Aviation Investigation Final Report

Location:	SMYRNA, Tennessee	**Accident Number:**	MIA00FA177
Date & Time:	May 30, 2000, 15:15 Local	**Registration:**	N6645P
Aircraft:	Beech C23	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General aviation		

Analysis

Two days before the accident, the CFI and pilot-rated left seat occupant were unable to keep the engine running after starting before a flight; the fuel selector valve was found in the "off" position. The airplane was flown between then and the accident date 1.5 hours with no maintenance or discrepancies noted. The pilot-rated occupant was notified of the fuel selector finding before the accident flight and offered to be checked out; he refused. The engine quit after starting on the accident date but was restarted. A witness saw confusion on the left seat occupants face while looking at the engine gauges following the engine quitting. He also saw him moving the fuel selector handle. During climbout following a touch-and-go landing, witnesses heard the engine sputtering and observed the airplane roll to the left and pitch nose down. Browning of grass forward of each wing fuel tank was noted; 4 gallons of fuel drained from the right fuel tank. Examination of the engine and flight controls revealed no evidence of preimpact failure or malfunction. Approximately 2 ounces of fuel were found in the carburetor bowl; the flexible hose from the engine driven fuel pump to the carburetor was dry. The fuel selector valve was found not in a detent but near one of the "off" positions. The arrow on the fuel selector handle which points to the tank selected was found to be painted red contrary to the engineering drawing. Fuel selector handles from airplanes flown by the pilot-rated left seat occupant consisted of the longer end pointing to the tank selected. The pilot-rated left seat occupant and CFI had no recorded flight experience in the airplane. Impact signatures on the co-pilot's control column correlate to a right roll and aft elevator input.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The failure of the dual student to maintain airspeed following total loss of engine power resulting in an inadvertent stall and subsequent uncontrolled descent. Also, inadequate

supervision by the CFI for her failure to note the position of the fuel selector valve and her failure to maintain control of the airplane. Factors in the accident were the flight crews lack of experience in the accident airplane, improper painting of the arrow on the fuel selector handle by an unknown person, and the improper placement of the fuel selector handle to the off position by an unknown pilot resulting in fuel starvation.

Findings

Occurrence #1: LOSS OF ENGINE POWER(TOTAL) - NONMECHANICAL
Phase of Operation: TAKEOFF - INITIAL CLIMB

Findings
1. (F) FUEL SYSTEM,SELECTOR/VALVE - UNMARKED
2. (F) FUEL TANK SELECTOR POSITION - IMPROPER - UNKNOWN
3. (F) LACK OF FAMILIARITY WITH AIRCRAFT - FLIGHTCREW
4. (C) SUPERVISION - INADEQUATE - PILOT IN COMMAND(CFI)
5. FLUID,FUEL - EXHAUSTION

Occurrence #2: LOSS OF CONTROL - IN FLIGHT
Phase of Operation: MANEUVERING

Findings
6. (C) AIRSPEED(VS) - NOT MAINTAINED - DUAL STUDENT
7. STALL - INADVERTENT - DUAL STUDENT
8. (C) SUPERVISION - INADEQUATE - PILOT IN COMMAND(CFI)

Occurrence #3: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: DESCENT - UNCONTROLLED

Findings
9. TERRAIN CONDITION - GROUND

Factual Information

HISTORY OF FLIGHT

On May 30, 2000, about 1515 central daylight time, a Beech C23, N6645P, registered to Tomco of Deleware, Inc., experienced an in-flight loss of control and crashed during the takeoff following a touch-and-go landing at the Smyrna Airport, Smyrna, Tennessee. Visual meteorological conditions prevailed at the time and no flight plan was filed for the 14 CFR Part 91 familiarization flight. The airplane was substantially damaged and the certified flight instructor (CFI) and private-rated pilot were fatally injured. The flight originated about 1437 from the Nashville International Airport, Nashville, Tennessee.

