Hawley, appointed Colonel Homer C. Smith, Jr. on 7 August 1997 to conduct an aircraft accident investigation of the F-16C (84-1255) accident that occurred on 20 June 1997 within the confines of R2508, near the northwestern boundary of Death Valley National Park. The accident resulted in minor injuries to the pilot, 1st Lieutenant Steven R. Jennings, and the destruction of F-16C aircraft SN 84-1255 (Tab A-2). Damage to desert terrain was limited to charred sage brush and ground disturbance caused by the impact (Tab S-2, Z-2). The investigation was conducted from 11 August - 2 September 1997. Technical advisors were Major Gerald L. Gallmeister, Maintenance; Captain Alexander R. D. Johnson, Flight Surgeon; and Captain Richard S. Pakola, Legal (Tab Y).

PURPOSE: An aircraft accident investigation was convened under AFI 51-503. This investigation is separate and apart from the safety investigation conducted under AFI 91-204. The purpose of this investigation is to find and preserve evidence to use in claims, litigation, disciplinary actions, adverse administrative proceedings, and all other purposes. The report is available for public dissemination under the Freedom of Information Act (5 U.S.C. 522) and AFI 37-131.

SUMMARY OF FACTS

1. History of Flight: On 20 June 1997, Lt Steven R. Jennings was scheduled as number two in a three-ship Air Combat Maneuvers (ACM) mission operating within restricted airspace, R2508. The flight was filed with the callsign Crud. Other flight members were: Crud 1 - Capt Anthony W. Bourke and Crud 3 - Lt Col Frank R. Hervatine. Crud flight departed Fresno Air Terminal (AT), CA, at 1322 PDT (Tab K-3). The flight exited Fresno AT airspace in a visual formation and proceeded via R2508 stereo routing to the working area. Coordination with Oakland Center was standard and hand-off to High Desert TRACOM (Joshau) was unremarkable. The flight repositioned to Saline MOA versus the scheduled Owens MOA due to "stranger" (other military aircraft) traffic within the airspace (Tab V-4, V-10). Following clearance to operate tactically in the restricted area, Crud 1 directed the flight to execute a G-awareness maneuver in accordance with squadron standards (Tab BB-2, V-4, V-10). Crud 1 split the flight into two groups; Crud 1 element (Crud 1 and 2) to the southeastern side of Saline MOA in the 20,000-24,000 foot block to operate as fighters and Crud 3 to the northwestern side of Saline MOA in the 25,000-29,000 foot block to simulate the bandit (Tab V-4). The first two intercepts executed by Crud 1 element and Crud 3 resulted in merges but

PFS Exh. 193

NUCLEAR REGULATORY COMMISSION

Jacket No. _____ Official Exh. No. 193
in the matter of PS

Staff _____ IDENTIFIED

Contractor RECEIVED

Witness _____ REJECTED _____

Contractor _____ DATE 7/1/02

Other _____ Witness _____

Reporter _____ ah

no tactical maneuvering because all flight members did not have each other in sight. The third and fourth intercepts resulted in visual merges for all aircraft with tactical maneuvering. On the mishap intercept, tactical maneuvering was initiated when Crud 1 and Crud 3 executed a high-aspect visual merge. The merge occurred above Crud 2, but from his perspective, in the area of the sun. Crud 2 lost sight of Crud 1 in the sun and did not have sight of Crud 3. He elected to begin an unloaded extension for separation from the merge (Tab V-11, N-4). Passing Crud 1, Crud 3 continued his turn to employ weapons against the extending Crud 2 (Tab V-6, V-16). Crud 3 initiated a radar lock to employ missiles. Crud 2 reacted to the radar lock with a defensive turn and impacted the ground 23 seconds later (Tab V-11, V-16, V-17, BB-3). The impact point was two miles south of Cameo Peak on the northwest boundary of Death Valley National Park (Tab BB-4) and 68 miles north of China Lake Naval Air Weapons Station (NAWS), CA (Tab A-2). 144th FW Public Affairs Office received approval from the National Guard Bureau and Air Combat Command through Headquarters, California Air National Guard to issue a press release concerning the mishap. News media and local community interest was low (Tab V-19).

2. Mission: The mission was scheduled and planned as a three-aircraft ACM training sortie, in accordance with ACM-3 (Tab BB-5). Crud 1 and Crud 2 as an element would begin each engagement by intercepting Crud 3, who was simulating an enemy fighter equipped with radar/infrared missiles and gun (Tab V-3, V-4, V-15). The element planned to practice AMRAAM (radar) and AIM-9 (infrared) missile employment as appropriate, utilizing the gun when necessary. However, missile employment by the element would require visual identification of the selected target prior to weapons release. Conversely, Crud 3 was cleared to employ ordnance beyond visual range. Therefore, the element would execute radar missile defense maneuvering and tactics as required to defeat Crud 3's simulated ordnance when warranted. Engagements began from a self-setup using thirty nautical mile separation between Crud 1 and Crud 3 as an initial starting point to ensure adequate time for radar interpretation and targeting execution (Tab V-4). The engagement would terminate when the element identified Crud 3 as a hostile and killed him, or when Crud 3 killed one member of the element (Tab V-3). Crud 1 element was assigned the southeastern side of Saline MOA at the 20,000-24,000 foot block of airspace, and Crud 3 was assigned the northwestern side of Saline MOA at the 25,000-29,000 foot block of airspace. The flight planned to continue intercepts to engagement until reaching recovery fuel for return to Fresno AT. Crud 1 briefed a flight recovery to an overhead pattern for a full-stop landing (Tab V-4, V-9).

