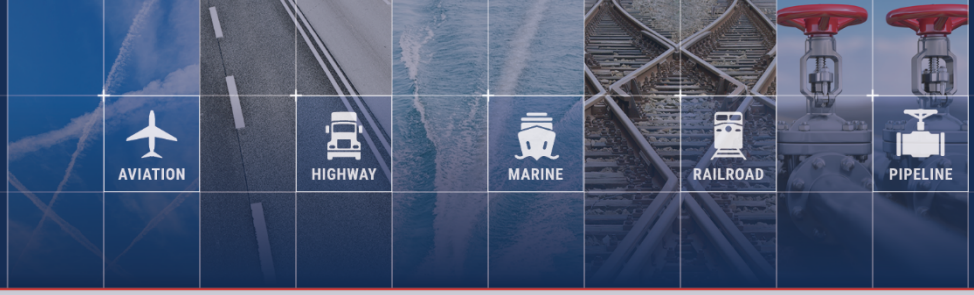

Aviation Investigation Final Report

Location:	BRADENTON, Florida	**Accident Number:**	MIA01FA028
Date & Time:	November 16, 2000, 15:48 Local	**Registration:**	USAF
Aircraft:	Lockheed-Martin F-16CG	**Aircraft Damage:**	Destroyed
Defining Event:		**Injuries:**	1 None
Flight Conducted Under:	Part 91: General aviation - Instructional		

Analysis

A formation flight of two F-16s departed Moody Air Force Base in Valdosta, Georgia, on an IFR flight plan leading to the entry point for a low-altitude military training route located near Sarasota, Florida. The flight lead pilot was provided an air traffic control (ATC) frequency change from Miami Center to Tampa Approach. The flight was unable to establish communications with Tampa Approach because an incorrect radio frequency was given to the flight lead by Miami Center. The flight lead reestablished radio contact with Miami Center, cancelled the flight's IFR clearance, and proceeded under visual flight rules (VFR). The controller acknowledged the cancellation, advised the F-16 flight lead pilot of traffic in his vicinity, and asked the flight lead pilot if he wanted VFR flight following (a service that includes VFR radar traffic advisories on a workload-permitting basis.). The flight lead pilot declined. The Miami Center controller then informed Tampa Approach that the flight lead pilot had elected to terminate ATC services, but did not specify that there were two aircraft in the flight. Tampa Approach procedures did not require that the controllers use flight strips (which would have included the number of aircraft in the formation), so the Tampa controllers had no other information indicating that there were multiple aircraft present. Continuing their descent under VFR, the two F-16s assumed the "fighting wing" formation. This placed the accident F-16 on the left side of the lead aircraft and approximately 0.7 miles in trail. The accident F-16's transponder was inactive, as is normal for formation operations, making the aircraft significantly less conspicuous on ATC radar than it would be with an operating transponder. At an unknown point in the flight, the F-16 lead pilot's navigation system developed a position error and was indicating that the aircraft was several miles from its actual position. The pilot failed to recognize the error, and was attempting to visually locate the entry point for the training route based on the erroneous navigation data. Because of the lead pilot's loss of situational awareness, the two F-16s inadvertently descended into the Class C airspace surrounding the Sarasota, Florida airport without establishing required communications with ATC. Meanwhile, a Cessna 172 pilot departed Sarasota under VFR and contacted Tampa Approach. The Cessna pilot was instructed by the developmental controller receiving

instruction to maintain 1,600 feet, turn left to a heading of 320-degrees, and to follow the shoreline. At 15:47:10, he was instructed to climb and maintain 3,500 feet. Miami Center contacted Tampa Approach at 15:47:55, and asked for the altitude of the F-16s. Although the Tampa controller was not in contact with the F-16s, he was able to locate the flight lead on the radar display and informed Miami that the flight lead was at 2,000 feet. A conflict alert between the lead F-16 and the Cessna activated 10 times between 15:47:39 and 15:48:03. The developmental controller stated that he heard an alarm, but could not recall where it was. The controller providing the instruction did not recall if he saw or heard a conflict alert, and no conflict alert was issued. There was no alert generated between the accident F-16 and the Cessna because the conflict alert system requires that both aircraft involved have operating transponders. The developmental controller informed the Cessna pilot at 15:48:09 that he had traffic off his left side, but received no response. The controllers were unaware of the position of the other (accident) F-16 in the formation flight. At 15:48:53, the lead F-16 transmitted, "Mayday, mayday." At 15:49:14, the flight lead pilot followed with, "Mayday, mayday, mayday, F-16 down." Examination of the wreckage of both airplanes determined that the accident F-16's left wing and cockpit area collided with the Cessna 172's right forward side (nose) and cabin area.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: the failure of the F-16 flight lead pilot and F-16 accident pilot to maintain an adequate visual lookout while maneuvering. Factors contributing to the accident were: the F-16 flight lead pilot's decision to discontinue radar traffic advisory service, the F-16 flight lead pilot's failure to identify a position error in his aircraft's navigational system, the F-16 pilots subsequent inadvertent entry into class C airspace without establishing and maintaining required communications with air traffic control (ATC); and ATC's lack of awareness that there was more than one F-16 aircraft in the formation flight, which reduced the ATC controllers ability to detect and resolve the conflict that resulted in the collision.

