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OFFICE OF THE SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFFSUMMARY OF FACTS
F-16C MISHAP ON 23 MARCH 1998

AUTHORITY and PURPOSE

1. On 9 April 1998 the commander of Twelfth Air Force, Lieutenant General Lansford Trapp, appointed Lieutenant Colonel Gregory Rogge to investigate an aircraft accident in accordance with Air Force Instruction (AFI) 51-503, Aircraft, Missile, Nuclear, and Space Accident Investigations. Assisting were Major Paul Bowman (maintenance advisor), Mr. James McLaren (legal advisor), and Captain Chetan Kharod (medical advisor) (Y-2-6).

2. On 23 March 1998 the left main gear of F-16C serial number 89-2067 collapsed upon landing at its home base of Hill AFB, UT. The accident caused an estimated \$1,865,328.75 of damage to the aircraft (M-8). AFI 51-503 directs an accident investigation for any Class A mishap. (AFI 91-204 defines a Class A accident as one where the mishap cost is greater than \$1,000,000.) The purpose of an AFI 51-503 investigation is to gather and preserve evidence for claims, litigation, disciplinary and adverse administrative actions, and for all purposes other than mishap prevention. Under 10 U.S.C. 2254 the investigating officer also gives his opinion on the cause and any contributing factors to the accident.

SUMMARY OF FACTS

3. History of Flight: Lt Col John Burgess, Jr., commander of the 388 Operations Support Squadron, briefed as the second man of a four ship training flight with the 4th Fighter Squadron (FS). The flight, call sign Bones, was to conduct night aerial refueling and practice procedures for dropping laser guided bombs (V-7.2). One aircraft had maintenance problems so Bones flight took off at 1859 hours local time as a three ship and proceeded to air refueling route AR-659 (V-7.2,7.3). The aircraft was carrying four missile launcher rails, a dummy AIM-9 missile, an acceleration measuring device (AMD) pod, an air combat maneuvering instrumentation (ACMI) pod, two low altitude navigation and targeting infrared for night (LANTIRN) pods, two empty weapons pylons (MAU-12s), two 370 gallon wing tanks, and an ALQ-184 electronic counter-measures (ECM) pod (M-2). At 1919, prior to refueling, the Hill Supervisor of Flying (SOF) initiated a weather recall due to a forecast of strong winds (N-2/V-6.2). Bones flight held in training area while Hill changed the active runway to 32 and another flight commenced its approach (N-6,8/V-7.4). Bones 2 (the mishap aircraft) was finally cleared to begin its recovery at 1958 (N-16). Problems with the up front control (UFC) prevented him from selecting the proper navigation aid (navaid) channels so Bones 2 received radar vectors to a visual approach to runway 32 (N-20/V-12.7). Upon touchdown the left main gear collapsed (R-13/V-12.11). The aircraft continued down the runway, drifting slowly to the left until it went off the runway surface shortly before stopping approximately 9400' past the threshold of runway 32 (R-11,13,15). The pilot ejected about the time the aircraft left the runway (R-15, V-12.12). Media inquiries about the

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In the matter of PPS
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Intervenor _____ REJECTED _____
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Contractor _____ Witness _____
Other _____
Reporter ELH

accident were handled by the Public Affairs office of the 388 Fighter Wing (FW) at Hill AFB and by the wing's vice commander (AA-2). Media interest was limited to the local area (AA-2-7).

4. **Mission:** This was a routine training flight. Lt Col Burgess needed this, his fifth flight that month, to requalify in basic mission capable (BMC) status (G-58). [Note: BMC means that a pilot is qualified to fly the basic combat missions of his aircraft (BB-2). BMC requires that a pilot fly five times a month or fifteen times in the past three months (BB-3). Lt Col Burgess had not met this sortie rate (called his look back) since the previous July (G-7,8). To regain BMC qualification a pilot must fly five combat training missions in a month (BB-4,5).] This mission would practice the procedures for dropping laser guided bombs. As no bombs were actually carried the results were to be graded based upon analysis of video recordings of the cockpit displays (V-7.2).

5. **Briefing and Preflight:** Lt Col Burgess reported to work that morning at 1205 after getting around nine hours of sleep (V-12.15,12.16). He worked in his office until going to the 4th FS for the mass brief which began at 1630 hours (V-12.16). Weather at Hill was forecast to be 10,000' broken and 25,000' overcast for recovery (K-9). The flight brief was given by the flight lead, Capt Jeffrey Clayton, call sign Bones 1. The briefing covered all required items for the mission (V-12.4). Capt Clayton talked about night lighting and trail procedures but did not particularly emphasize night landings (V-7.2). Lt Col Burgess had some questions after the briefing, but seemed to Capt Clayton to be ready to fly (V-7.2). Neither one noticed that Lt Col Burgess was overdue tanker currency which would require an instructor pilot or squadron level supervisor (defined as flight commander or above) to be in the flight (BB-6-8).