3. Briefing and Preflight: Crew rest was adequate. Lt Jennings flew the previous day, 19 June 1997, in a morning sortie and participated in a routine mission debrief. He left the squadron at approximately 1630L after completing various squadron duties (Tab V-9). He arrived for alert duty on 20 June 1997 at approximately 0700L. At the beginning of the day, he and Capt Bourke ensured the alert aircraft were on status (Tab V-4, V-9, K-3). Both alert pilots requested and received permission from the Western Air Defense Sector (WADS) coordinator for release to fly an afternoon mission. This is considered a routine and acceptable practice to ensure alert pilots are able to maintain a sufficient sortie rate (Tab V-4). Beginning at 1200L, Crud flight was briefed by the flight lead, Capt Bourke (Tab V-4, V-9, V-15). He used the 144th FW Briefing Guide (BB-6 to BB-12) to cover all pertinent and required items concerning the ACM mission. Special emphasis was placed on threat assessment, visual awareness, altitude awareness, and G-awareness (Tab V-3, BB-11). Because the flight was scheduled to operate in Owens MOA, 10,000 foot MSL was briefed as the operating floor (Tab V-4, V-10). All flight members considered the briefing adequate (Tab V-3, V-9, V-15). Aircraft preflight inspection and start were normal with the exception of Crud 2 executing a practice scramble (alert) engine start for his own training and proficiency. However, Crud 2 did not taxi until the flight was ready and therefore had time to verify completion of normal ground operations (Tab V-10, V-15).

4. Flight Activity: Crud flight departed Fresno AT via the R2508 stereo flight plan using standard coordination procedures with Oakland Center for clearance into the area. Hand-off to Joshua and MOA assignment was unremarkable. However, the flight moved from Owens MOA to Saline MOA due to "stranger" traffic (Tab V-4, V-10). Following clearance to operate tactically in the restricted area, Crud 1 directed the flight to execute a G-awareness maneuver in accordance with squadron standards (Tab BB-2). All flight members completed the maneuver and verified they were good (Tab V-4). Crud 1 split the flight into two groups; Crud 1 element to the southeastern side of Saline MOA in the 20,000-24,000 foot block to operate as fighters and Crud 3 to the northwestern side of Saline MOA in the 25,000-29,000 foot block to simulate the bandit. Crud 1 cleared Crud 3 to a discreet VHF radio frequency to ensure Crud 1 element had a dedicated VHF radio frequency for integrity of element communications. The flight maintained a common UHF radio frequency for flight and safety communications. The first intercept was uneventful, but the engagement was terminated due to Crud 1 and 2 losing visual contact with each other (Tab V-4, V-16). The second intercept resulted in merges but no tactical maneuvering because all flight members did not have each other in sight. The third intercept resulted in a visual merge for all aircraft with tactical maneuvering. However, no aircraft achieved weapons employment parameters and the

engagement was terminated for altitude as all flight members were at the briefed training area floor (Tab V-5, V-16). During reset for the next intercept, Crud 1 established a new training floor of 7000 feet MSL. Both Crud 2 and Crud 3 acknowledged the change in the operating floor (Tab V-5, V-10, V-16). This new floor still met the guidance of a 5000 foot AGL floor as long as engagements were located over Saline Valley. If operating over the mountains surrounding the valley, 5000 foot AGL would become a factor before reaching 7000 foot MSL (Tab BB-4). The fourth engagement resulted in a visual merge with all aircraft executing tactical maneuvering. Crud 3 achieved a simulated kill on Crud 2 prior to Crud 1 achieving a simulated kill on Crud 3. The engagement was terminated following Crud 1's kill (Tab V-5). Prior to the initiation of the mishap intercept, Crud 2 advised Crud 1, on element VHF frequency, he was having difficulty with the Gs and planned to use less G when maneuvering his aircraft. Crud 1 acknowledged Crud 2's situation and asked if he needed to "throttle back" (Tab V-5, V-10, N-2). Crud 2 felt no need to change the scenario or plan and responded in that manner (Tab V-10, N-2). Crud 3 was not aware of this communication because he was monitoring a different VHF frequency (Tab V-4, V-16). Crud 3 called "ready" in the north indicating he was in position for the fight to begin (Tab N-3). The flight paths of all Crud flight members from the moment of Crud 3's "fight's on" call to Crud 2's ground impact are depicted at Tab BB-4. Prior to the "fight's on" call, Crud 1 had a radar contact on Crud 3 and began to maneuver the element for intercept geometry on Crud 3. Crud 1 element offset to the east of Crud 3 to achieve turning room for the conversion. At ten miles from the merge, Crud 2 "notched" to the northeast to defeat Crud 3's simulated radar missile. Crud 1 accompanied Crud 2 in the maneuver to provide mutual support (Tab V-5, V-10, V-11, V-16, N-3). Once Crud 2 had maneuvered his aircraft, Crud 3 terminated radar tracking to simulate Crud 2 had defeated the missile (Tab V-16). With no indication of radar track, Crud 1 element turned back into Crud 3's position. Crud 1 selected an auto-acquisition radar mode, achieving a radar lock and subsequent visual of Crud 3 (Tab V-6, V-11, N-4). Crud 2 only had sight of Crud 1 but continued to follow Crud 1 in accordance with established tactical guidelines (Tab V-11, N-4). Crud 3 had sight of both Crud 1 and Crud 2 so tactical maneuvering was initiated (Tab V-16, N-5). Crud 1 and Crud 3 merged high aspect (Tab V-6, V-16) above Crud 2, but from Crud 2's perspective, in the area of the sun. Crud 2 lost sight of Crud 1 in the sun (Tab V-11, N-4) and executed an unloaded extension to ensure separation from the merge. He planned to gain turning room and position himself so the sun would not hinder his ability to regain sight of both Crud 1 and Crud 3. He continued this extension until receiving indications Crud 3 had acquired a radar lock on him and was possibly simulating missile employment (Duration of unloaded extension was at least seven seconds, Tab BB-3). He initiated a defensive reaction (hard turn of 5-6 Gs, Tab J-7) to

