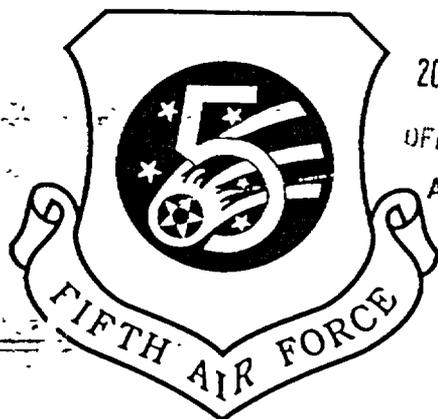


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AIRCRAFT ACCIDENT INVESTIGATION

F-16C #87-0302

MISAWA AB, JAPAN
7 MAY 1991

COLONEL ROBERT M. JOHNSTON
AIRCRAFT ACCIDENT INVESTIGATOR

PFS Exh. 128

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DEPARTMENT OF COMMERCE

Official Exp. No. 127

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Applicant

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Clerk

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HEADQUARTERS PACIFIC AIR FORCES
HICKAM AIR FORCE BASE, HAWAII 96853-5001

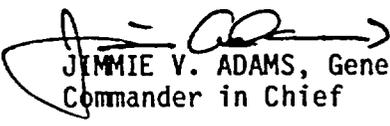
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SUBJECT: AFR 110-14 Report of Investigation, F-16C, 87-0302, Accident of 7 May 91

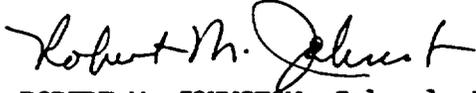
TO HQ 5AF/CC

The subject report of investigation is approved, contingent upon corrections noted in the legal review of my Staff Judge Advocate being accomplished.


JIMMIE V. ADAMS, General, USAF
Commander in Chief

Supplemental Statement

Documents contained in this report that are not originals are identical copies of the originals except for pages C-1, D-1, G-2 thru G-5, K-1, K-2, T-1-1 thru T-1-6, T-3-1 thru T-3-3, V-13 thru V-82-1 and V-83 thru V-85 from which "For Official Use Only" markings and social security account numbers were deleted in accordance with AFR 110-14, Atch 1, paragraph 3(e). Copies of the documents contained in Tabs A thru S (except as noted above) were provided by the president of the safety board. Originals of these documents were included in Part I of the safety report.



ROBERT M. JOHNSTON, Colonel, USAF
Aircraft Accident Investigator

SUMMARY OF FACTS
AIRCRAFT ACCIDENT INVESTIGATION UNDER AFR 110-14
MISAWA AIR BASE, JAPAN

1. Statement of Authority and Purpose:

On 31 May 91, by authority of Air Force Regulation 110-14, the Vice Commander-in-Chief, Pacific Air Forces, appointed Colonel Robert M. Johnston to investigate the aircraft accident which occurred on 7 May 91 and involved an F-16C assigned to the 432nd Tactical Fighter Wing, Misawa Air Base, Japan [now designated the 432nd Fighter Wing (432FW)] (TAB Y-1). By the same authority and on the same date, the Vice Commander-in-Chief, Pacific Air Forces, appointed Capt Richard L. Martin and Capt David C. Sanders as operations and legal technical advisors, respectively (TAB Y-1). By the same authority and on 5 Jun 91, the Commander, 432FW, appointed TSgt Alfonso J. Howard as maintenance technical advisor (TAB Y-2).

This General Dynamics F-16C, tail number 87-0302, was combat coded both by possession and assignment. The aircraft impacted the ground 1.2 nautical miles northwest of the runway at Misawa Air Base, Japan, with nearly all debris coming to rest on base recreational property known as Leftwich Memorial Picnic Grounds. Some small pieces of debris came to rest northwest and directly adjacent to base property on fallow rice paddies.

2. Summary of Facts:

a. History of Flight:

On 7 May 91, the 432 TFW was participating in the first day of a local operational readiness exercise (LORE 91-3). That day the 14th Tactical Fighter Squadron (14TFS) [now designated the 14th Fighter Squadron (14FS)] was tasked to provide defensive counterair sorties in the air defense portion of the overall exercise. Within the five scheduled launch periods that day, they scheduled one four-ship sortie, THOR 31, and nine two-ship sorties, FANG 41, STING 41, BUCK 41, THOR 41, FANG 51, STING 51, BUCK 51, THOR 51, and SHACK 41. During the third launch period, Capt Mark A. Sherrier flew this same mishap jet uneventfully on its first flight of the day (TAB T-1). During the fourth launch period, Capt Robert J. Norris III flew this mishap jet with call sign BUCK 41 and again during the fifth launch period with call sign BUCK 51 (TAB T-1). This mishap sortie which occurred on the fifth launch was the jet's third and this pilot's second sortie for the day. The mishap jet had accrued 2.0 hours of uneventful flying time on the day's first two sorties (TAB T-3).

On both sorties Capt Norris was flying as the leader of a two-ship formation with Capt Mark R. Aldrich as his wingman (TAB K). They were scheduled to fly two defensive counterair sorties that day. Their first day sortie was as BUCK 41. Their second was a night sortie as BUCK 51.

While sitting in their cockpits on five minute alert, BUCK 51 flight were ordered to scramble to perform a defensive counterair mission. After

takeoff from runway 28 at Misawa AB at approximately 2040I (local time or INDIA (I)), the jet experienced an engine failure. After analyzing his jet's deteriorating performance and determining he could not bring it back for an emergency landing at Misawa AB (TAB V-9), the pilot safely ejected from the disabled jet. The jet crashed slightly less than one minute after takeoff (TAB T-4).