6. **Flight:** Take off, rejoin, and departure were uneventful other than the number four man ground aborting (V-7.3). Lt Col Burgess reported no major problems flying the departure (V-12.5). Just as they rejoined with the tanker, the flight got the call informing them of a weather recall (V-7.3). Capt Dean Fair, the SOF on duty, had received information from the base weather shop indicating that winds would go above cross wind limits (V-6.2). Capt Clayton decided not to refuel so as to expedite the return to base (V-7.3). The flight held in the area while waiting for clearance back to Hill. Capt Clayton asked for separate approaches with Bones 2 recovering first due to his lower fuel state (V-7.5). Clover, the range controller, had Bones flight hold at Poison intersection at different altitudes with Bones 2 the lowest at 16,000' (N-12/R-3). The flight had to delay due to the runway change, requiring time for approach control to prepare for different approach paths, and to get spacing on the preceding flight on the recovery, call sign Killer (N-14). Bones 2 was given vectors for the recover at 1958 and cleared for the Moser recovery at 1959 (N-16/O-2,3). Clover asked Bones flight to maintain 250 knots (kts) on the recovery and advised them that Salt Lake approach would be talking to him on the VHF radio due to problems on their UHF radio (N-16,17). Lt Col Burgess had noticed that he could not enter data on his UFC; the first number he would enter would repeat itself and not allow anymore entries (V-12.6). Cycling power solved the problem briefly, but then the trouble came back (V-12.6). Bones 2 informed Clover that he was unable to dial up the proper TACAN (TACTical Air Navigation) frequency (N-

17). Clover acknowledged and gave Bones vectors to the Moser intersection (N-17). His UFC problem also prevented him from changing his inertial navigation system (INS) steerpoints (V-12.6). He did not try using the inc/dec switch to change steerpoints nor did he use the back up control that would have given him another means of changing the TACAN channel (V-12.6,12.7). However, the VHF radio frequencies can not be changed in the back up mode. Clover sent Bones 2 to the Salt Lake VHF approach frequency at 2006 (N-17). Bones 2 contacted Bear sector of Salt Lake approach at 2011:30; Lt Col Burgess could offer no explanation for the time gap between talking to Clover and Salt Lake (N-20/V-12.7). Bones 2 asked for information on distance from Hill as "...my nav aids (navigation aids) are out" and approach responded with an offer to vector him to a base leg 12 miles southwest of Hill (N-20). Lt Col Burgess later stated that he knew he was supposed to be doing a TACAN approach in accordance with flight crew information file (FCIF) 97-19, but felt that a visual approach to Hill was preferable to diverting to a strange field with no nav aids (V-12.11). Salt Lake approach passed the weather as being winds 330° at 9 kts, 7 miles visibility, lowest clouds at 6,000', and altimeter setting of 29.89 (N-20). [Note: This matches closely with the weather given by the Hill weather shop shortly after the accident with the addition of thunderstorms 5 miles northwest moving northeast (K-10/N-26)] At 2013 approach pointed out the aircraft in front of Bones 2 at five miles and the base at 7½ miles. Bones 2 called both in sight and was sent to tower frequency (N-21/V-12.8). Lt Col Burgess could see the location of the base but did not have sight of the runway itself at this point (V-12.8).

(a) Five of the pilots interviewed had flown a night approach to runway 32 and four agreed it was difficult. The approach is rarely done; only one of the five had done it more than once (V-8.5). The TACAN approach comes in at an angle (O-2/R-5,7,9). [Note: The TACAN ground track shown on the color maps in Tab R of Part 1 (the black line in the drawings) is slightly off. It was drawn using the local variation of 14° instead of the 17° variation that is actually set in the Hill TACAN (BB-11). The ground track should be plotted 3° further to the left.] The angling final creates a problem in that the high intensity runway lights (HIRLs—the ones along the edge of the runway) are bi-directional (BB-12). They are hard to see until one is lined up with the runway. Other lights in the area mask the runway lights until close to the field (V-4.3,6.6,8.5,11.6). On this particular night the 4th FS operations officer, who had also never made a night approach to runway 32, had to make a missed approach (V-11.6). He could identify the strobes marking the end of the runway but could not tell his alignment with the runway until he was too close to make a proper heading adjustment (V-11.6,11.7).

