RAS 5424 72-22-ISFSI — Applicant Exhibit 203 - Rec'd 7/1/02

AFI 51-503 ACCIDENT INVESTIGATION REPORT

AUTHORITY: Under the provisions of Air Force Instruction (AFI) 51-503, the Ninth Air Force Commander, Lieutenant General Hal M. Hornburg, appointed Colonel Jeffrey G. Fee on 1 September 1998 to conduct an aircraft accident investigation of the F-16CJ (SN 91-0397) accident that occurred on 22 July 1998 within the confines of W-177, in the Atlantic Ocean off the coast of South Carolina. The accident resulted in the destruction of F-16CJ aircraft SN 91-0397. No private property damage was caused. The investigation was conducted from 1 September to 15 September 1998. Technical advisors were Major Tony Monson (Medical), Captain Michele R. Zellers (Legal), Chief Master Sargent David Quick (Maintenance).

PURPOSE: An aircraft accident investigation was convened under AFI 51-503. This investigation is separate and apart from the safety investigation conducted under AFI 91-204. The purpose of this investigation is to find and preserve evidence to use in claims, litigation, disciplinary actions, adverse administrative proceedings, and for all other purposes. The report is available for public dissemination under the Freedom of Information Act (5 U. S. C. 552) and AFI 37-131.

SUMMARY OF FACTS

1. History of Flight: On 22 July 1998, Captain James K. Sevick was scheduled to lead Captain Michael F. Hernandez, on a Basic Fighter Maneuvers (BFM) training mission to Warning Area 177. The flight was filed as callsign Vandy 61, piloted by Captain Sevick (the wingman callsign was Vandy 62) and departed Shaw AFB, South Carolina, at 1629 EDT. During the first exercise, a heat-to-guns training maneuver performed from the offensive position, Vandy 61 experienced abnormal engine response. Level flight could not be maintained with available thrust. Captain Sevick was unable to regain normal engine operations and abandoned the aircraft. Ejection was successful. The aircraft impacted the water 23 miles south of Myrtle Beach airfield in 48 feet of water, at approximately 1650 EDT, and was destroyed. Captain Sevick was recovered by a US Coast Guard helicopter and taken to Charleston for medical evaluation. He had no injuries and was released the next day. 20 Fighter Wing Public Affairs office at Shaw AFB answered news media inquiries which were generally limited to local media.

2. Mission: The mission was scheduled and planned in conjunction with a squadron level sortie surge. Captain Sevick was scheduled to fly two missions. The mishap occurred during the first of the two missions he was scheduled to fly during the day. The aircraft had flown three missions prior to the accident mission, twice by the first pilot of the day and once by the second pilot of the day. All three missions were scheduled and flown on air-to-air mission profiles.

3. Briefing and Preflight: Crew rest was adequate (Tabs V-1, V-2). Both pilots purport the briefing to have been adequate and covered all required items using Captain Sevick's personal briefing guide (Tab BB). All proceedings were normal that afternoon, with no problems or questions about the upcoming mission (Tabs V-1, V-2). Aircraft preflight and ground operations were uneventful (Tabs V-1, V-2, V-3, V-4).

NUCLEAR REGULATORY COMMISSION

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In the matter of PFS
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Applicant ✓ RECEIVED ✓
Intervenor _____ REJECTED _____
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Contractor _____ DATE 7/1/02
Other _____ Witness _____
Reporter _____