Wing public affairs officials were drawn into a series of direct contacts with media representatives almost from the very moment of the impact. Several local and regional media reporters, concerned local citizens groups, and elected officials expressed great interest in the mishap. For several weeks following the mishap, wing officials pursued several avenues to address public concerns with safety of base flying operations and their expressed dissatisfaction with procedures used to advise elected officials of significant base mishaps.

To alert the base populace and others concerned to the circumstances of the mishap, the wing public affairs officials prepared a news release in English with Japanese translation on 7 May 91 (TAB AA-1). To preserve evidence for investigation by safety mishap investigation board members, the wing commander cordoned off the mishap site and strictly controlled authorized access. However, at approximately midnight on 7 May 91, two Kyodo News Service reporters were apprehended as they unsuccessfully attempted to bolt through the base's main gate to gain unauthorized access to the mishap site (TAB AA-4). Throughout the investigation of the mishap, the wing public affairs officials provided news releases and supported the wing command section's direct involvement with elected officials. The wing public affairs officials prepared a second and third news release in English with Japanese translation on 8 May 91 (TAB AA-2) and on 14 May 91 (TAB AA-3).

b. Mission:

The scheduled mission for BUCK 51 flight was defensive counterair. In accordance with wing and squadron policies, BUCK 51 flight were first committed as ground spares for the first four missions of the night launch. As such, they were to start when the first two two-ships were scrambled, so as to ensure the squadron met its scramble order with four jets (TAB V-5, V-9). After they started their engines as ground spares for the first four jets, they were directed to hold their positions because the first four jets met their scramble order and did taxi on time (TAB V-1, V-5). While in the process of "hot cocking" their jets for the alert posture and before actually shutting down their engines, they were ordered to scramble for their own defensive counterair mission. [Note: With reference to 432TFW Pilot Guide, "hot cocking" the jet involves starting the engine, aligning the inertial navigation system, programming computer equipment, and self testing various other components to attain a ready or "cocked" preparation status after engine shutdown which permits the pilot to respond more quickly upon restarting the jet to meet an alert scramble.] To meet their scramble order, they left their engines running and soon taxied for takeoff. They planned to launch with a 10 to 20 second interval, with BUCK 51 the lead and first to takeoff at approximately 2040I, followed by BUCK 52 at the proper interval.

c. Briefing and Preflight:

Capt Russell J. Quinn, the wing weapons officer, briefed all pilots participating in the night's launches during a mass briefing at 1400I (TAB V-9). Pilots in attendance characterized it as very professional, complete, and in full accord with wing standards (TAB V-9). The primary mission of the 432TFW was to be prepared to provide air to ground support to the supported ground commander. Since the wing devotes fewer sorties to defensive counterair sorties in normal training or exercises, the briefer covered a basic, simple plan for night time intercepts of airborne threat aircraft. Subsequently, Capt Norris briefed his wingman Capt Aldrich on their flight responsibilities and game plan. The plan involved maximum reliance on wing standard procedures, without relying on exceptional tactics, techniques or flight leader preferences which could be more complex or more difficult to accomplish. After a thorough briefing which fully accounted for weather, notices to airmen, special instructions for the exercise, training requirements, tactics, communications, and mission requirements, the two pilots proceeded to CHARLIE area of the hardened aircraft shelters.

Testimony reveals that aircraft maintenance personnel had accomplished the appropriate thru flight inspections and serviced both jets (TAB V-3). SSgt Olivia J. Brunetti [nee Hotard], dedicated crew chief for mishap jet 87-0302, had performed a very thorough "thru flight" inspection of the jet (TAB V-3). The jet had returned from its first flight in a code one maintenance status, indicating the previous pilot considered it acceptable for the next flight without any maintenance or repair except for servicing. As part of her thru flight inspection, SSgt Brunetti had taken an oil sample and provided it to the maintenance expediter for the joint oil analysis program. The only other preparation task she had was to refuel the jet. If any anomalies had been evident in the oil sample after its spectrometric analysis, the expediter would have so advised her prior to launching the jet. In most cases, however, these results are unavailable prior to the very next flight, but they are invariably reported to the maintenance operations center prior to the subsequent flight.

After briefing the mission, Capts Norris and Aldrich stepped to their jets and prepared to assume five minute alert posture in the cockpit. Others had previously "hot cocked" their jets and aligned their inertial navigation system which meant they could strap themselves in ready to go. In accordance with the 432TFW Pilot Guide, Capt Sherrier had annotated this accomplishment in the aircraft maintenance record (AFTO Form 781A) for jet 87-0302. The two jets were parked next to each other in echelon position. Capt Norris started his engine without any indication of abnormality or difficulty. Just as they were completing their preflight preparations with engines running, they were alerted that the first six jets should start. Testimony varies about whether the alert were provided on the radio by Lt Col Robert L. Ehmen, call sign GOLD RAT, the ramp supervisor, or by one of the maintenance supervisors by visual means (TAB V-5, V-9). Since the 14TFS always starts six jets to ensure four are available to meet their scramble order, BUCK 41 flight left their engines running.

