

# AIRCRAFT ACCIDENT INVESTIGATION AFR 110-14

*(F-16C)*

**DATE: 9 AUGUST 1990**

*Edwards AFB CA*

**DOCKETED  
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*PFS Exh. 112*

**IO: JOHN M. HOFFMAN**

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STATE OF NEW YORK  
IN SENATE  
January 12, 1962

ocket No. \_\_\_\_\_ Official Exh. No. 112  
in the matter of PES  
Clerk \_\_\_\_\_ IDENTIFIED   
Applicant  RECEIVED   
Intervenor \_\_\_\_\_ REJECTED \_\_\_\_\_  
Other \_\_\_\_\_ WITHDRAWN \_\_\_\_\_  
DATE 7/1/62 Witness \_\_\_\_\_  
Clerk [Signature]

FORMAL REPORT OF INVESTIGATION

26 October 1990

I. AUTHORITY AND PURPOSE

A. At the direction of the Commander, Air Force Systems Command (AFSC/DR Ltr, Dtd 17 August 1990), an AFR 110-14 investigation of an aircraft accident involving F-16C/SN86-0359 was conducted at the Air Force Flight Test Center (AFFTC), Edwards AFB, CA. (Tab Y)

Investigating officer: Colonel John M. Hoffman, Vice Commander, AFFTC, Edwards AFB, CA.

Legal Advisor: Lieutenant Colonel Kenneth M. Roberts, Det 3, AFFTC, Edwards AFB, CA

Legal Reporter: Mr. Stanley Hughes, Det 3, AFFTC, Edwards AFB, CA.

B. This investigation was conducted to determine the facts and circumstances surrounding the landing accident of F-16C/SN86-0359 which occurred near a remote test location on 9 August 1990, resulting in major damage to the aircraft. The mishap pilot, Major Vince G. Bonasso, was not injured.

C. The investigation revealed that there were no injuries to any personnel, military, civil service, contractor or civilians as a result of this mishap. Further there was no damage to any civilian property.

II. SUMMARY OF FACTS

A. History of Flight

1. Mission Description: The mishap sortie, designated as Flight 38 in this particular classified test program, was the second of two back-to-back test missions flown by Major Bonasso with the mishap F-16C on 9 August 1990. The mishap sortie originated at a classified test location near a classified test location, with a takeoff time of 1420 PDT, and terminated at approximately 1454 PDT, landing at the same location. The mission profile was a handling qualities evaluation with an asymmetric stores configuration and was flown in the local area with a T-38 chase aircraft. A preflight mission briefing was conducted prior to the first of the two test sorties and covered events for both sorties. A quick turn refueling of approximately 55 minutes duration was performed between sorties. Principal participants were as follows:

<u>CALL SIGN</u>	<u>AIRCRAFT</u>	<u>AIRCREW</u>	<u>POSITION</u>
Corky	F-16C	Maj Vince Bonasso	Test Pilot
Alpha	T-38	Maj Steve Green	Chase Pilot

Capt Keith Weyenberg	Chase Observer	(Flight Test Engineer)
"Jailhouse"	-	Edwards CTF
	Misson Control	
	Room	
"Warden"	-	Maj Robert Hicks
		Test Location Control Room
Tower	-	MSgt John Sorell
		Test Location ATC Tower Controller

The first test sortie, 47 minutes in duration, was uneventful. During the second (mishap) sortie, the mishap pilot (MP) completed the planned high altitude portion test events and recovered to the test location for several visual straight-in approaches and landings. The first landing approach was a handling qualities evaluation, using an offset final approach with a planned realignment to centerline. A touch and go landing was completed satisfactorily. The MP then made a turnout to downwind to set up for a visual straight-in full stop landing. While on downwind, the MP was off tower frequency while he conferred with the Edwards Combined Test Force (TFC) mission control room. The MP started his wide right base turn, returned to tower frequency, and rolled out on about a four mile final. He then landed the aircraft from a normal straight-in approach. All three landing gear were in the up and locked position when the aircraft contacted the runway. The aircraft touched down on the centerline tank, approximately 2300 feet from the approach end of the runway and came to rest approximately 11,000 feet from the approach end, 45 feet left of centerline, with the aircraft nose canted approximately 45 degrees to the left of runway heading. The centerline fuel tank exploded very shortly after touchdown and the aircraft was engulfed in fire from the center section aft. The MP egressed without injury as soon as the aircraft stopped and as the fire department extinguished the fire. (TAB A) (TAB C) (TAB H) (TAB K) (TAB N) (TAB S)