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4. Flight Activity: Vandy 61, flight of two, departed Shaw AFB via a radar departure enroute to W-177A/B South utilizing standard coordination procedures with the air traffic control agencies (Tab N). There were no communication or navigational difficulties. Vandy 61 flight completed standard checks enroute to include a "fence check" and a "G awareness exercise". Vandy 61 set the formation to complete a "heat-to-guns exercise". A heat-to-guns exercise is generally thought of as a warm-up exercise. The exercise uses limited "G" constraints and is designed to exercise the judgement and switchology dexterity of pilots under relatively benign conditions before entering unrestricted air-to-air maneuvering. The exercise began from a line-abreast formation of about 6000 feet. The exercise consisted of the flight completing a 60 degree turn into Vandy 62 at which time Vandy 61 executed a simulated Aim-9 attack on Vandy 62. Vandy 62 then reversed his turn and applied enough turn rate to put Vandy 61 at his beam position. Vandy 61made a simulated high angle gun attack on Vandy 62 from this position. When the gun attack was completed, Vandy 61 rolled wings level to cross to the opposite side of Vandy 62. Vandy 61's roll to wings level was the prebriefed signal to Vandy 62 to roll wings level also. Vandy 61 then commenced another simulated high angle gun attack on Vandy 62. This maneuver was the prebriefed signal for Vandy 62 to apply enough of a turn rate into Vandy 61 to place him back on the beam position. At the completion of the gun attack Vandy 61 again rolled wings level, signaling Vandy 62 to do the same and crossed to the original side and aft of Vandy 62. At this point (approximately 1646 EDT) Vandy 61 recognized an abnormal engine response from his aircraft (Tabs O, V-1, V-2).

Pilot testimony coupled with the Crash Survivable Flight Data Recorder (CSFRD) data indicate the following actions were taken after Captain Sevick recognized the abnormal engine response. The engine response was characterized by low thrust compared to indicated engine RPM, other engine instrumentation, and throttle setting. After approximately 20 seconds of analysis, Captain Sevick momentarily placed the throttle at idle because he thought he may have had a compressor stall cause by flying through mild wake turbulence caused by Vandy 62's aircraft. He then selected afterburner for approximately one minute in an attempt to regain useable thrust while he made a turn towards Myrtle Beach airport. Because he had not regained thrust sufficient to support level flight, he jettisoned the centerline fuel tank then put the throttle in idle and began airstart procedures. He put the throttle in the cutoff position then back to midrange, selected the secondary engine control (SEC) operation and started the jet fuel starter (JFS), all within 10 seconds in an attempt to regain useable thrust. He repeated the airstart procedure two more times at approximately one minute increments and attempted use of the afterburner when the engine indicated it was running. These attempts would only recover the engine to approximately 80 percent rpm and did not produce thrust capable of sustaining level flight. Although Captain Sevick allowed the airspeed to decay below optimum airstart airspeed immediately following his loss of thrust, during his turn towards Myrtle Beach airport, he ultimately maintained both airspeed and headings consistent with his attempts at engine airstarts and recovery. As the aircraft passed through approximately 3000 feet, Captain Sevick zoomed the aircraft to reduce airspeed consistent with ejection procedures and, at approximately 1650 EDT, ejected (Tabs J, O, V-1, V-2).

5. Impact: The aircraft impacted the water (N33-18.713, W078-54.238) at approximately 1650 EDT, 22 July 1998 within the confines of W-177A (V-2). No collateral damage was observed.

Approximate aircraft parameters were: heading northerly (Tabs V-1, V-2), 220 knots calibrated airspeed (accelerating) (Tab O). The aircraft was destroyed upon impact with the water (Tab S).

6. Egress System: The pilot initiated a controlled ejection at 3000 feet and 165 knots calibrated airspeed (Tab O), within the performance envelope of the egress system. Although the ejection seat was not recovered, pilot testimony (Tab V-1) and aircraft wreckage analysis (Tab J) indicate the ejection seat performed normally.