Findings

Occurrence #1: MIDAIR COLLISION
Phase of Operation: MANEUVERING

Findings
1. (F) FLIGHT/NAV INSTRUMENTS,ELEC FLT INFO SYST (EFIS) - MALFUNCTION

2. (C) COMMUNICATIONS/INFORMATION/ATC - DISCONTINUED - PILOT OF OTHER AIRCRAFT
3. (C) VISUAL LOOKOUT - NOT MAINTAINED - PILOT IN COMMAND
4. (C) ARTCC SERVICE - NOT ISSUED - ATC PERSONNEL(DEP/APCH)
5. (F) ARTCC SERVICE - NOT FOLLOWED - FLIGHTCREW

Factual Information

HISTORY OF FLIGHT

On November 16, 2000, at 1548 eastern standard time, a U.S. Air Force F-16CG, operated by the 347th Wing, Air Combat Command, collided in mid air with a Cessna 172, N73829, near Bradenton, Florida. The F-16, based at Moody Air Force Base (AFB), Valdosta, Georgia, was on a low-altitude training mission. The Cessna 172, registered to Crystal Aero Group, was operating as a 14 CFR Part 91 personal flight. The airline transport (ATP)-rated Cessna pilot was killed. The F-16 pilot, who held a commercial pilot's certificate, ejected from the airplane and sustained minor injuries. Visual meteorological conditions prevailed at the time of the accident. The accident F-16 was part of a flight of two F-16s. A composite military instrument flight rules (IFR)/visual flight rules (VFR) flight plan was filed. The two F-16s departed Moody AFB at 1513. The Cessna 172 departed Sarasota Bradenton International Airport (SRQ) Sarasota, Florida, about 1541. No flight plan was filed.

The accident F-16 pilot, who was using call sign Ninja 2, stated that he was maintaining visual formation with his flight lead, call sign Ninja 1, when he saw a blur "like a sheet of white" appear in front of him. He stated that the airplane shuddered violently, and part of the canopy on the left side was broken away. The accident pilot stated that wind, smoke, and a strong electrical smell filled the cockpit. He stated that he called his flight lead several times, but could not hear a reply. Because the airplane was still controllable, he decided to try to reach MacDill AFB, and he began a right turn in that direction. He stated that his primary flight instruments were shattered and that he could not see them. He stated that the engine began to spool down and that he realized that he would not be able to make the airport. He stated that he turned the airplane left toward a wooded area away from a residential area and attempted an engine restart, which was not successful. When the airplane cleared the residential area, it started an uncommanded left roll. When the airplane went past a 90-degree bank angle, the pilot stated that he decided to eject. During his parachute descent, he observed the airplane "pancake" into the ground inverted and explode.

The flight lead stated that the two F-16s were assigned a block altitude of between 25,000 feet and 26,000 feet en route to the entry point of visual military training route (MRT) VR-1098. As the flight approached the SRQ area, Miami Air Route Traffic Control Center (ARTCC) cleared the F-16s to descend to 13,000 feet. At 1543:39, the Miami ARTCC controller instructed the flight lead to contact Tampa Terminal Radar Approach Control (TRACON) controllers. The flight lead was not successful (because he was given an incorrect frequency), and he reestablished contact with Miami ARTCC and canceled IFR. Miami ARTCC advised him of traffic at 10,000 feet, which was acquired on radar. The controller accepted the cancellation and asked the pilot if he wished to continue receiving radar traffic advisory services. The flight lead declined. According to the air traffic control (ATC) transcripts, the controller then stated,

"radar service terminated, squawk VFR [transponder code 1200], frequency change approved, but before you go you have traffic ten o'clock about 15 miles northwest bound, a Beech 1900 at ten thousand [feet]." The flight then began a VFR descent to enter VR-1098. (For additional information see Air Traffic Control Group Chairman's Factual Report attachment to this report.)

The flight lead informed Ninja2 that they were going to perform a "G" check (G awareness maneuver). They accelerated to 400 knots, made a right 90-degree turn, followed by a left 90-degree turn back on course, and continued their descent below 10,000 feet. The flight lead then instructed the accident pilot to assume the "fighting wing" formation (with the wingman at the 7 o'clock position behind the flight lead). They continued to descend through 5,000 feet about 6 miles north of the entry point to VR-1098. The flight lead attempted to obtain a visual reference to the entry point. The flight lead also looked at his low-altitude en route chart to reference the class B airspace at Tampa and the class C airspace at Sarasota.