## 2. Significant Facts Surrounding the Accident.

(a) Normally a single sortie would have been accomplished to complete all the planned test maneuvers; however, a tanker aircraft was not available for in-flight refueling, so the test aircraft had to land to refuel with approximately a 55 minute interval between sorties. The first sortie, a handling qualities investigation using the F-16C loaded with asymmetric stores configuration, was flown at various altitudes, airspeeds, and centers of gravity (CG) conditions and was completed successfully without incident. No formal interim flight briefing was conducted between sorties. (TAB K) (TAB N)

The second sortie launched at 1420 hrs PDT after the F-16C and chase T-38 had been refueled. Initial test maneuvers for the second sortie, essentially a continuation of the first flight, were conducted as planned, investigating aircraft handling qualities in an asymmetric store configuration at various altitude, airspeed and CG conditions. Test results were as anticipated, causing no particular concern for the test pilot. A T-38 chase aircraft accompanied the test aircraft, monitoring test card accomplishment, providing visual traffic surveillance, and being in proximity to provide other in-flight assistance. The T-38 chase aircraft was significantly underpowered compared to the F-16C test aircraft. This dissimilarity made it difficult for the chase pilot to keep in close proximity at all times, particularly when the F-16 was at high power settings and accelerating. In testimony, the T-38 chase pilot indicated that this performance dissimilarity made his job difficult, that he was unable to be in the best chase position, and that he was unable to confirm landing configuration of the test aircraft at a critical point. He did acknowledge that this was an "implicit responsibility" as chase, even though the landing events had not been specifically briefed. (TAB V)

(b) The mission was monitored simultaneously from two control rooms, one located at the test location (call sign "Warden") and the other at the Edwards AFB (CTF), call sign "Jailhouse". Primary test control and telemetry (TM) data parameter monitoring were being done from the Edwards CTF control room, manned by F-16 flight test engineers. Range area and traffic safety surveillance were monitored from the test location control room ("Warden"). Because of the classified nature of the test mission, certain TM test parameters were masked during the takeoff and landing portions of the mission (mach, altitude, and heading). Otherwise, the Edwards primary test mission control room ("Jailhouse") was able to monitor all data being telemetered, including indication of aircraft configuration (gear up or gear down). (Tab N). In testimony, the MP indicated that not having the primary mission control room geographically located at the test location, with F-16 experienced engineering assistance available fulltime to monitor throughout the mission, was a definite shortcoming of the program. (TAB V)

(c) The F-16C test aircraft was equipped with both a VHF and UHF radio capability (one each). The T-38 chase aircraft, however, had only a single UHF capability. For test mission conduct, the UHF radio was used with a discrete mission frequency. This provided two way communication (R/T) between the test aircraft and chase aircraft, as well as to both the Edwards and local test location control rooms. For mission termination on both sorties, however, it was planned to have both the test and chase aircraft switch UHF frequencies to the local control tower frequency during the landing phase. This meant the Edwards control room was no longer in direct radio contact nor active monitoring role. Earlier sorties had used a different

procedure, letting the test aircraft talk to tower on VHF during landing, while still monitoring the UHF test frequency. In this instance, however, the T-38 chase aircraft (UHF only) was not directly monitoring the landing communications between the test aircraft and tower, a less preferred procedure. (TAB V)

In testimony, the MP indicated this procedure of switching from mission to tower frequency during the landing phase was not what he preferred to do (not "normal" procedure, based on his other F-16 experience). He felt this cut the primary control room (Edwards) out of a monitoring role at a critical time, particularly when doing a landing test event. (TAB V)