With no indications to the contrary, Capt Norris assumed they too would taxi, so he began to taxi and announced "continuous taxi". But then he was advised first to hold his position and, later, to shutdown. After the four-ship launched, GOLD RAT directed them to shutdown because the other four had met the scramble order. Since Capt Norris had placed his inertial navigation system into the NAV position when he assumed they would also taxi, he first needed to select NORM and realign it prior to shutdown. Therefore, he was unable to shutdown for at least eight minutes since the realignment takes that long. He advised his wingman of his intentions. Capt Aldrich, too, had had some unspecified difficulty with his inertial navigation system, so he kept his engine running as well.

Just as they each completed their eight minute realignment on the system, they were alerted to scramble their own two-ship. Shortly thereafter, they completed their checks in the chocks, so Capt Norris called "continuous taxi" when they began to taxi and contacted the GROUND controller to obtain the flight's departure clearance. They were advised what their intercept targets would be. In fact, the other four-ship formation which was beginning to taxi at approximately the same time were to be their targets. They inadvertently taxied between the elements of that four-ship; so at the first opportunity, they taxied out of their way, permitted the four-ship to rejoin, then proceeded on their way to the flow through "quick check". BUCK 41 flight were cleared onto runway 10, and there they again accomplished their checks of their secondary engine operation mode and emergency power unit. When BUCK 42, Capt Aldrich, raised his thumb, indicating all was okay, BUCK 41 began his takeoff roll, followed by BUCK 42 ten seconds later. That takeoff time was approximately 1727I, and the entire flight lasted only about an hour.

That first mission was totally unremarkable with respect to aircraft or engine performance or to Capt Norris' physical or psychological well being. In fact, when Capt Norris accepted the jet for his first sortie, the aircraft maintenance records (AFTO Form 781 binder) contained only a write up regarding a simulated tank jettison and one information write up regarding the "hot cocked" condition of the jet. He added no others after the flight. They landed on runway 10 as well and then reported to maintenance debriefers that the jet was maintenance code one. They shutdown the jets after "hot cocking" them and remained in the hardened aircraft shelter until required to assume cockpit alert in the jets. There, they put on their field gear and helmets required for the exercise conditions, debriefed the mission among themselves and with intelligence debriefers, and Capt Norris ate a sack lunch of turkey sandwiches, chips, carrot sticks, and juice.

When the jet returned from its second sortie, A1C Christopher R. James recovered the jet in the shelter. Testimony indicates he did a complete and thorough quick turnaround inspection, including a good inlet check (TAB V-6, V-8). He had received no word of any anomalies in the oil sample's spectrometric analysis from the expediter, so he too assumed there were no oil problems.

A1C James was delayed in refueling the jet by the late arrival of the refueling truck. As soon as they had refueled his jet, Capt Norris came up and began his preflight check. When he had completed this, he grabbed his gear, entered the cockpit, and asked for the aircraft maintenance records (AFTO Form 781 Binder). He indicated to A1C James that for exercise purposes, he was taking the forms with him. Once the crew chief had helped to strap him into the jet, he awaited his signal to start which did not come until nearly 45 minutes later.

During the thru flight inspection, A1C James only noted one unusual condition which was a looseness in the fan inlet guide vanes which enabled him to move them approximately a quarter of an inch. This did not alarm or concern him, because he had previously been advised this looseness was within tolerance. However, MSGt Timothy W. Shannon, noncommissioned officer in charge of the jet engine intermediate maintenance section, testified to a discrepancy with Technical Order 1F-16C-2-76FI-66-11 - Table 18-19 'Engine Fan Inlet Inspection and Repair' which uses a maximum serviceable limit of plus or minus 0.062 inches (0.124 inches range) for play at the outer trailing edge of the inlet guide vanes (TAB V-10). This discrepancy did not affect the mishap engine performance, as the engine had all fan inlet guide vanes intact in the crash debris (TAB J-4).

During their ground time between missions, Capt Norris noticed no peculiar maintenance activity on his jet. As far as he can remember, A1C James refueled the jet and performed the intake inspection. An entry in the aircraft maintenance records (AFTO Form 781) indicating the intake inspection had been accomplished reassured him of that perception. After approximately an hour and a half at 1930I, the pilots accomplished their individual walk around inspections of the jets which required Capt Norris' use of a flashlight to inspect the engine intake due to darkness. That night, sunset was at 1836I and the end of civil twilight was at 1906I (TAB W-1). They then again climbed into the cockpit of their jets to sit cockpit alert. Capt Norris noticed nothing unusual or remarkable about the condition of the jet or its engine during his preflight inspection.

Either the production or ramp supervisor eventually drove up to tell BUCK 51 to start. The engine start was normal. A1C James accomplished his walk around inspection prior to launch of the jet--checking the hydraulic system and filters and the jet's general appearance. He was being assisted by SSgt William C. Davis Jr. Five minutes after engine start, A1C James checked the engine oil sight gauge which indicated only 40 half pints, a little low for that stage (TAB V-6). According to the Technical Order 1F-16C-6WC-1-11 work card 5-007, this reading is in the green area and within acceptable limits. Capts Norris and Aldrich sat in their cockpits for about 45 minutes before they were alerted to start engines. The first radio call BUCK 51 flight received announced a runway change to runway 28.

The ground scenario for their second sortie was like the first. As the third two-ship formation, they were part of the ground spare for the first two two-ship formations on alert to ensure four jets got airborne. As before, BUCK 51 had heard nothing to the contrary, so Capt Norris assumed he was to

taxi when ready. Capt Norris selected NAV on the inertial navigation system and announced "continuous taxi" on the radio. BUCK 51 was told again to hold his position, so Capt Norris expected to be directed to shutdown in the chocks, but he could do so only after the inertial navigation system's eight minute realignment period had elapsed. Although this would consume more fuel than intended, and although he had empty wing tanks that night, Capt Norris was not concerned about his fuel state. When GOLD RAT contacted BUCK 51 to shut down, Capt Norris didn't remember whether he advised GOLD RAT of his requirement to wait eight minutes prior to shutdown due to alignment. By the time BUCK 51 had completed this second alignment, his engine had been running approximately 25 minutes on the ground.