7. Personal and Survival Equipment: Inspections were current on personal and survival equipment. Captain Sevick performed all the required steps for a parachute water entry and all equipment performed nominally with the following exceptions (Tab V-1):

a. Captain Sevick attempted to examine his parachute immediately after opening shock. He could not accomplish this because his head was being held forward by twisted risers. He pulled them apart forcing them to untwist. Additionally, the left side pull-down lanyard of the four-line jettison parachute modification could not be reached inside the tacking and the modification was not used (Tab V-1).

b. When Captain Sevick entered the life raft, he found the raft floor awash in sea water already tinted by green sea dye. The dye prevented him from easily finding and turning off the seat kit beacon he had placed on the floor of the raft. The beacon remained on during the rescue. The rescue was coordinated on the secondary frequency 282.8 (Tab V-1).

c. Captain Sevick was concerned with being entangled by the numbers of lanyards involved with the survival equipment (Tab V-1).

d. The USCG Rescue Swimmer pointed out a "pinprick" air leak in the life raft during his inspection in the water prior to sinking the raft. Captain Sevick noted he would have easily been capable of maintaining buoyancy using the oral inflation tube(Tab V-1).

8. Rescue: Rescue efforts were initiated immediately upon Captain Sevick's ejection (1650 EDT) by Vandy 62. The following actions were taken (Tab V-2):

a. Vandy 62 provided crash site coordinates to Mad Cat 61, another Shaw AFB F-16. Mad Cat 61, followed by Bullet 11 flight, another flight of F-16s from Shaw AFB, acted as a radio relay, providing subsequent search and rescue information and requirements to and from the Shaw AFB Supervisor of Flying (SOF). Vandy 62 lost visual contact with Captain Sevick when his parachute collapsed into the water due to low sun angles. Vandy 62 made radio contact with Captain Sevick and ascertained he was in his raft and was not injured. Through the use of the radio, Vandy 62 then regained visual contact with the life raft and passed updated coordinates for the raft's position (Tabs N, V-2).

b. Coast Guard Air Station Savannah, GA, was notified of the downed pilot at 1657 EDT by Jacksonville Center and at 1716 EDT dispatched a USCG HH-65A helicopter, callsign CG 6570 to the crash site. At 1725 EDT, CG 6570 was updated on the pilot's position in the raft while enroute to the site. At 1746 EDT, CG 6570 arrived on scene and deployed the rescue swimmer.

By 1751 EDT the pilot and rescue swimmer were brought on board the helicopter utilizing a basket and hoist. The rescue swimmer deflated the raft prior to returning on board the aircraft to prevent the empty raft from being blown up into the helicopter blades or causing confusion if it were later found empty. At 1802 EDT, CG 6570 delivered Captain Sevick to the Medical University of South Carolina at Charleston, SC (Tabs V-1, AA).

c. Vandy 62 remained on-scene until the accident pilot was retrieved from the water by CG 6570 then returned to home station (Tab V-2).

9. Crash Response:

a. The Shaw AFB tower informed the Command Post of the mishap at 1653 EDT. The Quick Reaction Checklist response was completed (Tab CC).

b. United States Coast Guard (USCG) Station Georgetown, SC was notified by Myrtle Beach Airport of the downed pilot at approximately 1700 EDT and dispatched a 41 foot patrol boat to the crash site. The patrol boat was advised of the rescue while enroute but was directed to survey the crash site. At 1815 EDT, the patrol boat arrived on scene but could find no sign of wreckage or debris and subsequently returned to home station (Tab AA). The only difficulty experienced during crash response was visually sighting the raft due to the low sun angle by Vandy 62 (Tab V-2). Additionally, when in the vicinity of the crash site, CG 6570 requested Captain Sevick ignite an orange smoke flare. Captain Sevick was immediately found visually after igniting the flare (Tab V-1).

10. Maintenance Documentation: A review of Air Force Technical Order (AFTO) Forms 781 and records did not reveal any evidence of maintenance discrepancies. A review of open Time Compliance Technical Orders (TCTO) did not reveal any evidence relating to the accident (Tab H). A review of the SOAP oil analysis records showed they had been accomplished and were within technical data limits (Tab D). A review of scheduled and unscheduled maintenance and inspections indicated no actions related to the accident. A review of equipment history reports did not reveal any over due maintenance actions (Tab H). No discrepancies were noted in maintenance procedures, practices, or performance.