(b) Bones 2 checked in with the tower at 2013:53 stating he was seven miles out for a visual straight in approach to runway 32 (N-23). The two SOFs (there was a changeover going on) both thought it unusual that Bones 2 was flying a visual approach instead of a TACAN, but did not want to call and distract him at this point (V-6.6,8.2). As he approached five miles from the field Lt Col Burgess tried one last time to switch the TACAN channel and managed to get the Hill TACAN (V-12.8). He noted he was one dot width (five degrees) off course to the left (V-12.8). In response to this he made a correction to the right and then continued to concentrate on picking out the runway visually (V-12.8). At five miles he was cleared to land and acknowledged with a gear down call (N-23). Twenty-one seconds later (2015:15) Bones 2 asked if "...the rabbits (are) on?" [Note: "Rabbit" is a slang term for sequenced flashing lights at the end of a

runway.] (N-23). As soon as he asked, the pilot remembered there are no approach lights to 32, only strobes marking the end of the runway (V-12.8). Tower replied that they had neither "rabbits" nor approach lights for 32 but did offer to turn up the lights along side the runway which was accepted by Bones 2 (N-23). There were no other radio calls from Bones 2 until after touchdown. Lt Col Burgess stated he had a lot of problems picking out the runway itself; he could just see the runway lights and didn't pick out the threshold lights until short final (V-12.8). Cockpit lights were turned down (light settings were verified by the investigating officer) and Lt Col Burgess stated that reflections off the canopy were not a problem (V-12.9). Once he saw the runway he stated things "started kind of happening pretty quick" (V-12.9).

(c) Lt Col Burgess felt a little high but was willing to accept a long touchdown (V-12.9). The PAPIs (precision approach path indicator lights) indicated he was a little high as he turned to final, then on glide path; his crosscheck was then focused on the runway (-12.9). He suddenly perceived ground rush and tried to flare the aircraft with back stick and power but it didn't respond (V-12.9). Data from the crash survivable flight data recorder (CSFDR) shows Bones 2 coming in at the runway from the south (R-7). He is initially heading to a point around ½ mile out on the extended centerline of the runway. At about 1 1/2 miles out Bones 2 makes a slight left turn to point directly at the end of the runway, followed at around 1 mile by a right turn to move toward the extended centerline of the runway (R-9). At CSFDR time 76:30 (just under 12 seconds from touchdown; equates to around ½ miles from touchdown) Bones 2 is at 4960' MSL (180' above the threshold elevation), going 180 kts, is at 11.25° angle of attack (AoA), is in 28° left bank to get aligned with the runway, and is climbing at 3 ft/sec (180 ft/min) (O-70). [Note: For an 11° AoA approach the proper speed for this aircraft weight is 171 kts (J-14/BB-10). The investigating officer judged airspeed to be within acceptable boundaries as was the altitude.] The amount of bank is unusual. The investigating officer also reviewed a computer generated simulation of the aircraft produced by HQ AFSC/SEFE-OL. It showed Bones 2 was still in a left bank as he crossed the end of the overrun (1000' before the threshold) and in a 5°-10° left bank just before touchdown meaning the left gear took the brunt of the touchdown.

7. Impact: Touchdown occurred at 76 minutes 41.813 seconds elapsed time on the CSFDR at 645' past the threshold of runway 32 (O-27/R-13). An analysis of the CSFDR data shows that AoA was around 16.4° (maximum allowed is 15° to prevent hitting the speedbrakes), speed was 151-177 kts, and the aircraft was in a slight left bank (CC-3). Less than a second prior to touchdown vertical velocity was 1140-1620 ft/min down (CC-3). Marks on the runway from the ECM, ACMI, and AMD pods show that collapse of the left main gear occurred at touchdown (R-13). The aircraft continued down the runway throwing up sparks (V-8.3,9.4). At some point the right main tire disintegrated from the side loads (J-28). A chunk of this tire is the likely cause of a puncture in the right wing root that allowed internal fuel to escape (S-13). As the jet continued down the runway the fuel ignited, causing the aircraft to have a trail of flame behind it (V-6.8,8.3). The tower controller radioed, "If able egress, you appear to be on fire" (N-24). The pilot asked, "Understand bailout?" (N-24). The controller, hesitant to give such a directive command, replied, "You appear to be on fire, complete fire out of the rear end" (N-24/V-9.6). The aircraft slowly drifted left and departed the runway surface just before coming to a stop

9400' down the runway (R-15). The pilot, perceiving that the fire was getting bigger, ejected just as the jet left the runway (R-15/V-12.12). The fire burned briefly before going out (V-8.4).

8. Egress Systems: Lt Col Burgess ejected when the airplane was traveling at 66 kts at an attitude of 6° nose up and 13° left wing down (CC-4). The ejection was within parameters and the system worked as designed (J-8-12, CC-10). He only had time to release his four line jettison on the parachute before landing (V-12.12).

9. Personal and Survival Equipment: Personal equipment inspections were up to date (U-2-7). There was no chance to use the survival equipment due to the quick response of the rescue forces.