defeat the missile by turning into Crud 3's perceived position. Crud 2 had no recollection of events or time following his threat reaction until he regained awareness just prior to initiating ejection. He did recall feeling disorientated and having little command of his hands. His vision was blurry, but he did perceive he was in a high-speed, steep angle dive close to the ground. He perceived he did not have sufficient time to recover before ground collision and elected to eject (Tab V-11, V-12). Crud 3 saw a flash from Crud 2 at this time, which he interpreted as a defensive flare, but later realized was Crud 2's ejection. He did not see the canopy or seat leave the aircraft. He was approximately two miles from Crud 2 when the flash occurred. He had no perception or indication Crud 2 was experiencing any difficulties. After Crud 2's ejection, Crud 3 observed Crud 2's aircraft transition from a hard defensive turn to an over-banked, extremely nose low maneuver. He immediately initiated a Knock-It-Off call and observed the Mishap Aircraft (MA) explode on ground impact (Tab V-17). An emergency beacon activated almost simultaneously with Crud 3's radio call (V-6, N-5). Crud 1 was within three miles of the crash site and observed the resultant fireball (Tab V-6, N-5, BB-4). Crud 3 was not aware Crud 2 had safely ejected until he observed a parachute in descent (Tab V-17, N-5). After Crud 2 failed to respond to a radio call, Crud 1 began coordination with the 144th FW Supervisor of Flying concerning a Search and Rescue (SAR) effort. Crud 1, with the lowest fuel reserve, elected to remain at 25,000 feet for high radio relay and assumed On Scene Commander duties (Tab V-6, N-5). Crud 3 remained at 15,000 feet and contacted Joshua to initiate scramble of the rescue helicopters at China Lake NAWS (Tab V-17, N-5). Twelve minutes after MA impact, Crud 3 established radio contact with Crud 2 (Tab BB-3). He confirmed Crud 2's physical status and assured him rescue helicopters had been scrambled (Tab N-10).

5. Impact: The MA impacted the ground two miles south of Cameo Peak on the northwest boundary of Death Valley National Park. The area was desert landscape, extremely rugged, and very isolated (Tab BB-4, S-2, Z-2). Located 68 miles north of China Lake NAWS, site coordinates are N36-46.40 and W117-39.19 at an elevation of 4989 feet (Tab A-2, R-4). Time of impact was 1408 hours PDT, 20 June 1997 (Tab A-2). The MA was estimated to have struck the ground in 90 degrees of left bank and a nose low attitude approaching 60 degrees (Tab V-17). The MA, with airspeed in excess of 450 knots (Tab J-7), cratered the landscape to a depth of approximately four feet (Tab BB-15). Debris consisted of mostly small size fragments; very few large size components were recovered from the mishap site (Tab J-12, R-4 to R-7). Wreckage ricocheted out of the impact crater into a fan-shaped area of at least 1800 feet long and 1400 feet wide (J-11, R-3). The center section of the wreckage was on a bearing of 040 degrees, defining the aircraft

flight path at impact (Tab BB-16). Post-impact fire caused by the ignition of JP-8 fuel further damaged or consumed the wreckage until it was extinguished by lack of remaining combustible material (Tab S-2, Z-2).