11. Maintenance Personnel and Supervision: A review of all active forms to include the exact maintenance, preflight and servicing performed on the aircraft did not reveal any discrepancies related to the cause of the accident. A review of the Core Automated Maintenance System (CAMS) did not reveal any evidence of maintenance discrepancies. A review of both crew chief's and their supervisors AF Forms 623 (On The Job training Records) and AF Form 797 (Job Continuation/ Command JQS) indicate that they were properly trained and had the level of experience to perform their duties. The level of supervision was appropriate for the assigned mission. Maintenance personnel and supervision do not appear to be related to the accident.

12. Engine, Fuel, Hydraulic, and Oil Inspection Analysis:

a. The fuel sample taken from the fuel truck used to service the aircraft prior to flight was normal. The hydraulic and oil samples recovered from aircraft servicing equipment also met

specification requirements. The fuel, hydraulic and oil inspection analysis indicate fluids do not appear to be a factor in this accident (Tab J).

b. The engine had performed flawlessly on three previous flights with the accident occurring on the fourth flight of the day (Tab H) . A review of maintenance records showed that the engine's last visit to the jet engine intermediate (JEIM) shop was in July 1997 for RPM surges. While in shop, the DEC and alternator were replaced. The last significant maintenance was the replacement of the fuel oil cooler and the right side VSV actuator in June of 1998 at 2485.3 hours of operation (Tab J). All fluid samples were within limits prior to the accident.

c. An investigation performed on the engine after it was recovered showed the left Variable Stator Vane (VSV) torque tube spherical bearing protruding beyond its outer bearing race (Tabs V-5, V-6). Examination of the torque tube indicated abnormal wear on both the torque tube spherical bearing and its outer bearing race (Tabs J, FF). This wear had allowed the torque tube bearing to extrude past the bearing race, outward from its proper position. This movement would decouple the torque tube drive splines from mates on the VSV bellcrank support assembly and cause the VSV actuator to lose control over the VSVs. Microscopic examination also indicated circumfrential wear inboard of the bearing on the torque tube (Tabs J, FF). This indicates the torque tube was outboard of its proper position and was being actuated by the torque actuator prior to aircraft impact. Loss of control of the VSVs by the VSV actuator would cause abnormal engine operations and a low thrust condition consistent with that experienced by the pilot and recorded by the CSFDR (Tabs V-1, V-5).

13. Airframe and Aircraft Systems: Analysis of the airframe, cockpit, flight controls, hydraulic, environmental control systems, jet fuel starter (JFS), and emergency power unit (EPU) indicate these items were working properly at impact. The main fuel shutoff valve was found in the open position. The fuel system's Fuel Flow Proportioner (FFP) was missing an "O-ring" on one of the two bypass check valves. There was no evidence the "O-ring" had ever been installed. Absence of the "O-ring" would not have caused a fuel interruption to the engine. A Product Quality Deficiency Report (PQDR) was submitted on this item (Tab I). The fuel system was providing sufficient fuel to the engine (Tab J).

14. Operations Personnel and Supervision:

a. Captain Sevick briefed the mission using his own briefing guide that had been extracted from MCI 11-F16 Vol 3, Pilot Operational Procedures. Both pilots contend the briefing was thorough and complete (V-1, V-2). A review of this briefing guide found significant worthwhile additions and techniques, however, upon comparison to the MCI, it disclosed some minor omissions that did not affect the accident (Tab BB). The flight briefing was not attended by supervisory personnel.

b. Captain Sevick was current on the latest Flight Crew Information File (FCIF), the monthly Situational Emergency Procedure Training (SEPT), and the weekly Critical Actions Procedure and Operations Limits test (Tab T).

c. The mission was properly authorized by Major Michael D. Keaton, the 78th Fighter Squadron Assistant Deputy for Operations (ADO), in accordance with AFI 11-401 as supplemented and as authorized by letter. Captains Sevick and Hernandez received a comprehensive "Step Briefing" on airfield, weather, sea, bird, and other conditions at the duty desk by A1C Keith D. W. Morford as they stepped to fly.

d. A review of Captain Sevick's Training Folder indicates supervisors within the 78th Fighter Squadron and the 20th Operations Group were highly involved with flying and supervisory upgrade training progression.