10. Rescue: From transcripts of conversations in the tower, touchdown occurred at 2016:00. Ejection occurred at 2016:46 (N-24). The crash phone was activated while Bones 2 was still sliding down the runway (N-24). The fire department responded within a minute (V-2.1). The aerodrome officer (AO) was cleared onto the taxiway at 2017:28 and made the initial report on the status of the plane (N-24). The ground controller reported the fire department arriving on scene at 2020:01 (N-25). Lt Col Burgess went over and waited by one of the fire trucks (V-12.12). The AO spotted the pilot at 2020:33 and called for an ambulance (N-25). By 2023:36 the AO reported that the pilot was in the ambulance and was leaving for the hospital (N-26).

11. Crash Response: The fire department dispatched with five vehicles: a P-18 rescue vehicle, a command vehicle, a P-19 crash vehicle, and two P-23 crash vehicles (V-2.1). On arrival, the fire chief found no signs of fire around the jet (V-2.2). He directed a crash vehicle to put out three or four burning pieces of aircraft tire on the runway (V-2.2). He found the aircraft off the left side of the runway with the engine still running (V-2.2). A fireman went to the right side and pinned the emergency power unit (EPU) (V-2.3). He did not find any hydrazine leaks, but did see fuel leaking from a hole in the right wing (V-2.3). The area was foamed to reduce the chance of a fire (V-2.3). Two firemen then approached the aircraft from the left side carrying a ladder and shut down the engine (V-2.3). The fire department then evacuated the area (V-2.3).

12. Maintenance Documentation: The maintenance representative reviewed aircraft forms and found no major irregularities or any indication of a pending system failure. A 180 day look-back of CAMS history, likewise, revealed nothing that appeared causal to this mishap. A check of pending Time Compliance Technical Orders (TCTOs) was also made (H-2). The only one that was considered to be related to the incident was TCTO 1F-16-2050, Inspection of main landing gear (MLG) and nose landing gear (NLG) components. This had not been accomplished prior to the mishap, however, the maintenance member felt this did not contribute to the incident as will be explained further in the Airframe and Aircraft Systems Section of this report. The only overdue inspection item was a 14 day records review that was due on 20 Mar 98. The inspection had been partially completed, but not yet signed off by maintenance supervision (H-17). This action did not contribute to the incident. A joint oil analysis program (JOAP) sample was taken and analyzed immediately prior to the mishap flight and found to be normal and consistent with previous wear

metal readings showing no negative trends (J-39/U-8). A review of the engine history also produced no irregularities that would contribute to this incident. In fact, the engine had been completely overhauled around four months prior to the incident (J-2). A combined basic postflight/preflight inspection had been accomplished at 21:30 on 20 Mar 98 and a walk around inspection accomplished at 12:00 on 23 Mar 98 with no discrepancies noted (H-4). A thru flight inspection was also accomplished after the first flight of the day at 17:00, also with no discrepancies noted (H-4). The previous five sorties prior to the mishap were code 1 (no in-flight discrepancies) (U-9), also indicating that the aircraft had been flying very well. In addition to maintenance documentation, the squadron commander, Lt Col Dean Wilson, verified in his sworn testimony that aircraft 2067 was one of the better flying aircraft in the squadron (V-5.5).

13. Maintenance Personnel and Supervision: The maintenance representative reviewed the crew chiefs and specialists' AF Forms 623 (On the Job Training Records) and AF Forms 797 (Job Qualification Standard Continuation/Command JQS). These training records indicated that the individuals assigned to work the mishap aircraft (MA) were properly trained and held the proper skill level required to perform assigned duties. The 4th FS Maintenance Supervision provided adequate oversight and was effectively organized in the manner specified in ACCI 21-101 (Objective Wing Aircraft Maintenance). No maintenance practice or procedure was deemed a factor in this incident.

14. Engine, Fuel, Hydraulic, and Oil Inspection Analysis: Fluid samples were taken from the mishap aircraft (MA) and analyzed by the OO-ALC Chemical Science Laboratory. Both hydraulic and fuel samples were analyzed for contamination from solvents and other fuels and oils using a capillary gas chromatograph equipped with a FTD detector. Samples matched respective reference samples indicating no contamination was noted (J-41). The samples were also tested for the presence of water with the following results:

Hydraulic fluid - 33.4 ppm (J-41); well within the 350-400 ppm recommended limit (U-10)

JP-8 fuel - 134 ppm (J-41); exceeds the 10 ppm limit per T.O. 42B-1-1 (U-11)

The maintenance representative discussed possible engine performance degradation due to the presence of 134 ppm water in the fuel system with the 388 FW General Electric Field Representative, Mr. Neil Kestler. In researching this issue, Mr. Kestler received an E-mail from the General Electric Field Integration Manager, Mr. Phil Garda, who indicated that from an engine operational standpoint, this amount of water in the fuel is considered a very low concentration, and will have no detrimental impact to F110 engine performance or operability (U-12). JOAP sample was also taken and analyzed by the 388 Maintenance Squadron NDI Lab. Analysis of critical wear metals was extremely clean and reflected the negligible wear typical of a recently overhauled engine (J-39). The results of this analysis were consistent with the JOAP historical records of this engine since being installed in this aircraft and indicated no negative trends in wear metals (U-8).