6. Egress System: The F-16C ACES II egress system was evaluated by an Air Force Materiel Command (AFMC) investigator. Thorough evaluation of recovered components indicated ejection was pilot initiated. The environmental sensor and recovery sequencer sensed parameters for Mode II or Mode III operation. The life preserver cell was exposed due to windblast which caused the container zipper to separate. With the exception of the life preserver anomaly, all indications are the system functioned as designed (Tab J-6).
7. Personal and Survival Equipment: Inspection records for the survival kit/Vacuum Packed Life Raft (VPLR), parachute, Pressure Breathing for G (PBG) equipment (Combat Edge), life preserver, and oxygen connectors were reviewed. All inspections were current (Tab U-2). The UHF radio and two emergency signal flares from the seat-packed survival kit were used by the Mishap Pilot (MP). However, the MP was unable to properly activate the first signal flare due to mishap injury. The second flare was activated when the helicopter arrived and functioned as designed (Tab V-12).
8. Rescue: The time of the mishap was 1408L on 20 June 1997 (Tab A-2). A ground explosion was noted by other members of the flight (Tab V-6, V-17). Crud 3 observed a parachute in descent after engagement maneuvering was terminated (Tab V-17, N-5). Crud 1 assumed On Scene Commander responsibilities and contacted the 144th FW SOF via the 144th FW Command Post (CP) minutes after confirming no response from Crud 2, the MP (Tab V-6). Crud 1 and Crud 3 circled the area of the explosion and Crud 2's parachute using visual references and on-board navigation system markpoints (Tab V-6, V-17, N-7). Crud 1 stayed high to act as radio relay and Crud 3 set up a low orbit, attempting to establish radio and visual contact with Crud 2. Crud 3 requested Joshau scramble the rescue helicopters at China Lake NAWS and attempted to pass the markpoint coordinates of N36-46.36, W117-37.90 (Tab N-7). At approximately 1415L, Col Alan R. Heers, 144th Operations Group Commander, was notified at his home of the mishap and arrived at the CP about 25 minutes later (Tab V-21). Twelve minutes after the MA impacted the ground, Crud 3 established radio contact with Crud 2. Due to fuel considerations, Crud 1 departed the area for Fresno AT approximately thirteen minutes after MA impact. Crud 3 became the On Scene Commander and remained on station for another twenty minutes. Prior to his departure, he coordinated a transfer of the SAR effort to Misty 47, a Marine AV-8B. After positive

identification of the wreckage area and Crud 2's location, Misty 47 assumed coordination responsibility and remained on scene until relieved by Ding flight (Tab BB-3). The 144th FW scramble launched Ding 1 - Maj Jack A Bolt and Ding 2 - Capt Scott T. Keller at 1440L to assist in the SAR effort (Tab K-3, V-31). They relieved Misty 47 of SAR coordination responsibility and remained on station until the rescue helicopter arrived to extract Crud 2 (Tab V-31). The rescue helicopter launched at 1500L, arrived on scene at 1545L, recovered Crud 2 at 1600L, and delivered him to China Lake NAWS for medical treatment at 1710L (Tab BB-13).

9. Crash Response: Search and rescue effort time-frame is described above. Weather and lighting conditions were favorable during survivor recovery. The crash site was about two miles south of Cameo Peak at N36-46.40, W117-39.19. Local terrain was rugged and desert landscape. Impact point elevation was 4989 feet MSL, located on the western side of steeply rising terrain (Tab S-2, Z-2, BB-4, W-2). A SAR helicopter from China Lake NAWS recovered Crud 2 at 1600L, one hour and 52 minutes after MA ground impact. (Tab BB-13). Recovery of MA wreckage was conducted under the direction of the Safety Investigation Board assembled to conduct the mishap investigation (Tab Q-2).
10. Maintenance Documentation: A review of all Air Force Technical Order (AFTO) Forms 781, located on the flightline in the crew chief's tool box during the mishap flight, revealed no evidence of maintenance discrepancies contributing to the accident. A review of open Time Compliance Technical Orders (TCTOs) did not reveal any evidence relating to the accident. All scheduled inspections were current and in order. An audit of the oil analysis records showed they had been accomplished and were within technical data limits (Tab U-2). The last oil analysis was accomplished after the AM flight on 20 June 1997 and test results were within normal ranges (Tab D-2). Examination of the Equipment Review Report did not reveal any overdue maintenance actions (Tab U-2). A review of all unscheduled maintenance performed during the 30 days prior to the accident revealed nothing pertinent to the accident (Tab H-2, H-3). Aircraft weight and balance, DD Form 365F, was current and within Air Force standards (Tab L). No discrepancies relating to this accident were noted in maintenance procedures or practices performed on this aircraft.
11. Maintenance Personnel and Supervision: A review of training records and currencies for maintenance personnel involved in preflight, through-flight, launch and end-of-runway inspection for the mishap aircraft indicated all personnel were properly trained and had the level of experience required to perform their duties.

The dedicated crew chief did have one overdue training requirement (ICT training) which was the only discrepancy in currencies noted (Tab U-2). There are no indications maintenance personnel and supervision were factors in this accident.