The test location control room ("Warden") was able to monitor both mission and tower UHF frequencies but, was essentially performing only routine test mission progress monitoring. Actual TM data parameters, such as landing gear position, were not being actively monitored by Warden. Additionally, the particular tracking video being monitored by Warden was felt insufficient to determine landing gear position while on short final. (TAB V). Close analysis of this video record distinctly showed the presence or absence of landing gear, although on short final with a mountain rather than sky background it was less obvious. (TAB S)

(d) Because the last test event on the mishap sortie was a handling qualities investigation in a touch and go landing pattern, the test aircraft had to switch back to the UHF test frequency to debrief the pilot evaluation comments to Edwards while on the downwind leg setting up for final full stop landing. There was also a requirement to communicate fuel status (weight and distribution) to the Edwards control room to ascertain the correct CG location prior to final landing. This discussion, on UHF test frequency with Jailhouse, took approximately two minutes while the F-16 was being flown on downwind and prepared for the final straight-in full stop landing. The mishap pilot came back to tower frequency while turning a wide right base turn to final, approximately four miles from the runway. The T-38 chase aircraft remained on tower UHF frequency following the earlier touch and go landing and while the mishap pilot was conferring with Edwards mission control on downwind. After returning to tower frequency, a standard "check wheels down" call was made by the tower and indirectly acknowledged (keyed mike) by the mishap pilot approximately one minute, thirty seconds prior to touchdown. The T-38 chase pilot made no radio transmissions, either during the go-around sequence and the momentary frequency switch by the F-16 pilot to test frequency while on downwind, nor during the final approach phase of the full stop landing. The first call from the T-38 chase is after the test aircraft first contacts the runway and a flash (fire) is observed. (TAB N)

(e) The particular F-16 asymmetric store configuration and associated heavy gross weight necessitated flying final approach and touchdown at higher than normal airspeeds and at reduced angles of attack (AOA). Specifically, the final approach airspeed on the final full stop (mishap) landing was above the minimal airspeed which triggers the landing gear warning horn for the F-16 (170 KIAS). This denied the MP an additional warning that the landing gear was not in the down and locked position for landing. (TAB V)

3. News Media: Due to the classified nature of the mission, no public news release was made. As little dissemination as possible has been made of the incident.

#### B. MISSION:

This test sortie was a classic stability and control/handling qualities investigation with an asymmetric store loading configuration on the F-16C test aircraft. There were no undesirable or adverse handling qualities anticipated during either the first or second (continuation) sortie. The only significantly unique aspect of the mission was the geographically detached mission control/TM monitoring from the Edwards control room during all but the landing phase of the mission.

#### C. BRIEFING AND PREFLIGHT:

Normal safety and technical planning for this series of test missions had been conducted, which the mishap pilot participated in. A preflight briefing was held the day prior to the mishap with the key engineers and ops personnel, including the mishap pilot, at the CTF at Edwards. A face-to-face mission briefing was also conducted the next morning at the test location, specifically including the chase aircraft crew and Warden personnel. Both briefings covered all test events, even anticipating the option for two sorties with a quick turn in between for refueling. Normal chase duties were briefed; area monitoring and traffic clearing, hazards to watch for/help with, and contingency emergency procedures. No specific mention was made of the test aircraft configuration monitoring as a chase responsibility. The T-38, being underpowered and lacking in performance from the F-16, was asked to do an "area" chase as opposed to continuously flying a close chase position. Testimony revealed crew rest was not a factor. (TAB V)

While key people in both control rooms were briefed, the tower personnel were not briefed on the mission nor the specific events associated with the landing evaluation. In later testimony, the tower controller indicated some concern with the close to touchdown maneuvering during this landing evaluation he thought the test aircraft was "unstable". (TAB V)