15. Crew Qualifications: Captain Sevick's Flight Evaluation Folder, Training Folder, Flight Records and AFORMS retrieval indicate he was current and qualified to perform the mission. He was an F-16CJ Four-Ship Flight Lead with 937 total flying hours, 867 hours in the F-16 (Tab G).

30/60/90 Day Flying Summary (Tab G):

30 Day 18.8 hours/14 sorties
60 Day 42.7 hours/31 sorties
90 Day 70.6 hours/50 sorties

Captain Sevick was current in all flying training events. Although his last BFM sortie was flown on 17 April 1998, his last Air Combat Training (ACBT) event currency was updated during a Red Air sortie on 17 July 1998 (Tab T). Captain Sevick's training record indicates average progression during his initial Mission Qualification, Two-Ship Flight Lead, and Four-Ship Flight Lead upgrade training programs. He had just completed Supervisor of Flying upgrade and had been approved for upgrade to Instructor Pilot.

16. Medical:

a. Captain Sevick was medically qualified for flight duty. His last physical examination was performed on 27 February 1998. No medical defects or diseases were noted. No chronic illnesses, medications, or medical waivers were present. No recent or chronic dental problems were noted in his dental records. A review of toxicology reports conducted after the accident revealed no indication of unauthorized drug use (Tab DD). Post accident medical records indicate no results which would relate to the mishap.

b. Although the pilot ejected, remained in the water for approximately one hour, was medevaced to a civilian hospital emergency room, examined by a civilian doctor and monitored for exposure, provided blood samples for toxicology testing, and was thoroughly examined by x-ray because of his ejection, an AF Form 1042 was not accomplished (Tab V-1). Although the AF Form 1042 contains a block labeled "Medically cleared for flying duty following:" and a choice labeled as "aircraft mishap", per the medical advisor, existing guidance does not require a an AF Form 1042 recommending returning Captain Sevick to flying duty.

17. Navaids and Facilities: NOTAMS are now disseminated via the worldwide web and are only retained for 15 days. The 78th Fighter Squadron provides each flight of aircraft a folder with a printout of the NOTAMS. Records from airfield management and pilot testimony indicates there were no NOTAMS of interest and the airfield was fully functional the day of the accident (Tabs V-1, V-2).

18. Weather: Forecast for Shaw AFB during this timeframe was 4,000 feet scattered, 25,000 feet scattered, 7 miles visibility. The local weather observation indicates the forecast was valid. Local temperatures were exceeding 95 degrees Fahrenheit. Visibility in W-177 was forecast to be restricted to 6 miles due to haze (Tab K). Pilot observations indicate the actual weather at Shaw AFB and within W-177 was clear with no restrictions to visibility (Tabs V-1, V-2). Weather was not a factor to the accident.

19. Governing Directives and Publications:

AFI 11-2F-16, Volume 1	F-16—Aircrew Training
AFI 11-202, Volume 3	General Flight Rules
AFI 11-401	Flight Management
MCI 11-F-16, Volume 3	Pilot Operational Procedures—F-16
T.O. 1F-16CJ-1	F-16C/D Flight Manual
T.O. 1F-16CJ-1CL-1	F-16C/D Flight Crew Checklist

Based on CSFDR data, Captain Sevick deviated from T.O. 1F-16CJ-1 and T.O. 1F-16CJ-1CL-1. The "low thrust" situation the pilot encountered is most closely described in these tech orders as either Abnormal Engine Response or as a Non-Afterburner (AB) Engine Stall.