Just as before, when that alignment sequence ended, BUCK 51 flight were alerted to scramble again by GOLD RAT on the radio. Shortly thereafter, BUCK 51 called "roll over" and began to taxi out. About this time, the supervisor of flying requested a subsequent radio call from BUCK 51 to provide an update on airborne weather, especially anything on the sea fog approaching Misawa AB. At some point during the taxi out, BUCK 51 had encountered fog on the canopy, so Capt Norris had attempted to defrost it with only partial success. His route of taxi took them south on taxiway TWO NORTH and east on parallel taxiway BRAVO to the flow through quick check point approximately 1,000 feet from the end of BRAVO. BUCK 51 spent approximately 20-30 seconds in quick check obtaining a thorough inspection prior to takeoff. Once BUCK 52 had also proceeded through quick check and when BUCK 51 and BUCK 52 were both in position on taxiway FIVE NORTH awaiting takeoff, the flight switched to TOWER frequency and requested departure.

d. Flight Activity:

BUCK 51 flight were cleared under instrument flight rules on a standard instrument departure (CHUHI TWO DEPARTURE with CHARLIE FOUR TRANSITION) with radar services provided by MISAWA DEPARTURE control (TAB T-2). When cleared on to the runway, both BUCK 51 and BUCK 52 pulled onto runway 28 approximately 200 feet down. They each accomplished their secondary engine operation mode and emergency power unit checks on the runway. BUCK 51 directed BUCK 52 to switch frequencies to the departure controller. BUCK 51 had briefed a ten second takeoff interval in only full military "MIL" power, because Capt Norris did not assess the need for an afterburner boosted takeoff. Capt Norris thought he could save the fuel and consume less.

While on runway 28 in takeoff position, Capt Norris accomplished his 90 percent performance check; everything appeared "good to go." So, BUCK 51 released brakes, advanced to full military "MIL" power, and began rolling down the runway. Their computed takeoff speed that night was about 154 knots. As BUCK 51 passed through 50 to 60 knots, the defroster finally eliminated the fog on the canopy, so Capt Norris could clearly see everything through it. BUCK 51 lifted off at 154 knots for takeoff, and Capt Norris noticed the sound of a minor "thump" from somewhere behind. He suspected it had come from the vicinity of the engine area or landing gear, but he quickly checked the

engine; it seemed good. The sound was not too unusual, in that Capt Norris had recalled hearing unrecognizable sounds occasionally on other flights without consequence.

As he rotated the jet for takeoff, Capt Norris raised the gear handle. The jet by then had proceeded about two thirds of the way down the runway. As the landing gear were retracted, lights in the cockpit appeared normal to him. Capt Norris heard nothing peculiar but did detect some nearly imperceptible movement in the jet. He characterized it as not prominent or alarming. It got his attention, but Capt Norris couldn't isolate it exactly.

Due in large part to the widely dispersed duty locations and round the clock operations during the local operational readiness exercise, numerous eyewitnesses observed the mishap sequence. No one reported observing anything unusual prior to takeoff. Their testimony on events following lift-off and through the pilot's ejection and jet's crash varies. However, the prevailing assessment is that the engine visibly displayed a cyclic trail of sparks like a Roman candle or self-protection flares which persisted for some time before the sparks either disappeared or seemed to come in contact with the ground (TAB V-15, V-28, V-42, V-45, V-55, V-65, V-77). Many reported the engine's displaying a bright orange glow throughout the entire flight sequence (TAB V-38, V-56, V-63, V-69, V-70, V-75). As the jet climbed on its takeoff leg, several witnesses noted sparks or flames projected forward through the intake, accompanied by a loud noise (TAB V-17, V-48, V-53, V-60, V-74, V-77). Similarly, the engine audibly reported muffled thuds, thumps, bangs, pops or explosions at least twice before the pilot ejected (TAB V-20, V-26, V-42, V-62, V-72). Many observers likened the engine noise to the muffled sound of a ground burst simulator pyrotechnic device (TAB V-10, V-34, V-39, V-74, V-76). One observer familiar with pyrotechnics likened the noise to an implosion (TAB V-31). Nearly all reported that the engine noises wound down and eventually went silent (TAB V-28, V-37, V-53, V-62, V-67, V-80).

On takeoff leg, Capt Norris looked over his right shoulder and detected sparks within the exhaust plume. To him, it appeared as if someone had shaken a poker in a fireplace and caused sparks to emit from the fire, not globs of metal. From his perspective, there appeared to be about a dozen or so evenly spaced sparks back there. At about that time the supervisor of flying in the air traffic control tower, call sign CARDINAL, called BUCK 51 to advise him that his jet was trailing fire or flames (TAB N, V-9, V-11). As Capt Norris looked back into the cockpit to confirm his flight attitude and performance indications, he first noticed the engine fire light, a red eyebrow light on the right hand side, an aural "warning, warning", and a visual warning indication in his heads up display.