There were no problems or misunderstandings from normal practices for this particular program that surfaced during the briefing or related preflight activity. The abnormally high final approach and touchdown speeds mandated by the lower AOA and heavy asymmetric stores loading were not specifically briefed. An interim preflight brief was not conducted between sorties, since all events had previously been briefed. (TAB V)

D. FLIGHT ACTIVITY:

1. Flight 38 was typical of previous test missions in this series of tests, essentially just a continuation of the previous sortie. The pilot resumed testing using the original mission card once airborne following the 55 minute delay for ground refueling. Test events were considered routine with no adverse results anticipated. The second sortie was planned to terminate with several landings, time permitting. (TAB-N)

2. Communications throughout the up and away portion of the flight were normal and satisfactory between the two control rooms and the test aircraft, using the discrete UHF mission frequency. On recovery to the traffic pattern, both the test aircraft and chase switched to tower UHF frequency. At this point, the Edwards control room (primary data monitoring) was no longer in direct contact. Mission control was then assumed by the local control room (Warden), but not in an active sense. TM data was not specifically monitored, however tracking video of primary and chase aircraft was displayed. Following the successful landing evaluation/touch and go, the test aircraft switched back to the mission UHF frequency for approximately two minutes to debrief with the Edwards control room. (TAB-N)

3. In his testimony, the MP considered this an abnormal practice; however, the tower controller and chase pilot did not feel particularly distracted by it. The MP came back up on tower frequency as he turned a right base to about a four mile straight-in final, approximately one and one half minutes prior to touchdown. The tower controller gave a landing clearance and directed a "check wheels down". The MP acknowledged by keying the mike. The chase aircraft made no radio calls during the first landing approach, go-around, or during the second approach until after fire was observed after runway contact. There was no recognition of the gear up condition immediately prior to landing by any of the participating control agencies or chase aircrew. Hence, no warning calls were made to the MP. (TAB-N) (TAB-V)

4. External factors such as weather, terrain, airspace limitations, or navigational facilities were not contributing factors to this mishap.

5. The aircraft performance differences, primarily the greater acceleration capability of the F-16 compared to the T-38, were considered a contributing factor. The chase pilot had

considerable difficulty keeping close to the F-16 at times, particularly as the MP would accelerate. The chase pilot lost sight of the F-16 several times at altitude (25,000 ft). In the landing pattern, the T-38 dropped back considerably during the go-around from the touch-and-go, then never did recover to a close chase position prior to being on final for the full stop landing. The chase pilot felt this performance deficiency prevented him from being in a more advantageous position, particularly during the final landing phase. Most of the time he was too far back or too high on short final to observe the gear position. (TAB V).

6. The events of interest leading up to and including the mishap include the initial touch-and-go landing, set-up for the straight-in full stop landing, and the final approach itself that culminated in the gear-up touchdown.

(a) In review of both the tracker and test aircraft HUD video, it is apparent that the landing gear is down on the first touch and go landing. The tracker video shows the gear present, particularly while the aircraft is against the sky background. On short final, against the mountainous terrain background and with underwing stores present, the landing gear is more difficult to recognize. The landing light is not turned on. The AOA bracket symbol is visible in the lower center of the HUD, a positive indication of a gear down condition. The realignment to centerline was satisfactorily accomplished at about 200 feet above the runway elevation. Final approach speed varied between 200 and 190 KIAS, with initial touchdown at approximately 172 KIAS and 10 degrees AOA. Minor pitch and directional perturbations are noted. (TAB-Z)

(b) Go-around was normal for the F-16. The T-38 chase pilot, however, indicated difficulty staying with the test aircraft due to power dissimilarities and was unable to maintain a good chase position. (TAB V). Airspeed on downwind was between 250 and 280 KIAS, for the approximate two minute debrief with the Edwards control room. The MP turned a right base holding approximately 210 KIAS, to a straight-in final at approximately four miles from the runway. (TAB-Z)