15. Airframe and Aircraft Systems: The aircraft underwent a major phase #1 inspection on 15 Jan 98 where the NLG and MLG bushings were inspected for wear in accordance with TO 1F-

16CG-2-32FI-00-1 procedures. The maximum wear limit for NLG bushings is 10/32s of an inch (U-13.4). The MA's NLG wear measurements indicated only 4/32s of an inch (U-14.1). The maximum wear limit for the MLG bushings is 8/32s of an inch (U-13). The MA's RMLG bushings measured only 2/32s of an inch (U-14.1) and the LMLG measured only 1/32 of an inch (U-14.2). These measurements indicate very little wear and are well within the tech data criteria. Prior to the mishap, the landing gear experienced a total of 37 landings since these measurements were taken. Additionally, upon post-mishap examination of the landing gear components, OO-ALC/LLE depot engineers concluded that accomplishment of this TCTO would not have reduced the severity of this incident but rather exacerbated the situation by increasing the loads to the shock struts due to being stiffer (J-15). The report also described the landing gear as being in very good condition prior to the mishap and had been lubricated, and maintained very well (J-15). Post-mishap engineering analysis of the 341 bulkhead landing gear attach lugs shows failure at both the shock strut and tension strut attach points (J-14). Tear-down analysis on 2 April 98 of both shock struts indicate severe over-pressurization in the dynamic pressure chamber as a result of the dynamic pressure exceeding the design limits of the strut (J-17, 18, 19). Pressure in the dynamic chamber exceeds the design allowable limits when the strut cannot compress fast enough and dynamic pressure increases until the outer piston yields. The reported sink rate of 23 feet per second at 28620 pounds exceeded the design limits of the landing gear (max landing wt of 31,000 pounds at a sink rate of 10 feet per second) (J-14) and substantiates the damage found to the gear components and attach fittings. The metallurgical analysis of the attach lugs indicates these parts showed only overstress as the failure mode. Material characterization revealed no significant material defects (J-29). CAMS records indicate that the Left MLG shock strut had been replaced with a recently overhauled strut on 29 July 1997 due to chafing the uplock hook (U-15, 15.1, 15.2, 15.3, 15.4), however, this maintenance history had not been recorded on the applicable AFTO form 95, Significant Historical Data Sheet. Examination and testing by the 388 Maintenance Squadron Pneudraulic Shop revealed only minor adjustments with the replaced strut (U-15.3), so it was subsequently returned to supply. Again, the maintenance member felt this action had no affect on the incident. Other recent landing gear associated maintenance included replacement of the right MLG tire on 16 Mar 98 for normal wear (U-16). This tire had seven landings prior to the incident. Additionally, both the left MLG tire and NLG tire had been replaced on 19 Mar 98 and had only one landing each, prior to the incident (U-16.2). Aircraft records also indicate that the canopy transparency had been written up on 26 Dec 97 as being excessively scratched and crazed. The pilot recommended daytime operations only due to excessive glare at night. The transparency was replaced on 30 Dec 97 (U-17). The pilot who flew 2067 on the previous sortie reported no problems with the canopy (V-3.2). Post mishap engine examination indicated the engine was in very good condition prior to the incident and withstood the affects of the mishap very well. The engine (serial # 509862) had been installed in aircraft 2067 on 15 Jan 98 after completing a 6000 TAC Cycle overhaul on 26 Nov 97 (J-2/U-18). Engine maintenance required to refurbish the engine to serviceable condition after the incident included blending a minor nick on one first stage fan blade, replacing two inlet guide vane arm bearings, replacing the climb/dive filter bowl packings, and replacing one divergent exhaust nozzle flap for a small crack (U-19.1, 19.2, 19.3). The pilot reported difficulties with the "up front

control" or Integrated Control Panel located on the pilot's HUD display unit (V-12.6). This unit was removed from the aircraft and bench checked on the 388th Maintenance Squadron Avionics Flight's automatic test station. The unit passed the diagnostic test (U-20) and had no maintenance history in CAMS or REMIS within the past 180 days (U-20.2,20.3).