Capt Norris simultaneously brought power back a knob width or two-- just to double check that he wasn't in afterburner, while he also checked into the cockpit. He confirmed that he had been in full military "MIL" power. He then began a right hand turn. As he recalled, he was approximately 1500 feet in altitude, 200 to 250 knots of airspeed, in 30 degrees of bank, with about a five degree climb angle. He recognized the jet clearly lacked the expected thrust and began to decelerate and level off in altitude. Capt Norris elected

not to jettison his two fuel tanks, because they were empty anyway, and he felt uncomfortable without knowing whether houses or people might be directly under his flight path. At this stage Capt Norris definitely recognized an inability to sustain level flight and an obvious deceleration. He recalled slowing below 200 knots and starting to "mush" in a sink rate. While trying to maintain aft stick pressure to keep the jet level, BUCK 51 was unable to maintain level flight and began to descend. His flight path was over Lake Ane Numa, the small lake just west and north of Mizawa AB, arcing toward the larger Lake Ogawara.

While in the right hand turn and as the 'elephant cage' AN-FLR-9 radar crossed his nose, BUCK 51 also began to get smoke in the cockpit. It seemed to come from behind at shoulder height and forward. Capt Norris assumed at the time that it came from the environmental control system duct right behind the seat. He characterized it as light in color and very caustic or "harsh smelling". It filled the cockpit and obscured all the instruments. At that point, Capt Norris pushed the throttle up to full military "MIL" power to gain more thrust. He elected not to push it up into afterburner. All the same interior lights stayed illuminated. Capt Norris cannot confirm whether the emergency power unit kicked on or not. However, the crash survivable flight data recorder indicated an air command of the emergency power unit at 029.125 seconds after lift-off (TAB T-4). He recalled that the heads up display worked throughout the flight. Capt Norris purposefully stayed with the jet a little longer while its expected flight vector arced through the 'elephant cage' or AN-FLR-9 radar. He tightened the turn or at least fed in some more bank and attempted to stretch the glide path out toward and over Lake Ogawara. He was able to see the Leftwich Memorial Picnic Grounds shelters. Since he could visually confirm that the jet appeared to be gliding toward the picnic area and away from inhabited areas, he then decided to eject.

e. Impact:

Approximately fifty two seconds after takeoff (2041I), the jet impacted at approximately 40 degrees 43 minutes 11.4 seconds north latitude and 141 degrees 20 minutes 22.2 seconds east longitude. Using the printed charts depicting the data stored in the crash survivable flight data recorder, this investigator extrapolated the following flight attitude at first impact: 156 knots calibrated airspeed, 21 degrees right bank, 8.5 degrees nose down pitch, and 036 degrees magnetic heading (TAB O-4, O-6, T-4). Most debris was confined to base property on Leftwich Memorial Picnic Grounds, and a few pieces landed just beyond the base boundaries on fallow rice paddies. The pilot parachuted to a location less than 80 feet inland of the northwest shoreline of Lake Ane Numa which is immediately west of the base. The ejection seat landed on land less than 500 feet further northeast from the pilot. The canopy landed approximately 275 feet northwest of the pilot on land.

f. Ejection Seats:

Based on investigator's analysis of data provided by General Dynamics, Fort Worth and withdrawn from the crash survivable flight data recorder, Capt

Norris safely ejected within the survivable ACES II ejection envelope (TAB O-4, O-6, T-4). Using printed charts depicting data stored in the flight data recorder, this investigator extrapolated the following approximate conditions of flight at the time of ejection: 620 feet mean sea level (500 feet above ground level), 3 degrees of nose low pitch, 16 degrees of bank attitude, 4,800 feet per minute vertical velocity (descent), and 145 knots calibrated airspeed (TAB O-4, O-6, T-4).

Capt Norris recalled making a radio call to announce that he was getting out of the jet and then confirming that the arming handle was down. Capt Aldrich confirmed hearing the radio call (TAB W, V-1). Although he was leaning forward somewhat with his head facing the heads up display, Capt Norris was in a good body position for ejection and initiated ejection by pulling the hand grips. As expected, he experienced a little delay before the seat actually left the jet. He remembers sensing the air stream, his tumbling somewhat, and hearing the parachute ripple. He looked up and confirmed a good chute, then he almost immediately went into the trees. Capt Norris only had time to close his eyes and turn his head. He hit mud and had a fairly soft landing.

The ACES II ejection seat (serial number F6A1704) performed as expected. It had been properly installed by General Dynamics with its next inspection due 36 months hence on 18 Oct 91.

g. Personal and Survival Equipment:

The parachute, raft, and seat kit were not factors in the mishap, and all inspections were current. All were recovered. As evidenced by recorded communications on 243.0 MHz, GUARD frequency, the emergency locator beacon was intermittent. A maintenance deficiency report was submitted on the emergency locator beacon (part number AN/URT-33C/W) (TAB I-4).

h. Rescue:

On the ground, Capt Norris released his risers and sat there for a while. He was in the mud and could easily see that the jet had impacted nearby and was engulfed in flames. He heard 20mm ammunition igniting and then exploding. He wanted to shut off the emergency locator beacon, but it took him a while to remember where it was located among his survival equipment. So, instead, he used his survival radio to transmit that BUCK 51 was on the ground and in good shape. As expected, the emergency locator beacon sounded immediately when he turned the radio on. BUCK 52 immediately responded and requested that BUCK 51 switch to a backup frequency, 282.8 MHz, but in the dark Capt Norris had trouble locating the proper switch and position. After leaving his impact point for a while to search for better terrain and to talk to BUCK 52, Capt Norris returned to the impact site in hopes of finding the emergency locator beacon. When he couldn't find it, he again returned to the second location; this time he located the proper switch to select 282.8 MHz. He then returned to the impact location where his ejection seat kit was located. Capt Norris finally found and disabled the emergency locator beacon by disconnecting the battery.