About 1547, the F-16 flight was heading south and descending through 4,300 feet on a converging course with N73829. Radar data indicated that the flight had overshot its intended entry point to VR-1098 and was several miles southwest of the MTR. The flight had also inadvertently passed through Tampa class B airspace without the required ATC clearance and was about to enter the Sarasota class C airspace without establishing communications with ATC, which is required by Federal regulations.

After continuing to descend, the flight lead looked back to the left and observed the accident F-16 slightly below him at the 7 o' clock position and about 4,000 feet to 5,000 feet behind him. The flight lead also observed a white, high-wing white airplane (the Cessna) in a 30 to 45-degree right turn. The Cessna and the accident F-16 collided in a left-to-left impact at the flight lead's 10 o' clock position, he stated. After the collision, the flight lead observed vaporizing fuel on the F-16's right side. The flight lead did not see the Cessna. The flight lead called the accident pilot and stated, "it appears you have had a mid air and are streaming fuel." There was no response. The flight lead began a left turn to keep the accident F-16 in sight. The flight lead saw the accident pilot bail out and the airplane collide with the ground. At 15:48:55, the flight lead stated, "mayday mayday." At 15:49:11, the flight leader stated, "mayday mayday mayday F sixteen down." At 15:50:00, the flight lead stated, "yes this is Ninja one we have an F sixteen down there is a light aircraft may have also gone down sir I am not sure." The collision occurred about 2,000 feet msl, about 6 miles southwest of the entry point for VR-1098.

A review of ATC transcripts of communications between N73829 and Tampa TRACON and communication between Miami ARTCC and Tampa TRACON indicated that N73829 contacted Tampa TRACON at 15:45:19 stating he was off Sarasota-Bradenton at 1,600 feet. At 15:45:23, Tampa TRACON told N73829 to maintain 1,600 feet. N73829 acknowledged the transmission at 15:45:30. At 15:46:59, Tampa TRACON informed N73829 to turn left to heading 320 and to follow the shoreline northbound. At 15:47:10, Tampa TRACON instructed N73829 to climb and maintain 3,500 feet, which was acknowledged by N73829 at 15:47:15.

The Miami ARTCC controller contacted Tampa TRACON at 15:47:55 and asked Tampa

TRACON for the flight lead's altitude because he had lost radar contact with the lead F-16 (only the flight lead had his transponder activated because formation flights are handled as a single aircraft by ATC). Tampa TRACON replied at 20:48:00, stating "ahh hang on I see him down at two thousand." At 15:48:09, Tampa TRACON informed N73829 that he had traffic off his left side at 2,000 feet. N73829 did not respond. (For additional information see the ATC transcript attachment to this report.)

A review of altitude data and ground track data (and airspace boundaries) determined that Tampa TRACON's intruder conflict detection software noted a conflict between the flight lead and the Cessna, and generated an aural conflict alert in the TRACON facility at 1547:39 that continued until 1548:03. The controller receiving instruction at the time of the accident told Safety Board investigators that he heard an alarm (conflict alert), but that he could not recall where it was. The controller providing instruction at the time of the accident stated that he didn't remember whether he saw an alert on his radar display or if he heard an aural conflict alert. He added that conflict alerts occur frequently, and that many were false. The conflict detection system did not account for the accident F-16, or a possible conflict, because it's transponder was in the standby mode. (For additional information see the NTSB Recorded Radar Study and the Air Traffic Control Group Chairman's Factual Report attached to this report.)

Witnesses stated that they heard the sound of approaching jets. They observed the first jet flying south, followed by the second jet located to the left and slightly lower than the first. They also observed a small civilian airplane flying from west to east, perpendicular to the military jets. The second jet collided with the civilian airplane and initially continued southbound, according to witness statements. The second jet was observed to make a right turn, followed by a left turn. A parachute was observed, and the airplane was observed to enter a flat spin to the left before it disappeared from view below the trees. An explosion was heard, followed by heavy dark smoke rising above the terrain. (For additional information see NTSB Group Chairman's Field Report, Ninja 1 and Ninja 2 pilot statements, and witness statements.)

PERSONNEL INFORMATION

Air Force training, flight evaluations and flight records indicated that the accident F-16 pilot, age 31, completed undergraduate pilot training on September 27, 1996. He was qualified in the F-16 on March 3, 1997, and graduated from the F-16 basic course on July 22, 1997. His most recent instrument/qualification examination was completed on October 22, 1999. His most recent mission examination was completed on June 21, 2000. He was qualified as a 2-airplane flight lead on March 19, 1999, and as a 4-airplane flight lead on January 11, 2000. He held a current military flight physical completed on May 30, 2000, with the restriction, "required to wear vision correction devices while performing flying or special operational duty." The pilot indicated on AF Form 1042 that he wore contact lenses while performing flying or special operational duty.