(c) During an approximate three mile final for the full stop, airspeed varied between 210 and 200 KIAS with good runway alignment and velocity vector symbol in the HUD superimposed on the end of the runway. The AOA bracket symbol is not visible in the HUD video on this approach, a direct indication that the gear is not down (while in the NAV mastermode). In testimony, the MP indicated he did not use this symbol as a control parameter during landing in the F-16, preferring to use airspeed instead. The aircraft contacted the runway at approximately 185 KIAS; AOA not available. Almost immediately the HUD video shows a "bounce" (the centerline fuel tank exploding) and then the aircraft settling back on the runway

at approximately 175 KIAS. The "WARN" symbology, coincident with triggering the landing gear not down and locked warning, appears in the center of the HUD as the aircraft decelerates thru 169KIAS. This is consistent with the aircraft gear up and locked warning system operating criteria. (TAB-Z)

E. IMPACT:

The aircraft impacted on the test location runway at 1454 PDT 9 August 1990 in a normal landing altitude, approximately 2300 feet from the approach end. On touchdown, the aircraft contacted on the centerline tank, which almost immediately exploded and triggered a fire. The aircraft slid down the runway and came to a rest approximately 11,000 feet from the approach end, 45 feet left of centerline, with the aircraft nose control approximately 45 degrees to the left of runway heading. The aircraft suffered substantial damage to the underside fuselage, wings, stabilizer, engine, and external stores. The aircraft, a heavily instrumented test vehicle, had very low operating time, 53.7 hours, at the time of the mishap. (TAB M)

F. CREW EGRESS/EQUIPMENT:

Almost immediately after the aircraft came to a complete stop, the MP opened the canopy with the normal system and rapidly egressed unassisted over the left side. The MP suffered no significant injuries. There were no malfunctions or discrepancies noted with aircraft systems or equipment during the egress.

G. PERSONAL AND SURVIVAL EQUIPMENT:

Personal and survival equipment functioned normally and were not a contributing factor in this mishap.

H. RESCUE/CRASH RESPONSE:

The rescue/crash response was practically instantaneous. The runway alert fire truck, located near midfield, entered the runway behind the aircraft as it slid by and was spraying foam on the fire even before it came to a complete stop. The fire was contained and extinguished very quickly, definitely saving the valuable aircraft. The very timely and highly effective response of the rescue/crash team is quite obvious in the TM tracker video. No collateral damage occurred after the fire was extinguished. The aircraft was hoisted and removed from the runway shortly afterwards without further incident. (TAB-Z)

I. MAINTENANCE DOCUMENTS:

The F-16C test aircraft had very low operating time at the time of the mishap (53.7 hours). In view of the maintenance

documentation, there are no outstanding discrepancies. It had flown the previous sortie Code One (no discrepancies) and was flying perfectly normal up until the time of the mishap. From a review of all the maintenance documentation, there was nothing from a maintenance viewpoint that contributed to the accident or events which led to the accident. (TAB H)

J. MAINTENANCE PERSONNEL AND SUPERVISION:

This area was adequate and did not contribute to the accident or events which led to the accident.

K. ENGINE, FUEL, HYDRAULIC AND OIL ANALYSIS:

The oil, hydraulic, and fuel analysis showed no discrepancies, and there was no indication of any contribution to the mishap. (TAB-J)

L. AIRFRAME AND AIRCRAFT SYSTEMS:

A post-mishap functional check of the landing gear system was obviously not possible, but it had functioned normally on the previous touch and go landing. Pertinent data revealed no evidence to indicate that the accident was caused by airframe or systems failures. (TAB-Z)

M. OPERATIONS PERSONNEL AND SUPERVISION:

1. The mission had been properly authorized and approved. All mission documentation had been properly executed.

2. Preflight briefings (2) for this mission, as previously discussed were considered adequate. Personnel in both control rooms had briefed with the MP, as had the chase aircrew. Previously, a technical and safety review had been conducted for the overall program. All preflight activities for the mission fully complied with existing directives that addressed test mission preparation and briefings. However, according to testimony, no emphasis was placed on (1) specific chase responsibilities with regard to monitoring the landings or aircraft configuration, (2) the abnormally high final approach/landing airspeeds due to a heavy asymmetric load and the implication of no gear warning (above 170 KIAS), (3) the impact of direct mission monitoring/control by the Edwards control room during the landing phase, and (4) any particular TM/Video monitoring requirement for the test location control room. (TAB V)