The tech order description of and procedures for Abnormal Engine Response most closely associated with this incident reads as follows: "Abnormal engine response is varied and generally indicated by abnormal thrust in relation to throttle position, ..., or insufficient thrust. A PRI" (primary engine control operation) "malfunction can cause these abnormal engine responses ... Insufficient thrust may result if the nozzle is more open than normal. SEC should be selected and, if the nozzle goes fully closed, engine operation should be continued in SEC." CSFDR data indicates the nozzle was responding abnormally in PRI and then responded normally when the pilot selected SEC as part of his airstart procedure. The tech order goes on to say: "If thrust is still insufficient to make a safe landing after selecting SEC or abnormal engine response is still present, reattempt PRI."

The tech order description of and procedures for Non-AB Engine Stalls most closely associated with this incident reads as follows: "Non-AB engine stalls may occur if the control system is malfunctioning, ... are a symptom of a severe engine problem. Non-AB engine stalls may be inaudible; the first indication may be a lack of engine response to throttle movement which may be difficult to differentiate from abnormal engine response. ... FTIT fluctuation and decreasing rpm will probably accompany stalls. If a stall is confirmed, the throttle should be immediately retarded to IDLE. ... If the stall continues, place ENG CONT switch to SEC. ... If the stall continues, initiate airstart. ... If the stall continues after the airstart, the engine may have a serious hardware problem. The focus should shift to using available thrust to land at the nearest

divert field." The tech order goes on to say: "For serious hardware problems, the engine may operate normally at idle rpm but exhibit stall/vibration conditions at thrust settings above idle rpm. Attempting additional airstarts will not clear the condition. Use the highest thrust setting below the stall/vibration condition to sustain flight."

These procedures indicate Captain Sevick's should have attempted SEC prior to his airstart attempts, then should have reattempted PRI when/if he found abnormal engine response still present in SEC, and should have made only one airstart attempt when it was successful regardless of thrust available. Additionally, he should have known that afterburner was unavailable when the engine is operating in SEC, however, afterburner could have been reattempted if PRI had been selected. Captain Sevick's placement of the throttle in afterburner, even in SEC, however, would be a natural pilot response to investigate if a throttle assembly had "slipped" or become mis-rigged, in an attempt to get a higher thrust setting.

The low thrust situation was caused by the mechanical failure of the VSV torque tube bearing. No action taken by the pilot would regain control of the VSVs. Therefore, there is no reason to believe that, if the pilot had taken any or all of these actions, he would have retained sufficient thrust to fly the additional 23 miles to Myrtle Beach and positioned himself to execute a successful landing.

STATEMENT OF OPINION

Under 10 U. S. C. 2254(d), any opinion of the accident investigators as to the cause or causes of, or the factors contributing to, the accident set forth in the accident investigation report may not be considered as evidence in any civil or criminal proceeding arising from an aircraft accident, nor may such information be considered an admission of liability by the United States or by any person referred to in those conclusions or statements.

Based upon evidence which I found to be clear and convincing, it is my opinion as investigating officer that the cause of the accident was the failure of a critical bearing in a linkage that controls the air flow into the engine. Abnormal wear between the left Variable Stator Vane (VSV) torque tube spherical bearing and its outer bearing race allowed the torque tube bearing to extrude past the bearing race, outward from its proper position. This decoupled the torque tube drive splines from mates on the VSV bellcrank support assembly which, in turn, control the angle of the VSVs. This caused the VSV actuator to lose control over the VSVs. Since the VSVs control the flow of air into the engine, this led to abnormal engine operations and a low thrust condition, incapable of supporting flight to an airfield suitable for landing. The pilot ejected and the aircraft was destroyed.

JEFFREY G. FEE, Colonel, USAF
AFI 51-503 Board President