The flight was cleared for takeoff at 1437:05, and frequency change to the Smyrna Air Traffic Control Tower (MQY ATCT) occurred at 1440:16. According to a transcription of communications with the MQY ATCT, the flight was cleared for four touch-and-go landings, a stop-and-go landing, and at 1511:29, the MQY ATCT controller advised the flight that they were No. 2 to land behind a Beech King Air that was on final approach. A flightcrew member responded that the traffic was in sight. The controller advised the flight that an airplane would be departing prior to their arrival and to widen the base leg. A flightcrew member advised that they would extend the downwind leg to which the controller responded at 1512:48, "sundowner four five papa you start your base leg now runway one niner cleared for a touch and go." A flightcrew member advised turning base and repeated the clearance for the touch-and-go landing. There was no further recorded communication from a flightcrew member of the airplane.

The airplane was observed by tower controllers following a touch-and-go landing on runway 19, to be in a left bank and nose-down attitude. Both controllers stated the airplane disappeared behind trees. Copies of the controller statements are an attachment to this report.

A witness near the accident site reported hearing the engine sputtering; another witness reported that there was no engine sound during the descent. The airplane was observed by several witnesses to be in a nose-low attitude at the time of impact. Copies of the witness statements are an attachment to this report.

PERSONNEL INFORMATION

The right seat occupant was the holder of a commercial pilot certificate with ratings airplane single engine land and sea, multiengine land, instrument airplane. She held ratings airplane single engine, and instrument airplane on her CFI certificate; the date of issue was January 10, 2000. She was issued a second-class medical certificate on May 8, 2000, with the

limitation to wear corrective lenses. Excluding the flight earlier that day in a single engine airplane and the accident flight, she logged a total of approximately 1,528 hours total time. Her total single engine time was 1,439 hours, and her total pilot-in-command time was 1,418 hours. She had not logged flight time in any model Beechcraft 19, 23, or 24 series airplanes. Excerpts from her pilot logbook is an attachment to this report.

The left seat occupant was the holder of a private pilot certificate with a single engine land rating that was issued on November 9, 1999. He was issued a third-class medical certificate on August 18, 1999, with the limitation to possess corrective glasses for near vision. He had logged a total time of approximately 118 hours, of which 107 hours were in single engine airplanes. He had not logged any time in the accident make and model airplane before the accident flight. He had flown a Cessna 172 for 1.5 hours with the accident CFI earlier that day. A copy of his pilot logbook is an attachment to this report.

AIRCRAFT INFORMATION

The airplane was inspected last in accordance with Beech inspection checklist form 130234E from the service manual, and was signed off as being inspected in accordance with an annual inspection on February 11, 2000. The entry for the inspection was in the front of the aircraft logbook when first examined by FAA inspectors. FAA personnel placed the entry on a page in the logbook postaccident. There was no entry in the maintenance records indicating repair or replacement of the fuel selector valve or handle. The carpeting was replaced on September 14, 1999, this required in part removal of the fuel selector handle; no work was reportedly done to the fuel selector handle during this time. The airplane and engine had accumulated a total time of approximately 1,755 hours. Excerpts from the maintenance records are an attachment to this report.

METEOROLOGICAL INFORMATION

A special weather observation taken at 1516 hours local at the accident airport indicated the wind was from 210 degrees at 6 knots. The visibility was recorded to be 10 statute miles, few clouds existed at 4,500 feet, broken clouds existed at 20,000 feet, the temperature and dew point were 81 and 59 degrees Fahrenheit, respectively. The altimeter setting was 30.04 inHg.

COMMUNICATIONS

The airplane was in contact with the Smyrna Air Traffic Control Tower. A transcription of communications is an attachment to this report.

AIRPORT INFORMATION

The Smyrna Airport has in part runway 01/19, which is 5,546 feet long and 100 feet wide. A right traffic pattern is specified for runway 19.

WRECKAGE AND IMPACT INFORMATION

The airplane crashed onto property owned by the Smyrna Municipal Golf Course; the crash site was located at 35 degrees 59.882 minutes North latitude and 086 degrees 31.126 minutes West longitude. That location when plotted was approximately 1,086 feet and 151 degrees from the departure end of runway 19. Examination of the accident site revealed an indentation associated from the nose landing gear oriented on a magnetic heading of 056 degrees. A ground scar from both wings was oriented on a magnetic heading of 340 degrees. The airplane came to rest approximately 43 feet from a ground scar associated with the left wingtip.