12. Engine, Fuel, Hydraulic, and Oil Inspection Analysis: Although the engine diagnostic unit (EDU) was not recovered, portions of the F-100-PW-22E, S/N PW0E703161 were retrieved from the mishap site and evaluated by SA-ALC. Their analysis indicated at the time of impact, the engine was running normally with a power setting of at least MIL, possibly as high as MAX, and a nozzle position no more than 20% open (Tab J-12, U-2). There are no indications of fuel or oil system malfunctions or contamination on the mishap sortie (Tab O-14, O-24 thru O-28). Recent maintenance actions included work related to blending two first stage fan blades on 18 June 1997 and a 50-hour engine inspection on 22 May 1997. The engine was removed for maintenance during the 200-hour aircraft phase inspection with the following engine maintenance performed: (1) replacement of the Low Pressure Turbine due to failed HS3 inspection, (2) removal and replacement of the #5 FTIT probe, (3) blending of twelve first stage fan blades, and (4) baking of augmentor spray rings (Tab H-6). Fuel samples were taken from R-11 refueler truck #91L204 and fuel tank #3, which were used to service the MA prior to the mishap flight. Both samples met all military specifications (Tab O-14 thru O-17). A Liquid Oxygen (LOX) sample was taken from the LOX storage tank and cart #827, which met all military specifications (Tab O-33). Six samples of hydraulic fluid containers were tested: three from hydraulic carts and three from unknown components at the mishap site. All six samples were evaluated and found to meet military specifications. Analysis did detect acceptable trace presence of compatible hydraulic fluid, MIL-H-5606 (Tab O-18 thru O-23). Four engine oil samples were tested from the unit's oil servicing carts. All samples were within military specifications (Tab O-24 thru O-28), and there were no observed discrepancies in the oil analysis program (Tab U-2). There were no samples of fuel, LOX, or engine oil recovered from the crash site (Tab O). Engine operation, serviceability of fuel, LOX, hydraulic fluid, and the oil analysis program do not appear to be factors in this accident.
13. Airframe and Aircraft Systems: The engine report from SA-ALC indicated the engine was functioning normally and operating at MIL to MAX power setting prior to ground impact (Tab J-12, U-2). The small size of debris, along with the large area over which it is spread, implies a high-speed impact (Tab J-12). There was no evidence of damage to the engine prior to impact (Tab J-13). Engine maintenance practices and procedures do not appear to be a contributing cause to this mishap. Recovery of FLight Control System (FLCS) components was not possible due to

extensive destruction of the airframe structure and subsystems. However, the seat-mounted flight data recorder (commonly called the seat data recorder or SDR) was recovered and returned to Lockheed Martin Tactical Aircraft Systems (LMTAS) for memory retrieval. The unit had sustained significant ground impact damage that prevented normal downloading. Therefore, the unit was opened and the four memory chips were installed into a download device for memory recall. A raw data file was converted into a data printout (Tab O-2 to O-13). LMTAS Stability and Control Engineer assessment indicated all major components of the aircraft, including flight control surfaces and speedbrakes were present and fully functional at impact. FLight Control Computer (FLCC) surface position data recorded at 44:48 minutes after takeoff, indicated the left flaperon was commanded and positioned at more than 1.65 degrees trailing edge down. This equates to a right roll rate of approximately 25 degrees/second given the flight conditions at the time of record. However, roll axis motion at that time could not be determined as the left flaperon recorded position had remained stable for almost 76% of the time since takeoff (Tab J-8). Estimated aircraft parameters at the last update were: 5.2 G's with 6.7 degrees AOA, 446 KCAS at 14450 feet pressure altitude (Tab J -7). There were no FLCS failures recorded. This lack of failure bits indicated the main generator was on-line and both hydraulic systems were pressurized from takeoff through ejection (Tab J-8). The electrical, fuel and hydraulic systems appeared to be functioning normally at the time of impact (Tab J-8). There was no indication of hydrazine consumption during the mishap flight (Tab U-2). A Combat Edge write-up on 12 June 1997 was corrected by securing the PBG cap on the oxygen regulator (Tab H-2). Combat Edge is designed to increase G-endurance and does not protect against rapid G-onset rates (Tab BB-24). Once corrective action was completed, eleven sorties were flown without a Combat Edge write-up prior to the time of mishap (Tab H-2, H-3). The Egress and Life Support report showed evidence the ejection was pilot initiated and met the parameters for a Mode II or III separation. A review of all systems indicated the ejection system functioned as designed. However, windblast did cause the container zipper of the life preserver to separate along its entire length, exposing the cell (Tab J-6, U-2, U-3). There are no indications hydraulic, electrical, mechanical, avionics, or power plant systems were a factor in this accident.

14. Operations Personnel and Supervision: The mission was authorized by Colonel Alan R. Heers, 144th Operations Group Commander, in accordance with AFI 11-206 and AFI 11-401 (Tab K-3). All flight members were current for the scheduled mission and the mission profile was tailored to meet their needs (Tab V-21). Crud flight was briefed and led by Capt Anthony W. Bourke, a current and qualified 194th FS flight lead (Tab K-3, G-21). He briefed the flight using the

144th FW Briefing Guide (Tab BB-6 thru BB-12, V-4). Lt Col Frank R. Hervatine, Chief of wing Stan/Eval was Crud 3 and attended the briefing (Tab V-14). All flight members considered the briefing was thorough and covered the pertinent areas (Tab V-3, V-9, V-15). Lt Col Dennis M. Mast was the Operations Supervisor on duty at the time of the mishap. Maj Thomas W. Westbrook was the Supervisor of Flying (SOF). Weather information was provided by McChord AFB weather cell on a service sheet forwarded to the 144th Fighter Wing CP. Notices to Airmen (NOTAMs) were compiled by Airfield Management personnel and provided for use via hard copy. Mission planning weather and NOTAMs were reviewed by the SOF. This information was available to the flight in a book located on the operations duty desk and updated by operations duty desk personnel as appropriate (Tab V-31).

15. Pilot Qualifications: Lt Jennings was current and qualified to perform the mission (Tab G-16, G-19). He accomplished an ACM sortie on 16 June 1997 and an Air Combat Tactics (ACT) sortie on 19 June 1997 (Tab G-16). He has been a fully qualified wingman since 30 April 1996 (Tab AA-2) with 634.2 total hours and 420.2 hours in the F-16 A/B/C/D (Tab G-4, G-5).