A review of FAA records indicated that the accident pilot held a commercial pilot certificate

issued on September 9, 1999, with ratings for airplane single-engine land, airplane multi-engine land, and instrument airplane. In addition, he held a flight instructor certificate with ratings for airplane single-engine land, airplane multi-engine land, and instrument airplane. The pilot's FAA second-class medical certificate was issued on December 21, 1998, with no restrictions. He had accumulated a total of 1,279 flying hours.

Air Force training, flight evaluations and flight records indicated that the flight lead completed undergraduate pilot training on May 16, 1980. He was qualified in the F-16 on December 20, 1988, and graduated from the F-16 basic course in March 1989. Following a non-flying tour he completed the F-16 re-qualification course on June 8, 1998. His most recent instrument/qualification examination was completed on September 29, 2000. His most recent mission examination was completed on December 29, 1999. He was qualified as a 4-airplane flight lead on February 10, 2000. He held a current military flight physical completed on August 30, 2000, with the restriction "required to wear vision correction devices while performing flying or special operational duty." The pilot indicated on Air Force form 1042 that he did not wear contact lenses while performing flying or special operational duty.

A review of FAA records indicated that the flight lead held an ATP certificate issued on May 18, 2000, with ratings for airplane single-engine land, airplane multi-engine land, and instrument airplane. The flight lead held a first-class medical certificate issued on October 30, 2000, with the restriction "must wear corrective lenses."

The Cessna 172 pilot, age 57, held an ATP certificate issued on December 15, 1999, with ratings for airplane single-engine land, multi-engine land, and instrument airplane. In addition, he held a flight instructor certificate with ratings for airplane single-engine and multi-engine land, instrument airplane, and a ground instructor certificate for basic and advanced instruments. His first-class medical certificate was issued on September 14, 2000, with the restriction "must wear corrective lenses and possess glasses for near and distant vision." The pilot's logbook was destroyed in the crash. The pilot indicated on his last medical certificate application that he had accumulated 2,020 flight hours.

AIRCRAFT INFORMATION

The accident F-16 was equipped with a General Electric turbofan F110-GE-100 engine. The engine was overhauled by Tinker AFB Oklahoma, Air Logistics Center, on December 17, 1998. The engine operating time was 2,537.5 hours, with 5,610 engine total accumulated cycles (TACs). The engine had accumulated 640 operating hours since overhaul. The airframe had accumulated 3,243.7 total flight hours. All time compliance technical orders pertaining to the airframe and engine assembly had been accomplished.

A Safety Board review of N73829's airplane logbooks indicated that the last recorded altimeter, static, and transponder system checks were completed on November 11, 1999. The last annual inspection was conducted on April 7, 2000. The last 100-hour inspection was conducted on November 13, 2000.

METEOROLOGICAL INFORMATION

The nearest weather reporting facility at the time of the accident was Sarasota-Bradenton Airport. The 1553 surface weather observation indicated the following: clear, visibility 10 miles, temperature 80 degrees Fahrenheit, dew point 64 degrees Fahrenheit, wind 210 degrees at 11 knots, altimeter 29.97 Hg.

WRECKAGE AND IMPACT INFORMATION

The F-16's wreckage was located in a wooded area near Sarasota. The wreckage was about 4 miles southwest of the Cessna 172 crash site on a bearing of 187 degrees magnetic.

Examination of the F-16 crash site revealed that the airplane collided with the ground in a left flat spin on a heading of 170 degrees. The right wing was found inverted and had evidence of an impact 81 inches inboard of the wing tip in the vicinity of the SUU-20 (bomb and rocket training dispenser). A aluminum fuel line from the Cessna 172 was found wedged between the lower wing surface and the SUU-20 attachment point. The Air Combat Maneuvering Instrumentation (ACMI) pod, with the associated missile rail launcher (MRL), was separated from the right wing tip at station 9. A faint transfer of red paint was present on the upper aft surface of the MRL. The ACMI pod exhibited scarring discoloration on the upper aft surface. A segment of one of the Cessna 172's flight control cables was found wedged in the F-16's right wing leading edge. The wing's leading edge was deformed upward and aft. Scratches were observed on the upper wing surface between the SUU-20 mount point area and the wing tip. The scratches extended from the wing's leading edge to the trailing edge.

The canopy was located about 640 feet northwest of the main wreckage. The canopy was shattered on the left side extending from the 11 o'clock position rearward to the 7 o'clock position. Gouging from the Cessna was present on the canopy rail's leading edge. The gouging extended aft and over the transparency portion of the canopy, ending at the 11 o'clock position. A faint paint transfer was present on the right forward canopy rail.

The SUU-20 was found imbedded tail first in the ground adjacent to the entrance of Rosedale Golf and Country Club Community. Part of the Cessna's main landing gear trunnion was found imbedded in the upper leading structure of the SUU-20.