The airplane was upright on a magnetic heading of approximately 273 degrees. All components necessary to sustain flight were in the immediate vicinity of the crash site. Crushing of the left side of the fuselage was greater than the right side of the fuselage between fuselage stations 181 and 210. The lower left portion of the firewall was crushed aft approximately 11 inches. The flaps were retracted. The front and rear spars of the left wing were fractured near the main landing gear location; the wing was rotated aft 180 degrees. The left aileron cable was fractured near the wing spar fracture location; no evidence of preimpact failure or malfunction was noted. The aileron balance cable remained secured to the left and right aileron bellcranks. The left wing fuel tank was ruptured; browning of grass was noted forward of the left wing (See photograph 1). No fuel leakage was noted aft of the left fuel filler cap which was in place or aft of the left fuel tank sump drain valve. The left wing tip was displaced up and aft. The forward attach of the right wing was fractured; fuel leakage and associated browning of grass was noted forward of the leading edge of the right wing from a broken line at the wing root (See photograph 3). Approximately 4 gallons of fuel were drained from the right wing fuel tank. No fuel leakage was noted aft of the right fuel filler cap which was in place or aft of the right fuel tank sump drain valve. The right wing tip was displaced aft. Stabilator and rudder flight control cable continuity was confirmed. Both fuel tank vents were clear. Examination of the fuel selector valve revealed it was rotated aft nearly 90 degrees; the end of the longer end of the handle was just visible through the fuel selector guard opening (See photograph 4). The valve was not in but near a detent; the shorter end of the handle was pointed aft. No obstructions were noted in the fuel lines. The fuel strainer which was upright, was empty; the fuel line from the outlet of the strainer to the tee of the auxiliary fuel pump was fractured near the tee. The fuel selector valve with handle and associated floor board with the attached fuel selector guard were retained for further examination (See Tests and Research section of this report).

Impact signatures were noted on the inboard edge of both ailerons and on the outboard edge of both flaps. Positioning of the left aileron matching the impact signature of it and the retracted flap indicate that the aileron was in a trailing edge down position (See photograph 5). Positioning of the right aileron matching the impact signature of it and the retracted flap indicate that the aileron was in a trailing edge up position (See photograph 6). Examination of the pilot's and copilot's control tube revealed an impact signature associated with a near full

aft elevator control input. The co-pilot's control column was separated from the control tube. Mating of the separated control column with the fractured control tube revealed evidence of a right roll input (See photograph 7). The engine was removed from the airplane for further examination.

Examination of the engine revealed crankshaft, camshaft, and valve train continuity. Thumb compression and suction was noted from each cylinder. Magneto to engine timing was not confirmed. Each magneto was rotated by hand; spark was noted from all towers. Impact damage was noted to the ignition leads. No discrepancies were noted to the engine-driven fuel pump; approximately 1 tablespoon of fuel was found in the pump. No fuel was found in the flexible hose between the engine-driven fuel pump and the carburetor. The carburetor was broken at the mount flange; approximately 2 ounces of fuel were drained from the carburetor bowl; no contaminants were noted.

MEDICAL AND PATHOLOGICAL INFORMATION

Postmortem examinations of the CFI and pilot-rated left seat occupant were performed by Charles W. Harlan, M.D., of Forensic Pathology Associates, P.C., Nashville, Tennessee. The cause of death of the CFI was listed as multiple injuries. The cause of death of the left seat occupant was listed as exsanguinations, secondary to multiple injuries.

Toxicological testing of specimens of the CFI and pilot-rated left seat occupant was performed by the FAA Toxicology and Accident Research Laboratory (CAMI). The results of analysis of specimens of the CFI was negative for carbon monoxide, cyanide, ethanol, and tested drugs. The result of analysis of specimens of the left seat occupant was negative for carbon monoxide, cyanide, and volatiles. Chlorpheniramine (0.13 ug/g) was detected in the blood and also in the urine. Acetaminophen (4.342 ug/g) was detected in the urine.

TEST AND RESEARCH

The fuel selector valve has four detents, one each for the left and right positions, and two off positions. A one-piece handle attached to the fuel selector valve has in part one end that resembles a blunt point; the upper surface of the point has a raised surface called an "arrow" that also resembles a blunt point. The side of the handle with the raised arrow points to the desired fuel tank to supply fuel to the engine, or to one of the two "off" positions. The arrow and handle by design are painted with white epoxy and red epoxy paint, respectively. A fuel selector guard made of plastic surrounds the fuel selector valve; a safety feature consisting of a stainless steel spring ("fuel selector stop") was installed on the guard to prevent inadvertent movement of the fuel selector to the "off" detent position.