30/60/90 Day Flying Summary (Tab G-2, G-3):

30 Day	15.1 hours/11 sorties
60 Day	29.7 hours/23 sorties
90 Day	46.3 hours/36 sorties

Lt Jennings' performance and pilot skills during F-16 formal and conversion training were assessed as slightly below average to average by unit instructors and supervisors. He was placed under increased supervision and given additional training in both programs. Despite his deficiencies, he was recognized as having a good attitude and an eagerness to improve (Tab AA-3 thru AA-5). 144th Fighter Wing supervisors and pilots interviewed during the course of this investigation regarded him as a promising wingman who possessed an outstanding attitude and worked hard to improve (Tab V-3, V-14, V-21, V-22, V-25, V-29). He "stayed in the books" to improve his knowledge, paid attention to detail, and adhered to strict flight discipline (Tab V-3, V-14, V-21, V-22, V-25, V-29). Lt Jennings' sorties per month were consistent and enabled him to maintain Mission Ready status continuously since his 30 April 1996 Mission Ready certification (Tab AA-2). His lowest monthly sortie count since 1 January 1997 was May 1997 with nine sorties (Tab T-7 thru T-9). Lt Jennings' most recent checkride was an Instrument/Qualification Evaluation accomplished on 27 February 1997 (Tab AA-6) in an F-16C, with the Flight Examiner in a chase aircraft. He had one discrepancy,

knowledge of instrument holding procedures, which resulted in an overall downgrade in the instrument portion of the checkride. Additional training was directed (Tab AA-8) and completed on 4 March 1997 (Tab AA-7). No documentation on the evaluation of unusual attitude recoveries existed since his 20 October 1995 Instrument/Requalification Evaluation (Tab AA-9, AA-10). His last Mission Evaluation was accomplished on 21 October 1996 (Tab AA-11) where he employed as number two of a four-ship formation against two F-16s simulating MIG-29s and two LEAR-35s simulating strikers. This mission was completed with no discrepancies noted and a positive comment from the Flight Examiner (Tab AA-12). Lt Jennings completed a G-awareness check on the mishap sortie with no problems noted (Tab V-10).

16. Medical: Lt Jennings' medical and dental records were reviewed. He was medically qualified for flight duty at the time of the accident. There were no disqualifying medical, psychological, or physiological discrepancies noted in his medical or dental records. A valid AF Form 1042 was filed in the his medical records (Tab AA-13). Post-mishap toxicology analysis for drugs of abuse was negative and no presence of ethanol was detected in his blood (Tab AA-13, AA-16).

Human factors reviewed during the course of this mishap investigation included the following:

- a) Personal relationships: Lt Jennings was described as an individual with a professional attitude. He was characterized as having excellent flight discipline, but below average to average pilot skills. Possessing an exemplary attitude, he compensated for his developing pilot skills by diligent study and hard work (Tab V-3, V-14, V-21, V-22, V-25, V-27, V-29). He was well liked and respected by those interviewed, and was described as a family-oriented individual. He worked well with his peers and had no adverse behavior mentioned (Tab V-3, V-14, V-21, V-23, V-24, V-27, V-31, V-33).
- b) Lifestyle: Review of Lt Jennings' medical records revealed no indication of smoking or adverse alcohol consumption (Tab AA-13). He had a well balanced schedule between his ANG flights and personal commitments. He was thought to consistently adhere to crew rest requirements (Tab V-3, V-14, V-21, V-27). Lt Jennings has a family. He is currently completing a baccalaureate degree in computer science at Fresno State University (Tab V-7).

- c) Physical characteristics: Lt Jennings was 69 inches tall and weighed 199 lbs at the time of his last physical exam (Tab AA-13). He was described by members in his squadron as healthy and physically fit (Tab V-27, V-29). However, he described his conditioning as varying based on personal commitments and time constraints (Tab V-8). Injuries he sustained after the mishap included: (1) left renal contusion, (2) left elbow posterior dislocation, (3) left neck laceration (1½"), (4) multiple contusions, (5) 10th left rib contusion, and (6) right forehead hematoma (Tab X, Tab AA-13). His X-ray surveys (cervical, thoracic, and lumbar) were unremarkable for acute pathology. His metabolic/whole blood screening was consistent for mild dehydration or internal blood loss. Available medical data did not allow determination if he was dehydrated at the time of the mishap or if mild dehydration occurred during SAR efforts. Contusions following his ejection and parachute landing fall may have resulted in internal bleeding (Tab AA-13).
- d) Physiological factors: G-induced adverse effects and spatial disorientation were further investigated. Lt Jennings accomplished two standard levels of centrifuge training. Both Air Training Command and Combat Air Force centrifuge training were completed approximately three years prior to the mishap (Tab AA-15). He reported "working harder with G's" during the mishap sortie (Tab V-10). Reviewing the mishap engagement, he recalled the following: (1) initiation of the initial defensive maneuver (which caused a rapid onset of G-forces); (2) not being conscious of anything until regaining awareness and perceiving the aircraft was extremely nose low relative to the ground; (3) perceiving no sense of sound; (4) having little command of his hands; and (5) a "fuzzy" visual scene with cloudy sensorium (Tab V-11). This symptom complex is commonly observed after G-induced loss of consciousness (G-LOC) (Tab BB-17, BB-19, BB-27). Lt Jennings initiated ejection when he perceived efforts to recover the aircraft were futile (Tab V-12).
- e) Pathological factors: There was no evidence of predisposing injury or disease according to medical and dental records review (Tab AA-13).
- f) Psychological factors: Evidence indicated no history of behavioral or psychological problems (Tab AA-13). He was described as an easygoing, quiet individual who was mission focused and maintained a positive attitude at all times (Tab V-3, V-14, V-21, V-23, V-27, V-29, V-33).

