



National Transportation Safety Board Aviation Accident Factual Report

Location:	BLOUNTVILLE, TN	Accident Number:	ATL93MA068
Date & Time:	04/01/1993, 2128 EST	Registration:	N500AK
Aircraft:	Fairchild SA227-TT	Aircraft Damage:	Destroyed
Defining Event:		Injuries:	4 Fatal
Flight Conducted Under:	Part 91: General Aviation - Executive/Corporate		

HISTORY OF FLIGHT

On April 1, 1993, at 2128 eastern standard time, a Fairchild Aircraft, SA227TT, N500AK, collided with the ground while executing an Instrument Landing System (ILS) approach to runway 23 at the Tri-City Regional Airport, Blountville, Tennessee. The registered owner was Robert H. Brooks, and the airplane was operated by Eastern Foods Inc.. The business flight was conducted under 14 CFR Part 91 with a valid instrument flight clearance. Visual weather conditions prevailed at the time of the accident. The airline transport rated pilot and three passengers were fatally injured, while the airplane was destroyed by impact forces and post impact fire. Origination of the flight was Knoxville, Tennessee, at 2100, on April 1, 1993.

At 1421:53, a pilot who identified himself as the pilot of N500AK telephoned the Georgia Automated Flight Service Station (AFSS), Macon, Georgia, and stated that he planned a series of instrument flights from Fulton County Airport, Atlanta, Georgia. The pilot requested a weather briefing for the planned flights. According to the AFSS Air Traffic Control Specialist, the pilot was given a standard weather briefing, after which he filed four instrument flight plans (See the attached Eastern Foods flight schedule for April 1, 1993).

Following two previous routine flights, N500AK arrived in the Knoxville area. At 1805, Atlanta Center, at the pilot's discretion, cleared the flight to descend to 11,000 feet from 16,000 feet. The pilot was advised to expect light to moderate icing during the descent. N500AK was handed off to Knoxville Approach for the approach and landing clearance at Knoxville, Tennessee.

Upon landing at Knoxville, the airplane was serviced with 60 gallons of jet fuel. The pilot telephoned Nashville Flight Service Station and obtained a weather briefing. According to the Air Traffic Control Specialist, the pilot was given a standard weather briefing which included a pilot report of rime icing east of Knoxville. The pilot also confirmed that he had encountered icing conditions en route to Knoxville.

At 2058, the flight was cleared for takeoff from Knoxville en route to Tri-City; the flight was

subsequently assigned an en route altitude of 7000 feet. At 2110, Tri-City Approach accepted the flight as a radar handoff from Knoxville Approach Control; the pilot was advised to expect an ILS approach to Runway 23. Shortly after establishing contact with N500AK, approach control informed another aircraft of light icing reported by another aircraft at 10,000 feet (see attached witness statement from pilots of a Gulfstream, G-1 and a Beech, King Air).

At 2128, N500AK was cleared to land. According to an Air Traffic Controller, he observed N500AK on final approach until it disappeared from view. He further stated that, while looking in the direction of landing traffic, he heard an unintelligible radio transmission from a pilot. At approximately the same time, the controller observed the lights of the airplane descend out of the bottom of the clouds. The lights appeared to have been in a steep spiraling descent.

PERSONNEL INFORMATION

Information on the pilot is included in this report at the data field labeled First Pilot Information. A review of the Federal Aviation Administration (FAA) records disclosed that the pilot had received an airframe and powerplant mechanic's certificate. The pilot was type rated in the Beech 400, Mitsubishi 400, Douglas DC-9 and the Fairchild SA227TT aircraft. The pilot completed his initial SA227TT training from Flight Safety International in February of 1992. According to Federal Aviation Administration records, the pilot received the SA227TT type rating from an FAA Operations Inspector assigned to the Saint Louis Flight Standards District Office on February 21, 1992.