Examination of the fuel selector guard assembly revealed an impact signature on the top of the guard to the left of the line for the left tank position indicator (See photograph 8). The distance from the edge of the cutout in the guard to the impact signature on top of the guard closely matched the length of the long end of the fuel selector handle from the shaft to

the end of the handle. Additionally, the width of the impact signature on top of the guard closely matched the width of the bottom end of the long end of the fuel selector handle. A semi-circular impression at the edge of the cutout of the guard and nearly in line with the impression on the top of the guard was noted; the diameter closely matched the diameter of the shaft of the fuel selector valve. Matching of the impact signatures on the guard with the fuel selector valve assembly placed the fuel selector handle/valve assembly being near one of the "off" detents (See photographs 10). Impact damage was also noted to the fuel selector stop assembly, to the fuel selector guard, and to the floor board.

Visual examination of the accident fuel selector valve handle revealed two different shades of red paint on areas of the handle where the outer layer of paint was chipped (See photograph 11). The base metal is exposed near the tip of the arrow; red paint with chips in the paint covers the majority of the remainder of the arrow (See photographs 12 and 13). Examination of the fuel selector handle by the Miami-Dade Police Department Crime Laboratory Bureau was performed to determine in part layers of paint on the arrow. The examination determined that the arrow of the handle has red/white/red layers of paint. A copy of the engineering drawing of the handle and the report from the Miami-Dade Police Department are attachments to this report.

Postaccident bench testing of the fuel selector valve revealed it failed due to excessive leakage from the "out" port when tested in both "off" positions at approximately 2 and 5 psi. All detents could be felt. The valve was placed in the same make and model airplane as the accident airplane and failed to secure fuel to the engine. A copy of the report from the airplane manufacturer representative who witnessed the engine run test is an attachment to this report. Trouble shooting of the fuel selector valve determined that the leakage was due to the O-rings; replacement of the O-rings resulted in no fuel leakage when tested for a 1-minute period.

According to the owner of the airplane, the day before the accident date, he and his son went to the airport to fly the accident airplane. While preflighting, he found a note in the cockpit from Scott Mercy that said they were unable to fly the airplane the day before because they were unable to start the engine. The note also indicated that he surmised there was a fuel pump problem because after priming, the engine would start but would only run for 8-10 seconds before stopping. After the exterior preflight was complete he and his son entered the cockpit and found the fuel selector valve in the "off" position. The fuel selector was placed to supply fuel from one of the fuel tanks and the engine was started normally with no discrepancies noted. The flight lasted approximately 1.5 hours; the fuel selector was positioned to the right tank for approximately 1.1 hours and the remainder of the flight to the left tank. No maintenance checks were performed due to finding the note. The owner also reported that the following day (accident date) he called Scott Mercy and advised him of his finding relating to the fuel selector valve. He offered to "fly with him to see that he was properly checked out"; the offer was declined. His statement is an attachment to this report.

According to the left seat occupant's wife, the purpose of the flight was for her husband to be checked out in the make and model airplane. She stated that her husband complained to

her about a problem with the accident airplane when they planned to fly it the day before the accident. She also said that her husband advised her that there was nothing wrong with the airplane, they had failed to put a "switch" or something in the correct position. A written statement was requested from her, she failed to provide a written statement. A record of conversation form is an attachment to this report.

A witness who is an airframe and powerplant mechanic, reported that on the day of the accident before the flight departed, the accident airplane engine was started then quit a short time later. He had an unobstructed view of the cockpit of the accident airplane and reported seeing confusion on the left seat occupants face. He saw him glancing/looking at the instrument panel and engine controls with a confused expression. He also saw him cycling the fuel selector two or three times and could only recall him looking down one time while doing so. The person in the left seat primed then started the engine; the airplane then taxied away out of his sight and he did not witness the takeoff. A copy of his written statement and NTSB Record of Conversation form are an attachment to this report.