Visual examination of the airframe revealed no evidence of a precrash mechanical failure or malfunction. Flight control continuity was confirmed through data retrieved from the crash survivable memory unit (CSMU). The engine assembly was not examined because the pilot reported that he did not experience any engine-related problems before the collision.

The Cessna wreckage was located in numerous pieces in the southwest quadrant of the Rosedale Golf and Country Club community on the east side of Bradenton. Numerous small pieces of F-16 structure and canopy material were located within the Cessna debris field.

Because of airframe disintegration, verification of flight control continuity was not possible. No preimpact discrepancies were observed during the on-site wreckage inspection.

The engine, propeller and forward cabin section were found in one piece at the edge of the main north-south entry road on the southwest side of the complex. The propeller was attached to the engine with the No.2 blade buried in the ground vertically to the hub. Propeller blade No.1's outer 4 1/2 inches was missing. Gray/white paint transfer was observed spanwise at the mid span on the forward side of the No.1 blade. Minor scrapes were observed chordwise on the No. 2 blade, which was imbedded in the dirt.

The engine was attached to the engine mounts and firewall, and came to rest in about a 20-degree, right-side-low attitude.

The cabin section was separated just forward of the rear seat location. The front and rear seats were not found in the aircraft cabin section. Parts of the seats were found in the debris field. The left front seat belt was found buckled and its length was consistent with normal use. The inboard attach point was found separated from the floor structure.

The right wing, including the lift strut, was recovered from a pond. A portion of the cabin roof (rear seat area) was attached to the right wing root. The right wing's flap surface was fully retracted. The left wing was located in the back yard of a nearby residence. The left wing had impacted the roof of the residence, coming to rest in the back yard. The left wing fuel tank had evidence of hydraulic deformation "ballooning," which was more pronounced at the root. The left wing root structure had evidence of span-wise compression damage. A leading edge deformation, semicircular five to six inches in diameter, started at the broken upper wing strut attachment and was oriented forward and outward through the leading edge at a 45-degree angle.

An empennage section (baggage area to rear flight surfaces) was removed from the pond about 100 feet south of the right wing location. The bottom side of the empennage section had impact marks, which were oriented approximately 38 degrees from the empennage centerline. The impact marks originated from the right front of the empennage and progressed to the left rear.

MEDICAL AND PATHOLOGICAL INFORMATION

Toxicology samples from the F-16 accident pilot and flight lead were forwarded to the Armed Forces Institute of Pathology, Washington, DC, for analysis. The results were negative for carbon monoxide, major drugs of abuse and prescription and over-the-counter medications.

An autopsy determined that the Cessna pilot was killed by blunt force trauma. The FAA's Forensic Toxicology Research Section in Oklahoma City performed a postmortem toxicology analysis of tissue and fluid specimens from the pilot. The results were negative for major drugs of abuse and prescription and over-the-counter medications.

Traces of ethanol were detected, but the toxicology reported noted that "ethanol found in this case may be potentially be from postmortem ethanol formation and not from the ingestion of ethanol."

FLIGHT RECORDERS

The accident F-16 was equipped with a General Dynamics seat data recorder (SDR). The unit was forwarded to Lockheed-Martin, Fort Worth, Texas, for examination.

The flight lead F-16's SDR was downloaded at Moody AFB. The data were forwarded to Lockheed-Martin for further analysis. However, due to a recoding anomaly with the flight lead F-16's SDR, no useful data was recovered. (For additional information see the NTSB F-16 Recorded Data Study attached to this report.)

The CSMUs (crash survivable memory units) were forwarded to the U. S. Air Force Safety Center in Albuquerque, New Mexico, for readout and evaluation. The data were forwarded to the Safety Board for further analysis. (For additional information see the NTSB F-16 Recorded Data Study attached to this report.)

In addition, the F-16s were equipped with 8mm audio airborne video tape recorders (AVTRs). The tapes were also forwarded to the Air Force Safety Center for analysis. Examination determined that accident airplane's tapes were destroyed by fire.

The tapes from the flight lead F-16 were found to have good quality voice and video. The recorded data of the accident sortie covered about 25 minutes, and began about two minutes before the midair collision.

Lockheed Martin examined the download data from the crash survivable flight data recorder (CSFDR), the SDR, data printouts from the general avionics computer (GAC), the global positioning system (GPS), the inertia navigation system (INS) and the AVTR tapes from the flight lead's airplane. Lockheed Martin's examination report stated that M Aero stated that GPS "was removed from the navigation solution at some time prior to the midair. It cannot be determined from the data why the GPS was removed from the navigation solution." The report added: "A position error of approximately 9-11 nm was entered into the navigation system at some time on the mishap flight prior to the video recording. It can not be determined from the data what caused this position error." (For additional information see the Lockheed Martin Aeronautics Company Report of F-16C 89-2104 Mishap Investigation and the NTSB F-16 Recorded Data Study attached to this report.)