16. Operations Personnel and Supervision: The mission was authorized on 23 Mar 98 by Lt Col Dan Seville, 4 FS Operations Officer (K-2). A mass brief given by Lt Col Seville preceded the flight brief (K-6-9/V-12.3). Bones flight lead was Capt Jeffrey Clayton (K-2). Capt Clayton briefed Bones flight using the squadron briefing guide (reviewed by the investigating officer and found to be directly out of Multi-Command Instruction (MCI) 11-F16, Vol 3) supplemented by a personal guide to brief threat reactions (V-7.2). All applicable items were covered (V-12.4). Runway 32 operations were not mentioned as nobody thought they would be switching runways (V-12.4). Neither the squadron leadership, the flight lead nor Lt Col Burgess noted that he was out of air-to-air refueling currency and, therefore, required an instructor pilot or squadron supervisor to be in the flight (V-7.3,11.5,12.3/BB-6,7). Also, Lt Col Burgess had been identified as N-BMC due to lack of sorties (see next paragraph)(G-57,58). Note 1 of Table 4.1 of MCI 11-F16 states, "Prior to being recertified CMR/BMC, the pilot must satisfy the subsequent 1-month sortie look back requirement" (BB-4). Paragraph 1.4.4.4, of MCI 11-F16, Volume 1 states, "While N(on)-BMC, pilots may not perform combat training without supervision until recertified" (BB-9). The definition of "supervision" in this sentence is not specifically stated, but the intent would seem to be for an instructor pilot (IP) or flight commander or above to be in the flight (BB-8). Neither Capt Clayton, while highly experienced, nor the number three man, Capt Thompson, met this definition (G-47/K-2/V-7.1). An additional review of his sorties (see next paragraph) showed Lt Col Burgess should have been further regressed to mission qualification training (MQT) status for being N-BMC for over 180 days which would have mandated flying with IPs or squadron supervisors (BB-15,16,17).

17. Pilot Qualifications: Lt Col Burgess met all currencies required to fly except for air-to-air refueling (G-14-16). He has flown the F-16 since Dec 87 (G-6). He previously was a flight lead and instructor pilot although he is currently just a wingman due to the limited amount of flying he does (G-5,31-36,47,64/V-5.5). Excluding the mishap sortie he has 1074.1 hours in the F-16 (including 49.2 at night and 22.0 as an instructor pilot) and 3450.8 hours total (G-4-6). His 30/60/90 breakdowns (excluding the mishap sortie) are as follows (G-55):

	Hours	Sorties
30 Days	7.2	5 (including one night)
60 Days	11.0	8
90 Days	12.3	9

a. His sortie look back by month is as follows (G-7-9):

Jul 97	Aug	Sep	Oct	Nov	Dec	Jan 98	Feb	Mar
5	3	1	3	3	2	1	4	4 (+ mishap sortie)

This was Lt Col Burgess' first night sortie in a month and only his second night sortie since July (G-7-9). He was N-BMC due to lack of sorties; he had not flown five sorties in the previous month nor fifteen sorties in the last three months as required by Table 1.1 of MCI 11-F16, Vol 1 (BB-3). He had been placed in N-BMC status on 3 Feb 98 due to not meeting sortie look back (G-57/BB-4,5). However, by the raw sortie counts shown above, he should have been identified as N-BMC at the end of October for look back. Additionally, his last sortie in July 1997 was an advanced handling characteristics (AHC) ride which does not count as a combat training flight and therefore he should have been identified as N-BMC as of 1 Sep 97 (G-15, BB-3,4). By paragraph 4.10.2. of MCI 11-F16, Vol 1 this should have placed him as N-BMC for over 180 days which would require reaccomplishment of MQT (BB-15,16,17). If not for the weather recall before any training was accomplished, the mishap flight would have been Lt Col Burgess' fifth combat training sortie, returning him to BMC status (G-58/BB-4).

b. It should be noted that the 4th FS has been heavily tasked recently with a Southern Watch deployment in Dec and Jan, a Green Flag exercise, one current and one future weapons instructor course support, and, later on, a Maple Flag exercise and Northern Watch deployment (V-5.1, 11.1). The squadron's long range training program is in a constant state of flux due to changes in taskings (V-11.1). The 4th is manned at 107% and priority is given to squadron pilots over BMC flyers (V-5.2, 5.3, 11.2). For the weekly schedule the flight commanders put it together and it is checked by the squadron supervisors (V-5.3, 11.2). Flight leads should also be checking members' currencies (V-11.3). There was disagreement over his availability to fly with Lt Col Burgess stating he was available every day but Tuesday and the squadron saying he could make it only once a week (V-11.2, 12.3).

c. His three previous sorties as logged on his requalification letter indicated they had been flown as DCA (defensive counter-air) in which the airplane is flown in a lighter configuration (G-58). On a personal level Lt Col Burgess felt he had not been flying enough although he understood the limitations of available sorties in the 4th FS (V-12.2, 12.3).

d. A review of his checkrides for the last 10 years, including one on a combat mission in Desert Storm, shows good performance with only one downgrade on any of them (G-25-46). His performance at his most recent visits to the replacement training unit, in June 94 following a staff tour and Sep 95 for a LANTIRN checkout, were characterized by strong performance (G-87,89). He had no problems with the night landings during the LANTIRN checkout (T-2-7).