By his own account, he then calmed down enough to accomplish what the rescue party wanted him to, that is, shoot off a flare to pinpoint his position. During the 30 to 40 minutes he spent on the ground he tried to hike out to more open terrain, but the dense underbrush was too challenging in the dark. The base civil engineer, Lt Col John H. Estes IV, first recognized that the pilot's description of marshy terrain indicated that he must have landed south of the Security Hill Drive and toward Lake Ane Numa. Prior to this determination, search efforts had concentrated north of Security Hill Road toward Lake Ogawara.

When Capt Norris once returned to the edge of Lake Ane Numa, he climbed a small fence and could observe the red crash truck lights and a nearby road. By radio, the rescue party acknowledged that they had generally located him. So, Capt Norris shot off one of the gyro-jet flares (A/P 255-5A) to alert them and to pinpoint his position. He initially heard some rescue party members yell that they saw it. They were obviously a ways away from him, however. After BUCK 51 shot another one on cue with the rescue party's attention directed in the proper southerly direction, the rescue party were able to pinpoint his position. Almost immediately, Capt Norris could hear and see the flashlight of closer rescue party members, so he yelled at them as well. When they met up with each other in the brush, they escorted him out of the marsh and walked him to where the ambulance was waiting. At approximately 2130I the ambulance then drove Capt Norris to the base hospital. He left behind at the scene all his equipment and everything he had on, except his anti-G suit and anti-exposure suit.

1. Crash Response:

The primary crash net alerted the 432 TFW accident response team and firemen to respond at 2043I. During normal base operations an international memorandum of understanding for airfield operations with the Japan Air Self Defense Force at Misawa AB calls for their fire department to respond to primary net crash notifications [FB5205-MOUI-3005]. However, due to local operational readiness exercise conditions, the 432TFW fire department had assumed responsibility for crash and fire response in the hardened aircraft shelter area. Using dispersed alert locations near the hot pit refueling area, the 432TFW fire department had maintained crash alert with equipment which included one major (P-10) and two minor (P-20) crash vehicles rather than structural fire (P-12) pumper vehicles. Their location was less than three to four minutes away from the impact site.

Within five minutes of primary crash net activation, a crash fire truck equipped with water and aqueous film forming foam agent had arrived on scene. Several other crash vehicles later responded as well. After impact the jet burst into flames and burned for only a few minutes. A brush fire developed north of the impact site and was extinguished at 2125I.

j. Maintenance Documentation:

The aircraft maintenance records (AFTO Form 781 Binder) in the jet did not survive the impact and post crash fire. During exercises, the pilots carry the aircraft maintenance records (AFTO Form 781 Binder) with them in the jet in the event they are diverted to another airfield where cross servicing might be expected. According to Capt Norris' testimony, there were no open discrepancies in the record which had any factor in this mishap (TAB V-9). The write ups that were present acknowledged that the jet had been "hot cocked" for the exercise alert posture by the previous pilot and made some mention of a simulated tank jettison.

No time compliance technical orders were outstanding on this jet or engine which had any bearing in the accident. All scheduled inspections were satisfactorily completed. All time change requirements were completed on time. All historical samples analyzed under the joint oil analysis program were satisfactory (TAB D-1).

k. Maintenance Personnel and Supervision:

During the exercise the maintenance supervision included a production supervisor, an area supervisor, a crew chief and supporting personnel from several back shops to help with flight line responsibilities. At 1730I, just as Capt Norris departed on his first sortie, the day shift relinquished their responsibilities to the swing shift. The mishap jet was parked in front of hardened aircraft shelter CHARLIE SEVEN in CHARLIE area. For the day shift, the dedicated crew chief, SSgt Brunetti, served as crew chief of jet 87-0302. She was replaced during the swing shift by AIC James, the assistant crew chief for mishap jet 87-0302. The CHARLIE area supervisor during the swing shift was MSgt Willie McGee, and MSgt Santo Calcagno was the production supervisor. In addition to their regular sortie production, servicing, and maintenance duties, these personnel were in exercise conditions which required cover and concealment, aircraft and equipment dispersal, varied protective clothing, and appropriately tailored work activities.

Noncommissioned officer in charge of the jet engine intermediate maintenance shop, MSgt Timothy W. Shannon, is a skill "nine level" jet engine superintendent, highly qualified, professional, and fully certified to perform intermediate level maintenance on the F110-GE-100 engine. The jet engine mechanic who supervised the propulsion crew during in-shop repair of jet engine 500174, SSgt Walter C. Woolcott, was a skill "seven level" jet engine technician. He was fully certified to accomplish his assigned duties.

l. Engine, Fuel, Hydraulic, and Oil Analysis:

As evidenced by AFTO Forms 95, Significant Historical Data, on the F110-GE-100 engine as well as the consolidated engine management system records, this mishap engine (E500174) has undergone numerous inspections and repairs of high pressure compressor blades between October 1987 and May 1990.

Numerous blades on stage one through stage nine of compressor rotor were either blended or replaced (TAB U-2). This engine had 1,669.3 total engine hours (TAB D-1).