The flight lead stated during an interview conducted by the Air Force Accident Investigation Board that he did not perform an INS update before the accident flight. He stated that navigation along their planned route was conducted in the NAV mode and that they were steering off INS steer points. He added that no INS en route updates were accomplished. The flight lead stated that he not detect any NAV problems on the return flight to Moody Air Force

Base after the accident. He stated that he thought the navigation system was functioning correctly and giving him accurate information. He stated, "I had no suspicion at all that there was a navigation system problem."

TEST AND RESEARCH

Radar data from the FAA's Sarasota-Bradenton ASR7 facility and radar data from the Air Force's 84th Radar Evaluation Squadron (84th RADES) were used to determine the airplane flight paths, speeds and altitudes. (The radar tracks for the three aircraft are shown in the plots included in the recorded radar study.)

The F-16 flight entered the top of the class B airspace about 380 knots airspeed and left the airspace at 6,000 feet about a minute later at 360 knots. Speeds of up to 450 knots were noted during the descent. The airspace between Tampa class B airspace and Sarasota class C airspace is Class E airspace, with a lower floor at 700 feet. About 30 seconds after leaving the Tampa class B airspace, the flight entered the Sarasota class C airspace at 380 knots. The flight remained in the Sarasota class C airspace where the midair collision took place. The flight lead's speed remained above 300 knots until the accident F-16's collision with the Cessna.

OTHER INFORMATION

The Department of Defense's (DoD's) Flight Information Publication General Planning GP, Section E-Supplementary Information, Para 5-35, "Aircraft Speed Below 10,000 Feet Mean Sea Level" states:

"(Exemption to Federal Air Regulations 91.177 issued to DOD, May 18, 1978)-Operations below 10,000 feet Mean Sea Level at Indicated Air Speed in excess of 250 knots, in noncompliance with Federal Air Regulations 91.117 (a), are authorized for military aircraft, including Reserve and Air National Guard components, only under the following conditions:...

"g. If the airspeed required or recommended in the airplane flight manual to maintain safe maneuverability is greater than the maximum speed described in Federal Air regulations 91.117, the airplane may be operated at that speed."

The F-16C/D flight manual, in Section VI, "Flight Characteristics," recommends "a minimum of 300 knots during normal cruise operation below 10,000 MSL." The Air Force Instruction 11-2f-16, F-16 Operations Procedures states in Chapter 5, "Air to Air Weapons Employment," Para 5.3.2, that the "minimum airspeed during low altitude offensive or defensive maneuvering is 350 KIAS."

The DoD's Flight Information Publication Area Planning AP/1B, Military Training Routes, North and South America states (in Chapter 2, "VFR Military Training Routes (VR)," Para I, General) that "VRs are developed by DoD to provide for military operational and training requirements

that cannot be met under terms of FAR 91.117 (Aircraft Speed). Accordingly, the FAA has issued a waiver to DoD to permit operation of an aircraft below 10,000 feet MSL in excess of 250 knots indicated airspeed along DOD developed and published VFR routes." It further states (in Para IV, Flight Plans) that "operations to and from VRs should be conducted on an IFR flight plan. Pilots operating on an IFR flight plan to a VR shall file to the fix/radial/distance (FRD) of their entry/alternate entry point."

The DoD's Flight Information Publication Area Planning AP/1, North and South America notes (in Chapter 3, "Flight Planning 3 f. Class B Airspace") that "generally that airspace from the surface to 10,000' surrounding the nation's busiest airports in terms of IFR operations or passenger enplanements. The configuration of each Class B Airspace area is individually tailored and consists of a surface area and two or more layers and is designed to contain all published instrument procedures once an aircraft enters the airspace. An ATC clearance is required for all aircraft to operate in the area and all aircraft that are so cleared receive separation services within the airspace."

CFR Part 91.113, Right-of-way rules (Paragraph (b), General), states:

"When weather conditions permit, regardless of weather an operation is conducted instrument flight rules or visual flight rules, vigilance shall be maintained by each person operating an aircraft so as to see and avoid other aircraft. When a rule of this section gives another aircraft the right-of-way, the pilot shall give way to that aircraft and may not pass over, under, or ahead of it unless well clear. (f) Overtaking. Each aircraft that is being overtaken has the right-of-way and each pilot of an overtaking aircraft shall alter course to the right to pass well clear. (g) Landing. Aircraft while on final approach to land or while landing, have the right-of-way over other aircraft in flight operating on the surface, except that they shall not take advantage of this rule to force an aircraft off the runway surface which has already landing is attempting to make way for an aircraft on final approach. When two or more aircraft are approaching an airport for the purpose of landing, the aircraft at the lower altitude has the right-of-way, but it shall not take advantage of this rule to cut in front of another which is on final approach to land or to overtake that aircraft."