- g) Environmental factors: The mishap sortie was conducted in full daylight and clear skies. Takeoff was early afternoon (1322L). Flightline temperature was 95 degrees and FITS (Fighter Index of Thermal Stress) Normal. There were no cloud layers in the operating area (Tab K-4, W-2, AA-13). R2508 was described as favorable for day operations with intermittent air traffic. On the day of the mishap, Saline MOA was described as "nothing seemed out of the ordinary" (Tab V-9, V-15). No unusual cockpit temperatures, noise, or lighting were detected. While confident all G-protection equipment was connected, Lt Jennings could not positively state awareness of Combat Edge operation during the course of the mishap sortie (Tab V-10).
17. Nav aids and Facilities: There were no NOTAMs pertaining to navigational aids or facilities on 20 June 1997 that affected the ACM mission. All relevant navigational aids and facilities were functional. The NOTAM system, updated daily by Airfield Management personnel via a printed hard copy, was received by operations duty desk personnel and posted. Pertinent NOTAMs for Fresno and local area alternate airfields are filed in a briefing book maintained at the duty desk (Tab K-4, V-31).
18. Weather: (Tab K-4, W-2, W-3)

SYNOPTIC WEATHER ON 20 JUNE 1997 FOR CENTRAL CALIFORNIA

The central section of California was under the influence of a high pressure system over the region. The only hazard noted in the area was light to moderate turbulence extending from surface to 10,000 feet MSL. Skies were clear with no restriction to visibility. Visibility in flight was seven miles or greater. Surface winds were from the southwest at approximately 10 knots with temporary gusts of 12 to 25 knots. Conditions were stable and forecast to remain at that way. Sunset was at 1921L.

FRESNO (FAT) OBSERVATIONS AND FORECAST

At 1100L, McChord weather service forecast winds to be from the west by northwest at nine knots, with visibility greater than three miles. Skies would be clear.

R2508 OPERATING AREA PLANNING FORECAST

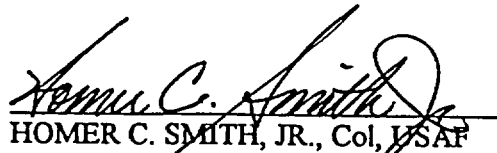
Weather forecast at 1100L by McChord Weather Cell, valid until 21 Jun 97, 0530L, called for weather conditions of clear skies with inflight visibility of greater than

seven miles. Winds were forecast as gusty from the southwest with a minimum altimeter setting of 29.77.

19. Governing Directors and Publications: Primary directives and publications relevant to this investigation are:

AFI 11-206, General Flight Rules
AFI 11-206, ACC Sup 1, General Flight Rules
AFI 11-401/ANG Sup 1, Flight Management
AFI 11-214, Aircrew and Weapons Director Procedures for Air Operations
MCI 11-463, Operations Supervision
MCI 11-F16 Vol 1, Pilot Training F-16
MCI 11-F16 Vol 3, F-16 Pilot Operational Procedures
MCI 11-F16 Vol 3, 144 FW Sup, Chapter 8, Local Operating Procedures
MCH 11-F16 Vol 5, Flying Operations - Combat Aircraft Fundamentals - F-16
MCM 3-1 Vol 5, Tactical Employment F-16 (U)(S)
ACCI 11-301, Aircrew Life Support Program
AFPAM 11-404, G-Awareness for Aircrews
T.O. 1F-16C-1, F-16C/D Flight Manual
T.O. 1F-16C-1-1, Supplement Flight Manual
T.O. 1F-16C-1-4, Supplemental Flight Manual
T.O. 1F-16C-34-1, Avionics and Non-nuclear Weapons Delivery Flight Manual (U)(S)
T.O. 1F-16C-34-1-3, Avionics and Non-nuclear Weapons Delivery Flight Manual
T.O. 00-20-5, Aircraft, Drone, Aircrew Training Devices, Engines, and Air-Launched Missile Inspections, Flight Reports, and Supporting Maintenance Documents
AFM 66-279, Core Automated Maintenance System Users Manual
144th FW Inflight Guide

Dated this 2nd day of September, 1997.


HOMER C. SMITH, JR., Col, USAF
Accident Investigation Board President

Statement of Opinion

Under 10 U.S.C. 2254(d), any opinion of the accident investigators as to the cause or causes of, or the factors contributing to the accident set forth in the accident investigation report may not be considered as evidence in a 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.