During post mishap engine teardown at Misawa AB and through team analysis led by Mr Caesar J. Sabatelli, GS-12, aerospace engineer for Oklahoma City Air Logistics Center, many discrepancies in the engine core were apparent. The local teardown proceeded only to the shop replaceable unit level. Even so, substantial compressor damage was clearly evident. Two holes were burned through the upper compressor case in the third stage plane of rotation. In Mr Sabatelli's description and discussion of the mishap engine components and hardware, he identified several relevant points about the condition of the compressor's first, but more frequently, the second stage variable stator vanes (TAB J-4). One first stage compressor variable stator vane was noted approximately 31 degrees out of alignment. One second stage compressor variable stator vane was turned 90 degrees with respect to the engine/flow axis (TAB J-4). To obtain further analysis of suspect parts, the wing submitted three materiel deficiency reports on the following F110-GE-100 engine parts: compressor stators, high pressure compressor rotors, and compressor rear stator case (TAB I-1, I-2, I-3).

As part of a Misawa AB conversion to large inlet F-16Cs, a squadron complement of F-16Cs with F110-GE-100 engines transferred to Misawa AB, Japan from Osan AB, Republic of Korea, during the period January 1990 through February 1991. According to records in the wing plans and scheduling branch, the F110-GE-100 mishap engine, serial number E509174, arrived at Misawa AB on 7 Sep 90 installed on F-16C, tail number 87-0332 (TAB U-1). [Note: However, the wing's consolidated engine management system indicates an engine arrival date on or about 28 or 30 Aug 90.] On 18 Jan 91, this engine was removed from that jet for an engine oil leak. Oil was detected on the fan inlet; and, the jet engine intermediate maintenance section later attributed the leak to an improperly installed lube and scavenge pump aluminum seal gasket (TAB V-10).

During that 18 Jan - 11 Feb 91 period in the jet engine intermediate maintenance section, the engine was also diagnosed as having a loose first stage compressor retaining ring which was later repaired (TAB V-10, V-12). As a result of concerns over the potential impact and fleet-wide extent of this loose retainer ring discovery, the wing initiated a one time inspection of their entire fleet of recently transferred engines (TAB V-10). The wing commander grounded the jets, and the jet engine intermediate maintenance section did a records check on all engines which had had first through third stage compressor maintenance performed off station including such locations as Osan AB, Kunsan AB, MacDill AFB, Ramstein AB, Torrejon AB, Spangdahlem AB, Oklahoma City Air Logistics Center, and General Electric Strother in Arkansas City, Kansas (TAB V-10).

When this engine had first been received into the jet engine intermediate maintenance section on 18 Jan 91, SSgt Woolcott detected a bend on the trailing edge of a first stage variable stator vane (TAB V-12). His crew installed a new case assembly. The next day, his crew reassembled the engine and verified the rig of the variable feedback cable and the rig of the

bell cranks. They then completed all time compliance technical orders in the Falcon 110 Block Two upgrades for which they had parts available, but some were deferred until a future date when the engine next came into the shop.

On 25 Mar 91, this repaired engine was installed on mishap jet 87-0302 (TAB U-1). Since its installation, this engine has accrued 87.3 total engine operating hours (TAB D-1). During this latest installation, the jet was impounded and subsequently released after mechanics and quality assurance personnel searched extensively for a 1/4 inch drive universal tool lost during maintenance. The lost tool was never found (TAB H-1).

Following the mishap, the local fuels management branch sampled all relevant JP-4 fuel sources including the associated refueling unit (R-9 serial number 81L-108), fill stands one and two, and bulk storage tank #2-1 as well as five other F-16Cs (tail numbers 85-1501, 87-0308, 87-0310, 87-0324, and 87-0326) serviced with the same refueling unit. Results were satisfactory (TAB U-4, U-6). At the time of the mishap, the fuels management branch was advised by responsible authorities on scene that they would be unable to obtain a fuel sample from the mishap jet at the crash site due to impact leakage and post crash fire's consuming the fuel.

However, at some unknown time, an unidentified individual allegedly belonging to the wing's accessory branch's fuel shop allegedly collected a fuel sample at the crash site from the jet's internal wing tank which he provided for analysis. This sample is suspect, due to the uncertainties surrounding its authenticity and chain of custody. Nonetheless, both this suspect fuel sample from the mishap jet and another from the R-9 refueling unit were analyzed by the aerospace fuels laboratory at Kadena AB, Japan (TAB U-4, U-5). The Kadena AB laboratory indicated the suspect fuel sample did not meet specifications. However, their results should not be considered conclusive, since the failed properties are ones easily altered by exposure to atmospheric contaminants. This is a relevant factor, since the fire fighters used aqueous film forming foam as well as water to battle the ensuing post crash fires. The R-9 refueling unit fuel sample met specifications, however.

The 432TFW non-destructive inspection laboratory, under the joint oil analysis program, determined the engine oil samples after two previous flights were within spectrometric limits and indicated no abnormalities (TAB D, U-3, V-73). Due to impact leakage, malformations in the tank and lines, and post crash fire, the engine technicians were unable to obtain engine oil samples from normal locations. Three samples were taken from the mishap jet engine at the lube and scavenge pump filter bowl, hydraulic pump, and hydraulic pump filter bowl, and all samples revealed unexpectedly high readings (TAB U-3). Since engine technicians do not normally take samples from these areas, no technical data or normative criteria exist from which to make comparisons.