The FAA's Aeronautical Information Manual, Section 3-2-4, Class C Airspace, states that "two-way radio communication must be established with the ATC facility providing ATC services prior to entry" and that pilots must "thereafter maintain those communications while in Class C airspace." The manual adds that "radio contact should be initiated far enough from the Class C airspace boundary to preclude entering Class C airspace before two-way communications are established."

The wreckage of the accident F-16 was released to the Air Force Safety Investigation Board. The Cessna 172 wreckage was released to the owner's agent.

Pilot Information

Certificate:	Commercial	**Age:**	31,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Front
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 Valid Medical--no waivers/lim.	**Last FAA Medical Exam:**	December 21, 1998
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	September 29, 2000
Flight Time:	1279 hours (Total, all aircraft), 705 hours (Total, this make and model), 1014 hours (Pilot In Command, all aircraft), 93 hours (Last 90 days, all aircraft), 29 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Lockheed-Martin	**Registration:**	USAF
Model/Series:	F-16CG F-16CG	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:		**Serial Number:**	89-2104
Landing Gear Type:	Retractable - Tricycle	**Seats:**	1
Date/Type of Last Inspection:	September 21, 2000 Continuous airworthiness	**Certified Max Gross Wt.:**	42300 lbs
Time Since Last Inspection:	640 Hrs	**Engines:**	1 Turbo fan
Airframe Total Time:	3244 Hrs at time of accident	**Engine Manufacturer:**	GE
ELT:	Not installed	**Engine Model/Series:**	F110-GE-100
Registered Owner:	HQ Air Combat Command	**Rated Power:**	28000 Lbs thrust
Operator:	69TH FIGHTER SQD, 347TH WING	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	SRQ,27 ft msl	**Distance from Accident Site:**	5 Nautical Miles
Observation Time:	15:53 Local	**Direction from Accident Site:**	274°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	11 knots / None	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	210°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29 inches Hg	**Temperature/Dew Point:**	27°C / 18°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	VALDOSTA, GA (VAD)	**Type of Flight Plan Filed:**	VFR/IFR
Destination:	(VAD)	**Type of Clearance:**	VFR
Departure Time:	15:13 Local	**Type of Airspace:**	Class C

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Destroyed
Passenger Injuries:		**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	On-ground
Total Injuries:	1 None	**Latitude, Longitude:**	27.434999,-82.449996

Administrative Information

Investigator In Charge (IIC):	Smith, Carrol A
Additional Participating Persons:	STEPHEN DOBROVIC; Tampa FSDO; Tampa, FL Pablo A Sanchez; Headquaters U.S. A. F. Safety Center; Kirkland A.F. B., NM Joseph A Hutterer; Cessna Aircraft Company; Wichita, KS James G Parham; NATCA; Washington, DC
Original Publish Date:	January 23, 2003
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=50639

Aviation Investigation Final Report

Location:	BRADENTON, Florida	**Accident Number:**	MIA01FA028
Date & Time:	November 16, 2000, 15:48 Local	**Registration:**	N73829
Aircraft:	Cessna 172N	**Aircraft Damage:**	Destroyed
Defining Event:		**Injuries:**	1 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

A formation flight of two F-16s departed Moody Air Force Base in Valdosta, Georgia, on an IFR flight plan leading to the entry point for a low-altitude military training route located near Sarasota, Florida. The flight lead pilot was provided an air traffic control (ATC) frequency change from Miami Center to Tampa Approach. The flight was unable to establish communications with Tampa Approach because an incorrect radio frequency was given to the flight lead by Miami Center. The flight lead reestablished radio contact with Miami Center, cancelled the flight's IFR clearance, and proceeded under visual flight rules (VFR). The controller acknowledged the cancellation, advised the F-16 flight lead pilot of traffic in his vicinity, and asked the flight lead pilot if he wanted VFR flight following (a service that includes VFR radar traffic advisories on a workload-permitting basis.). The flight lead pilot declined. The Miami Center controller then informed Tampa Approach that the flight lead pilot had elected to terminate ATC services, but did not specify that there were two aircraft in the flight. Tampa Approach procedures did not require that the controllers use flight strips (which would have included the number of aircraft in the formation), so the Tampa controllers had no other information indicating that there were multiple aircraft present. Continuing their descent under VFR, the two F-16s assumed the "fighting wing" formation. This placed the accident F-16 on the left side of the lead aircraft and approximately 0.7 miles in trail. The accident F-16's transponder was inactive, as is normal for formation operations, making the aircraft significantly less conspicuous on ATC radar than it would be with an operating transponder. At an unknown point in the flight, the F-16 lead pilot's navigation system developed a position error and was indicating that the aircraft was several miles from its actual position. The pilot failed to recognize the error, and was attempting to visually locate the entry point for the training route based on the erroneous navigation data. Because of the lead pilot's loss of situational awareness, the two F-16s inadvertently descended into the Class C airspace surrounding the Sarasota, Florida airport without establishing required communications with ATC. Meanwhile, a Cessna 172 pilot departed Sarasota under VFR and contacted Tampa Approach. The Cessna pilot was instructed by the developmental controller receiving