Lieutenant Jennings, the mishap pilot, was a relatively new F-16 pilot with moderate experience (Tab G-5, T-6). He was respected by his fellow pilots and supervisors for his attitude and desire to improve (Tab V-3, V-14, V-21, V-22, V-25). He was healthy and in excellent physical condition (Tab V-27, V-29). He approached his flying and duties within the 144th FW professionally, enthusiastically, and diligently (Tab V-21, V-22, V-25, V-29). His currency for ACBT was updated on 19 June 1997 by an ACT sortie and his last ACM sortie was 16 June 1997 (Tab G-16). He regularly used sound practices and procedures while accomplishing required training. He was considered a conservative pilot who knew his capabilities and would not knowingly exceed them (Tab V-14, V-23). However, during his fifth ACM intercept to engagement, he was unable to control his aircraft's position and flight path relative to the ground and entered a high-speed, near vertical dive from which he was unable to recover. He initiated ejection when he perceived recovery attempts were futile (Tab V-11).

A thorough review of aircraft maintenance records (Tab U), seat-mounted flight data recorder analysis (Tab J-7), Lt Jennings' training records (Tab G-16 thru G-21), squadron standards, and common practices revealed no discrepancies or causal factors (Tab V, BB-2, BB-6 thru BB-12). Therefore, this mishap was caused by human factors.

Human factors embody anomalies in human perception, thought processing and action, and the physical and mental status of an aircrew member before and during a mishap sequence. Specific human factors considered central to this investigation include incorrect assessment of G tolerance and occurrence of G-induced Loss of Conscious (G-LOC). Both of these contributed to a loss of situational awareness (a loss of accurate position and time sense with respect to the environment) due to amnesic incapacitation. The loss of accurate space and time assessment, combined with the confused mental state and hampered motor functions during recovery, can and does result in disaster (AFPAM 11-404, Tab BB-17, BB-19, BB-27).


Flight path depiction shown in Tab BB-4, combined with a timed sequence of events from HUD/radar information (Tab BB-3) and flight member testimony (Tab V-6, V-10, V-16), provide a thorough description of the events, factors, and circumstances of this mishap. As the mishap engagement began, Crud 1 element (Crud 1 and Lt Jennings) and Crud 3 were separated by thirty miles. As the two groups approached to ten miles separation, Crud 3 employed a simulated radar missile against Lt Jennings. In response, Crud 1 element executed a defensive maneuver to the right, away from Crud 3. After the element completed the maneuver, Crud 3 terminated the radar missile attack and continued toward the element to engage visually. Crud 1 element turned back into Crud 3 when they had indication the missile attack had been terminated. Crud 1 and Crud 3 saw each other and executed a high-aspect pass. Lt Jennings lost sight of Crud 1 at the merge due to the sun. He did not see Crud 3, so he elected to extend out from the merge, gain turning room and airspeed, and then reenter the visual engagement from an position where the sun would not be a factor. During this unloaded extension, Crud 3 engaged him with a simulated missile. Lt Jennings had indications of the attack and initiated a hard left defensive turn (Tab V-10) of 5-6 Gs (Tab J-7). He had been in an unloaded extension for at least seven seconds prior to initiating this maneuver (Tab BB-3). The next conscious awareness Lt Jennings recalled was perceiving the aircraft was in a steep dive towards the ground. He felt disoriented, had blurry vision, no sense of sound, and could not make his hands move as he wished. He ejected when he perceived his recovery attempt was unsuccessful and ground collision was imminent (Tab V-11).

Prior to the mishap engagement, Lt Jennings recognized his G tolerance was less than at the beginning of the mission. He was having to work harder to maintain his earlier level of G tolerance and this resulted in slight fatigue. He did not associate his increasing fatigue with a possible PBG malfunction as his G-awareness maneuver and system check had been normal. The decision not to terminate the mission at this point was based on prior G tolerance experience (Tab V-8) and anticipated G requirements (Tab V-10). Fatigue and associated decrease in G tolerance during the course of a mission involving high Gs is not unusual (Tab BB-25). Lt Jennings' G awareness and decision to reduce the level of Gs when maneuvering, as well as inform flight lead of such, is indicative of a mature and conservative pilot. He was highly motivated and physically prepared for this mission. He followed current unit philosophy (Tab V-5, V-20, V-22, V-27, V-29) and published guidance in assessing his physical capabilities during the course of the mission (Tab BB-24) and adjusted accordingly (Tab V-10). However, his fatigue level, combined with his unloaded extension, reduced his G tolerance to a lower level than he anticipated and delayed the effectiveness of his Anti-G Straining Maneuver (AGSM) (Tab BB-19, BB-27). His training for the high-G environment, both physical and mental, dictated preparation for anticipated

G-onset rate and peak level prior to initiation of Gs (Tab BB-25). However, he was unprepared for the degree of G tolerance reduction following his unloaded extension (Tab BB-26, BB-27). Resultant of these factors was a G-induced phenomenon in which Lt Jennings experienced either a short-term loss of consciousness (G-LOC) or an almost loss of consciousness (A-LOC) episode (Tab BB-19, BB-27).

Extensive interviews with 144th Fighter Wing supervisors and personnel, along with direct observation of daily flying operations, indicate a flying organization with a positive and professional unit culture. The wing's approach to all training flights is methodical and well disciplined. Missions are appropriately tailored to each flight members' proficiency and requirements. The unit's cooperative philosophy and motivation to improve, reflect a healthy environment with high professional standards. Unfortunately, even with the most thorough preparation and capability, the human factor continues to limit perfect success.

Dated this 2nd day of September, 1997.


HOMER C. SMITH, JR., Col, USAF
Accident Investigation Board President