According to SSgt Thomas E. Summers of the wing's non-destructive inspection laboratory, a hydraulic sample was burned by the laboratory. While SSgt Summers testified to the actual burning, he noted that he was unable to analyze the sample without any technical criteria (TAB V-73). While no record of those test results is currently available, the results of such a hydraulic

fluid sample remain suspect. This accident investigator cannot authenticate the sample or its chain of custody. There is no record to indicate whether another laboratory analyzed the suspect hydraulic sample.

m. Airframe and Aircraft Systems:

F-16C, tail number 87-0302, arrived at Misawa AB on 22 Jan 91 (TAB U-1). [Note: An entry on Air Force Form 711C indicates the jet was assigned to its present organization on 16 Jan 91 (TAB D-1).] From 23-28 Jan 91, the 432TFW placed the jet into an acceptance inspection status (coded "BT" for being transferred) which culminated in acceptance and possession status as a combat coded (coded "CC") jet on 28 Jan 91 (TAB U-1). This jet had accumulated 735.8 total flight hours since its Air Force acceptance date of 16 Dec 88 (TAB D). From pilot's testimony, no open discrepancies or system conditions which could ground the jet were carried in the aircraft maintenance records (AFTO Form 781 Binder) (TAB V-9).

n. Operations Personnel and Supervision:

The mishap sortie was conducted under authority of AFR 66-1, Flight Management. Flight procedures were in accordance with PACAFR 55-116, F-16 Pilot Operational Procedures. Prior to assuming cockpit alert in the jets, pilots "hot cocked" the jets in accordance with local guidance in the 432TFW Pilot Guide. Special instruction messages of the published air tasking order for the local operational readiness exercise (LORE 91-3) provided other relevant guidance.

The operational chain of command and supervisory chain for Capt Norris were fully qualified and current in their duties. Capt Wheeler, the supervisor of flying; Lt Col Ehmen, the ramp supervisor; Capt McCarthy, the mission director; and, the 14TFS's top three supervisors were among the most highly qualified and proficient officers in those capacities. The officer who delivered the mass briefing for the pilots flying in the air defense exercise the night of the mishap, Capt Quinn, was highly reputed to be among the most professional wing staff officers.

o. Crew Qualifications:

Capt Norris was a fully qualified and mission ready F-16 pilot and flight leader. He had a current instrument rating and a qualified tactical certification for the F-16 (TAB G-3, G-4, G-5). His total flying time was 1,371.8 hours of which 188.5 hours were student pilot hours during Undergraduate Pilot Training. He had previously flown operationally in Tactical Air Command as a forward air controller in the O-2A and the OT-37B with 206.1 and 521.6 hours, respectively. During Fighter Lead In Training, he accumulated 39.7 hours in the AT-38A/B. He had 416.5 total hours in the F-16. His previous 30/60/90 day totals for sorties and hours follow: 18/37/38 and 26.5/48.9/49.9 (TAB G-1, G-2).

p. Medical:

Capt Norris had a current Air Force Form 1042, Medical Recommendation for Flying or Special Operational Duty, and was medically cleared to fly. He had completed an annual flight physical on 17 Dec 90 at Misawa AB. During the ejection and in subsequent rescue operations, he sustained no injuries requiring medical attention. He was evaluated on 7 May 91 at Misawa AB hospital by Capt (Dr) Jodi L. Siskin, 432nd Medical Group, and released on unrestricted flying status.

q. Nav aids and Facilities:

Misawa AB's published notices to airmen for the 7 May 1991 flights noted the west end of runway 10-28 selective slab replacement project, its 2,500 feet of displaced threshold for runway 10, its relocated barrier and arresting gear equipment, its relocated runway and threshold lights, and its effect on minimum descent altitudes for various approach aids. No other notices to airmen had any bearing on the mishap.

r. Weather:

Weather was not a factor. Forecast and observed weather for the day is at TAB W. A special observation at 2042I noted clear skies, 5,000 meters (3 1/8 miles) visibility, light fog, and light westerly winds (270/02). The mishap occurred during night hours. Sunset was at 1836I with end of civil twilight at 1906I.

s. Directives and Publications:

AFR 00-1	Flight Management
AFR 00-16	General Flight Rules
AFR 00-39	Oil Analysis Program
MCM 3-1, Vol V (S/NF)	Tactical Employment, F-16
PACAFR 55-116	F-16 Pilot Operational Procedures
	432TFW Pilot Guide
PACAFR 00-23	Joint Oil Analysis Program (JOAP)
T.O. 00-20-5	Aircraft, Drone, Aircrew Training
	Devices, Engines, and Air Launched
	Missile Inspections, Flight Reports,
	and Supporting Maintenance Documents
	Flight Manual
T.O. 1F-16C-1	Flight Crew Checklist
T.O. 1F-16C-1CL-1	Fault Isolation and Power Plant (F-16C
T.O. 1F-16C-2-70FI-00-11	and F-16D Aircraft, Block 30)
	Engine Removal and Installation
T.O. 1F-16C-2-70JG-10-11	Combined Preflight/Basic Postflight
T.O. 1F-16C-6WC-1-11	Work Cards
	Ground Handling, Servicing, and
T.O. 1F-16C-C-2-2	Airframe Maintenance

t. Summary:

During a local operational readiness exercise, an F-16C belonging to the 432nd Tactical Fighter Wing took off from Misawa AB, Japan on 7 May 91 at approximately 2040I, experienced a catastrophic F110-GE-100 engine failure, and crashed 1.2 nautical miles from the runway on base property described as Leftwich Memorial Picnic Grounds. The pilot, Capt Robert J. Norris III, was a fully certified and qualified F-16C pilot and flight leader. He safely ejected from the disabled jet prior to its crash.



21 JUN 1991

ROBERT M. JOHNSTON, Colonel, USAF
Aircraft Accident Investigator

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