instruction to maintain 1,600 feet, turn left to a heading of 320-degrees, and to follow the shoreline. At 15:47:10, he was instructed to climb and maintain 3,500 feet. Miami Center contacted Tampa Approach at 15:47:55, and asked for the altitude of the F-16s. Although the Tampa controller was not in contact with the F-16s, he was able to locate the flight lead on the radar display and informed Miami that the flight lead was at 2,000 feet. A conflict alert between the lead F-16 and the Cessna activated 10 times between 15:47:39 and 15:48:03. The developmental controller stated that he heard an alarm, but could not recall where it was. The controller providing the instruction did not recall if he saw or heard a conflict alert, and no conflict alert was issued. There was no alert generated between the accident F-16 and the Cessna because the conflict alert system requires that both aircraft involved have operating transponders. The developmental controller informed the Cessna pilot at 15:48:09 that he had traffic off his left side, but received no response. The controllers were unaware of the position of the other (accident) F-16 in the formation flight. At 15:48:53, the lead F-16 transmitted, "Mayday, mayday." At 15:49:14, the flight lead pilot followed with, "Mayday, mayday, mayday, F-16 down." Examination of the wreckage of both airplanes determined that the accident F-16's left wing and cockpit area collided with the Cessna 172's right forward side (nose) and cabin area.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: the failure of the F-16 flight lead pilot and F-16 accident pilot to maintain an adequate visual lookout while maneuvering. Factors contributing to the accident were: the F-16 flight lead pilot's decision to discontinue radar traffic advisory service, the F-16 flight lead pilot's failure to identify a position error in his aircraft's navigational system, the F-16 pilots subsequent inadvertent entry into class C airspace without establishing and maintaining required communications with air traffic control (ATC); and ATC's lack of awareness that there was more than one F-16 aircraft in the formation flight, which reduced the ATC controllers ability to detect and resolve the conflict that resulted in the collision.

Findings

Occurrence #1: MIDAIR COLLISION
Phase of Operation: MANEUVERING

Findings
1. (F) FLIGHT/NAV INSTRUMENTS,ELEC FLT INFO SYST (EFIS) - MALFUNCTION

2. (C) COMMUNICATIONS/INFORMATION/ATC - DISCONTINUED - PILOT OF OTHER AIRCRAFT
3. (C) VISUAL LOOKOUT - NOT MAINTAINED - PILOT OF OTHER AIRCRAFT
4. (C) ARTCC SERVICE - NOT ISSUED - ATC PERSONNEL(DEP/APCH)
5. (F) INSTRUCTIONS,WRITTEN/VERBAL - NOT FOLLOWED - FLIGHTCREW

Factual Information

(NARRATIVE SAME AS MIA01FA028A)

Pilot Information

Certificate:	Airline transport; Private	**Age:**	57,U
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Unknown
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Instrument airplane	**Toxicology Performed:**	Yes
Medical Certification:	Class 1 Valid Medical--w/ waivers/lim	**Last FAA Medical Exam:**	September 14, 2000
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	2020 hours (Total, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	**Registration:**	N73829
Model/Series:	172N 172N	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	17267705
Landing Gear Type:	Tricycle	**Seats:**	4
Date/Type of Last Inspection:	November 13, 2000 100 hour	**Certified Max Gross Wt.:**	2300 lbs
Time Since Last Inspection:	7 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	5631 Hrs at time of accident	**Engine Manufacturer:**	Lycoming
ELT:	Installed	**Engine Model/Series:**	O-320-H2AD
Registered Owner:	CRYSTAL AERO GROUP INC	**Rated Power:**	160 Horsepower
Operator:		**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	SRQ,27 ft msl	**Distance from Accident Site:**	5 Nautical Miles
Observation Time:	15:53 Local	**Direction from Accident Site:**	274°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	11 knots / None	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	210°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29 inches Hg	**Temperature/Dew Point:**	27°C / 18°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	SARASOTA, FL (SRQ)	**Type of Flight Plan Filed:**	None
Destination:	ST. PETERSBURG (SPG)	**Type of Clearance:**	None
Departure Time:	15:41 Local	**Type of Airspace:**	Class C

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal	**Latitude, Longitude:**	27.434999,-82.449996

Administrative Information

Investigator In Charge (IIC):	Smith, Carrol A
Additional Participating Persons:	STEPHEN DOBROVIC; Tampa FSDO; Tampa, FL Pablo A Sanchez; Headquaters U.S. A. F. Safety Center; Kirkland A.F. B., NM Joseph A Hutterer; Cessna Aircraft Company; Wichita, KS James G Parham; NATCA; Washington, DC
Original Publish Date:	January 23, 2003
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Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=50639