N. CREW QUALIFICATIONS:

1. A review of data and testimony indicated that the MP, Major Bonasso, was a highly experienced and qualified F-16

instructor pilot. A graduate of the USAF Test Pilot School, he was equally well-experienced in a variety of F-16 test activities. He had nearly 2300 total hours and approximately 1200 hours in the F-16. In testimony, his airmanship was judged to be excellent. Major Green, T-38 chase pilot, was likewise a highly experienced test pilot. Captain Weyenberg, the chase observer, had a reasonable amount of flight crew experience, primarily flying in chase aircraft in the test program.  
(TAB-E)(TAB-V)

2. No training discrepancies were found in any available documentation. (TAB-E)

O. MEDICAL:

All crew members were medically qualified for flight duty. No significant injuries were attributed to the accident.

P. NAVAIDS AND FACILITIES:

Nothing in this area contributed to the accident or adversely affected the rescue portion of this mishap. From testimony, the tower controller felt he had performed his duties properly. (TAB V)

Q. WEATHER:

Weather was not a factor in this mishap.

R. DIRECTIVE AND PUBLICATIONS:

1. This is a list of regulations, manuals and documents which had a direct bearing on this accident.

(a) Air Force Regulation 60-16, General Flight Rules, and the AFSC and AFFTC supplements thereto.

(b) Air Force Regulation 60-1, Flight management, and the AFSC and AFFTC supplements thereto.

(c) AFFTC Regulation 55-2, Aircrew Operation.

(d) AFFTC Regulation 55-7, Fighter and Trainer Aircrew Procedures.

(e) F-16C Flight Manual, F-16C-1.

(f) Test Project Technical and Safety Review.

(g) Test Mission flight cards, Flight 38.

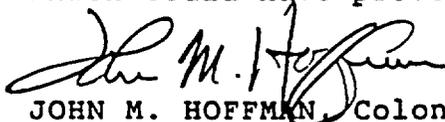
2. Deviations from Directives or Publications.

(a) The MP deviated from flight manual procedures for landing by neglecting to lower and then check the landing gear down and locked prior to landing. He also failed to fully

utilize all available information to successfully perform the landing, i.e. crosscheck the angle of attack at final approach airspeed, which is normally displayed in the HUD with the landing gear down (TAB-W)

(b) The T-38 Chase Pilot, while not deviating from the currently established procedures for chase aircraft, neglected to fully and properly perform his duties as safety chase pilot by not confirming or challenging proper configuration for landing. (TAB-W)

(c) The mission flight control monitoring by both control rooms, while not deviating from or violating any established procedures, failed to exercise full capability and implicit responsibility, given that information was available which could have prevented the accident. (TAB-W)



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I N D E X

<u>ITEM</u>	<u>TAB</u>
AF Form 711 .....	A
Not Used.....	B
AF Form 711b Aircraft Flight Mishap Report .....	C
AF Form 711c Aircraft Maintenance & Material Report....	D
Flight and Personnel records.....	E
Not Used.....	F
Not Used.....	G
AFTO Form 781 Aerospace Vehicle Flight Data.....	H
Not Used.....	I
Technical or Engineering Evaluations.....	J
DD Form 175, Military Flight Plan .....	K
DD Form 365-4 Weight and Balance Clearance .....	L
Certificate of Damage .....	M
Transcripts of Recorded Communications.....	N
Not Used.....	O
Statement of Damage to Private Property.....	P
Document appointing Safety Investigation.....	Q
Not Used.....	R
Photographs .....	S
Individual Flight Records.....	T
Aircraft Maintenance Records .....	U
Testimony of Witnesses .....	V
Technical Orders (T.O. 1F-16C-1).....	W
Not Used .....	X
Document appointing Accident Investigation Officer ....	Y
Not Used .....	Z