18. Medical: A thorough review of the mishap pilot's dental and mental records, including post-mishap physical exam, radiographic studies, and toxicology tests, was performed. The mishap pilot was medically qualified at the time of the mishap, having a current AF Form 1042 valid until 30 November 1998 (X-3). The post-mishap toxicology studies revealed no evidence of prescription or non-prescription medications in the blood or the urine. The mishap pilot suffered a moderate contusion of the coccyx (tailbone) as a result of the parachute landing after ejection. This injury contributed to a 15 day period of restriction to duties not involving flying. The mishap

pilot suffered no permanent injuries as a result of the mishap and was medically cleared for flying duties on 1 April 1998 (X-2).

19. **NAVAIDS and Facilities:** No copy could be found of the Notices to Airmen (NOTAMS) that were published that day by Hill AFB base operations. The NOTAMS briefed at the afternoon mass briefing at the 4th FS indicated that all navaids and lights were operational (K-7). The tower controller stated that the lights on 32 were functional as did other pilots who landed that evening (V-4.2.9.2,11.7).

20. **Weather:** Weather at Bones 2 landing time was 6,000' broken, 8,000' overcast with the winds from 330° at 7 kts (K-10). The altimeter setting was 29.89 which was found set in the altimeter when the investigating officer inspected 2067's cockpit (K-10). There were thunderstorm cells to the northwest but they were not felt to be affecting Hill's pattern by the SOFs (K-10/V-6.7,8.1). Winds had peaked at 312° at 41 kts, prompting the runway change, but had died down by time Bones 2 made his approach (W-2). The crosswinds that the weather shop told the SOF to expect that prompted the weather recall never materialized (V-6.3,6.5). At the time of the mishap the winds at the approach end of 32 were recorded as 336° at 6 kts and the winds at the middle of the field were 318° at 8 kts (W-2,3).

21. **Governing Directives and Publications:** Primary directives relevant to this flight were: TO 1F-16CG-1, TO 1F-16CG-1CL-1, MCI 11-F16, Vol 1 and 3 and 388th Fighter Wing Supplement 1, and AFI 11-206 and ACC Supplement 1 to AFI 11-206. Suspected deviations from written guidance are flying a visual night approach to runway 32, a procedure forbidden by wing FCIC 97-19 (O-5,6); and failure to use the approach procedure that provided the most effective means to determine azimuth during a night landing as specified by paragraph 5.9.5.1. of ACC Sup 1 to AFI 11-206 (BB-14).

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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 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. Based upon clear and convincing evidence, this accident was caused by Lt Col Burgess failing to properly control his descent rate during landing. Bulges were found in both main gear struts, particularly the left one (J-21, 23). The force required to cause bulging like this is 67499 pounds (J-14). The designed maximum load is 50985 pounds (J-14). The force was also sufficient to cause the left main strut to break off from its bulkhead attach point (J-30/S-4-9). Data from the CSFDR shows that the aircraft was descending in a slight left bank at around 23 ft/sec, well above the 10 ft/sec design limit (CC-3/J-14). A touchdown at this rate would equate to a load of up to 85860 pounds on the left gear (J-14). The gear was well maintained and no signs of previous cracks or corrosion were found (J-15, 30).

a. The rapid descent occurred during a late turn to line up with the runway. Lt Col Burgess had never flown to runway 32 at night before (V-12.7). He chose to fly a visual approach instead of a TACAN approach as dictated by local directives for runway 32 operations at night (O-5, 6). The UFC problem prevented entry of the correct TACAN channel (V-12.6). He also could not enter the number for the INS steer point for Hill because of the UFC problem, but he did not try the inc/doc switch to try to step one point at a time to the steer point (V-12.7). The back up communication mode would have given him another means of entering the TACAN channel, but you cannot control the VHF radio which was needed that night by Salt Lake approach and it was not tried (N-17). In the end, he felt more comfortable doing a visual approach to his home field as opposed to diverting to a strange field at night without being able to tune in the appropriate nav aids (V-12.11). The two SOFs noted he was not flying a TACAN approach but made the proper decision in my opinion not to distract him with questions this close in (V-6.6, 8.2). He was able to get the proper TACAN channel when he was about seven miles out and did use it to make an initial correction to the TACAN ground track, but then chose not to use it further and instead concentrated on picking out the field visually (R-5/V-12.8). The TACAN approach comes into the runway at an angle because of high terrain to the east (O-2). Coming in at an angle makes it difficult to pick out the runway edge lights due to their bi-directional design and distractions from other lights in the area (BB-12/V-4.3, 6.6, 8.5, 11.6). He made his visual approach at an even more acute angle exacerbating the problem (R-7). When he did pick up the lights and made a correction to line himself up, he was quite close in; the ground track shows the turn began less than a mile from the threshold (R-7). As he turned onto final he saw the PAPIs indicate he was high on the glide path, then it indicated he was on glide path before his visual cross-check was arrested by the rest of the runway lights (V-12.9). No doubt he