Review of the left seat occupants pilot logbook revealed that he logged a total of 70 flights, excluding the accident flight. Sixty-four of the 70 logged flights were flown in either Cessna 150, Piper PA-28-140, or Cessna 172 type airplanes. Review of the CFI's pilot logbook revealed that for approximately 1 month before the accident, she logged a total of 59 flights; of which 52 flights were in either Cessna 150 or Cessna 172 type airplanes.

The fuel selector for a Cessna 150 airplane has two positions; "on" and "off." The fuel selector handle for a PA-28-140 airplane has a pointed end that measures approximately 2 inches in length with the opposite end measuring approximately 1.25 inches in length and is rounded. The longer end of the handle has a recessed area on the top surface from the attaching screw to near the point which is painted white; this end points to the tank selected. The fuel selector handle for Cessna 172 airplanes has one end that has tapered sides ending with a blunted point (the length is 1.86 inches from the center of the cutout for the shaft to end of the point); this end points to the tank selected. The opposite end of the handle measures .900 inch, and also has tapered sides. Illustrations of the fuel selector valve handles for the Cessna 150 and 172, and the Piper PA-28-140 airplane are an attachment to this report.

The airplane was fueled last on May 5, 2000; the fuel tanks were topped off. The first flight since the fuel tanks were topped off occurred on May 29, 2000, which was flown with the airplane owner on board; the flight duration was approximately 1.5 hours. Fueling information is an attachment to this report.

ADDITIONAL INFORMATION

The wreckage minus the retained fuel selector valve assembly and section of floor which had affixed to it the fuel selector guard assembly and a fire extinguisher bracket was released to Mr. Richard Hall, a detective with the Smyrna Police Department, on June 1, 2000. The retained items were released to Mr. Kevin Twiss, a claims representative for Phoenix

Aviation Managers, Inc. on July 19, 2001.

Pilot Information

Certificate:	Commercial; Flight instructor	**Age:**	28,Female
Airplane Rating(s):	Single-engine land; Single-engine sea; Multi-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane single-engine; Instrument airplane	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 Valid Medical--w/ waivers/lim	**Last FAA Medical Exam:**	May 8, 2000
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	1528 hours (Total, all aircraft), 1418 hours (Pilot In Command, all aircraft), 192 hours (Last 90 days, all aircraft), 73 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Beech	**Registration:**	N6645P
Model/Series:	C23 C23	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal; Utility	**Serial Number:**	M-2384
Landing Gear Type:	Tricycle	**Seats:**	4
Date/Type of Last Inspection:	February 11, 2000 Annual	**Certified Max Gross Wt.:**	2450 lbs
Time Since Last Inspection:	11 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	1755 Hrs	**Engine Manufacturer:**	Lycoming
ELT:	Installed, activated, did not aid in locating accident	**Engine Model/Series:**	O-360-A4K
Registered Owner:	TOMCO OF DELEWARE, INC.	**Rated Power:**	180 Horsepower
Operator:		**Operating Certificate(s) Held:**	None
Operator Does Business As:		**Operator Designator Code:**	

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	MQY ,543 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	15:16 Local	**Direction from Accident Site:**	351°
Lowest Cloud Condition:	Unknown	**Visibility**	10 miles
Lowest Ceiling:	Broken / 20000 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	6 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	210°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30 inches Hg	**Temperature/Dew Point:**	81°C / 59°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	(MQY)	**Type of Flight Plan Filed:**	None
Destination:		**Type of Clearance:**	None
Departure Time:	15:14 Local	**Type of Airspace:**	Class D

Airport Information

Airport:	SMYRNA AIRPORT MQY	**Runway Surface Type:**	Asphalt
Airport Elevation:	543 ft msl	**Runway Surface Condition:**	
Runway Used:	19	**IFR Approach:**	
Runway Length/Width:	5546 ft / 100 ft	**VFR Approach/Landing:**	Touch and go;Traffic pattern

Wreckage and Impact Information

Crew Injuries:	2 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Fatal	**Latitude, Longitude:**	35.97985,-86.510253(est)

Administrative Information

Investigator In Charge (IIC):	Monville, Timothy
Additional Participating Persons:	LYNN W LAFEVER; NASHVILLE , TN PAUL E YOOS; WICHITA , KS DAVID C MOORE; ARDSLEY , PA NICHOLAS C DELIHAS; NAPLES , FL
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Last Revision Date:	
Investigation Class:	Class
Note:	
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