was actually passing through the proper glide path but did not have time to stabilize himself on glide path before he had to shift his attention to the runway itself. Comparing the descent rate and speed from the CSFDR to a vertical velocity chart from an instrument approach book shows his descent angle was probably around 5 degrees (OC-3/BB-13). The difference between the angle of attack (14.9 degrees) and nose position (9.8 degrees) from the CSFDR one second before touchdown validates this descent gradient (O-53). Five degrees is only 2 degrees above the normal glide slope of around 3 degrees. This is not an extreme difference, but enough in those last seconds of flight to put him in a corner. He did realize at the last second he was going down too fast but his reactions to stop the sink rate were too late (V-12.9).

b. After the gear collapse he kept his jet pointed down the runway. Leaking fuel was ignited by sparks coming from the aircraft. Given his perception that the fire was getting bigger, the decision to eject was proper (V-12.12).

2. Contributing to this accident was the high ops tempo facing the 4th Fighter Squadron and the malfunction of the UFC. The squadron did not properly monitor Lt Col Burgess' continuity nor provide sufficient sorties. The UFC problems started a chain of poor choices.

a. The squadron was in Southwest Asia for most of December and January. It then went to the Green Flag exercise in Nevada for two weeks. They are currently supporting a weapons instructor course and will soon deploy to support another one. They are also getting ready for a Maple Flag exercise in Canada (V-5.1, 11.1). A deployment to Operation Northern Watch will happen after that. The impression I got from talking to squadron members was that they were working as hard as they could to maintain the standards expected of a front line combat squadron. This means that primary attention is paid to the needs of the squadron pilots and less to the attached flyers. This is as it should be, but it decreases the quality of training for the attached flyers. A long range training program is in place, but it is difficult to adhere to due to frequent changes in taskings (V-11.1). Flight commanders are the key to scheduling their people and watching out for their needs (V-5.3). This is backed up by senior squadron leadership doing a sanity check of the schedule (V-11.2). Flight leads are also responsible for checking flight member currencies (V-11.3). The fact that nobody noticed that Lt Col Burgess was scheduled for a night air refueling with overdue currency and no IP in the flight is an example that the system broke down under all the other pressures. Another example is the failure to note the need to regress him to MQT earlier. MQT would also have required an IP in the flight, although one can not state with certainty that an IP would have mandated another course of action than the one Lt Col Burgess decided to follow.

b. The squadron is manned at 107% (V-5.2). With the competition for sorties, BMC personnel have a low priority (V-5.3, 11.2). The squadron operations officer stated the mishap pilot had limited availability, perhaps once a week, while Lt Col Burgess himself stated he had much more availability and it was the squadron that was only scheduling him once a week (V-11.2, 12.3). He stated emphatically that the squadron was not flying him enough although he conceded that the squadron was probably doing all it could (V-12.2, 12.3). During the last nine months he flew only 26 times (G-7, 8, 9). His operations officer complimented him on his mental capacity to fly the F-16 and his check ride performance seems to bear out his knowledge of the

airplane (V-11.5/G-25-46). However, while he flew enough to maintain his currencies, I do not believe flying an average of three times a month is sufficient to maintain the skills and judgment required of the pilot of a multi-role fighter. This was only his second night ride in a year (G-7-10). Also, his three previous day rides in March were air-to-air (G-58). Aircraft on these missions are configured with a lighter load than he had that night. The end result was that he was put in a position of facing a difficult, unfamiliar approach at night with no aids and flying in a heavier aircraft configuration than he was used to. With his limited currency, his skills were not sharp enough to recognize and react quickly enough to correct a bad approach.

c. The malfunction of the UFC, triggering the initial decision to fly a visual approach, contributed to the accident. As discussed above, it put the pilot in the initial mindset of having to fly a visual approach as opposed to diverting to a strange field if he could not get the proper aids up. In my opinion it was not causal for two reasons. First, Lt Col Burgess got the Hill TACAN selected while on final approach and used it for a correction to the runway azimuth (V-12.8). Second, Lt Col Saville's go around from an earlier approach showed that a properly flown TACAN to runway 32 at night was still challenging to an experienced pilot (V-11.6). The TACAN does not provide glide slope information and, because it angles in, still requires the pilot to align himself visually with the runway at endgame. With Lt Col Burgess' lack of recent sorties he may or may not have handled the visual transition better from a full up TACAN approach.

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