According to Eastern Foods Inc., officials, the pilot was hired on January 27, 1992, as the company's principal pilot. The pilot's flight logs were not recovered for examination. Pilot flight time in the SA227TT shown in the pilot's information section is an estimate of flight time flown in N500AK since the pilot was hired. The total flight time was also secured from the company's personnel records.

AIRCRAFT INFORMATION

Information on the aircraft is contained in this report at the data fields labeled Aircraft Information. According to the Director Of Maintenance at Hill Aircraft & Leasing, Atlanta, Georgia, the pilot often requested assistance from Hill Aircraft to complete routine service and scheduled maintenance on N500AK.

The following is a brief history of maintenance procedures performed on N500AK during the last two years:

On June 9, 1991 at a total engine time of 1856.5 hours, 3,713 cycles, Garrett General Aviation Services Division Augusta, Georgia, performed major engine work (time since last inspection was 108.1 hours on both engines). On November 8, 1991 at a total engine time of 1946.8 hours, Hill Aircraft & Leasing performed Garrett Spectrographic Oil Analysis Program (SOAP) samples analysis and "A" & "B" inspections.

On March 30, 1992 Hill Aircraft & Leasing performed Fairchild letter check program "C" and "D" at aircraft total time (ACTT) 2053.7 hours, time since hot section inspection (TSHSI) 197.2 hours, time since overhaul (TSO) 2035.4 hours. Fairchild Aircraft letter checks, "A" and "B", were performed at ACTT 2145.9 hours, TSHSI 289.4 hours TSO, 2127.6 Cycles 1778 by Hill Aircraft & Leasing Corp. The SOAP oil and filter analyses were completed with "normal" results.

On February 2, 1992 at ACTT 2242.4 Fairchild letter check inspections "C" and "D" were performed by Hill Aircraft and Leasing, and Garrett SOAP analysis was carried out.

On January 29, 1993 at ACTT 2293.8 and engine time 2280.1, cycles 1906, Garrett Aviation Services Division Augusta, GA cleaned and flow checked the fuel nozzles and rerigged both engines according to the Garrett maintenance manual.

METEOROLOGICAL INFORMATION

Visual weather conditions prevailed at the time of the accident. Weather information is contained in this report at the data field labeled Weather Information. The pilot received two weather briefings during the course of the days flight. Both Air Traffic Control Specialists alerted the pilot to the possibility of encountering inflight structural ice. According to the weather study, a trough of low pressure, in the lower atmosphere, was observed through central Kentucky, central Tennessee, and northern Alabama, at 1900 hours. A deep temperature trough centered over Missouri and northern Arkansas and prevailing westerly winds resulted in a low level, cold air advection, (the horizontal movement of an airmass associated with the change in temperature), across Tennessee, during the evening of April 1, 1993. The upper airstation at Nashville, Tennessee, was the closest site to Tri-city Airport. This site reported the freezing level, at 1900 hours, of less than 4000 feet. Further east, the upper air reporting site at Greensboro, North Carolina reported the freezing level at 7,500 feet at 1900 hours.

The study also revealed that the base of the cloud layer was approximately 3900 feet and tops ranged in excess of 17000 feet. A pilot on final approach to Tri-City Regional Airport reported cloud bases at 4000 feet.

WRECKAGE AND IMPACT INFORMATION

The impact area was located in a pasture about 1/2 mile outside of the outer marker (North 36 degrees, 33 minutes, and 59 seconds by West 83 degrees, 19 minutes and 04 seconds). Examination of the accident site disclosed that the aircraft flight control surfaces were located in the immediate vicinity of the impact area. The center empennage sections of the airframe were fire damaged. Both engines were located in their respective positions, but the propeller assemblies separated from the propeller shafts and were buried about two feet into the ground.

The wreckage came to rest on the downhill side of a sloping, grassy, three acre field, 5.5 miles

northeast of Tri- City Regional Airport. There were undamaged 60 foot tall trees at the top of the slope. Ground scars were confined to an area within 60 feet of the main wreckage. The ground beneath and to the downhill side of the wreckage was muddy and smelled of fuel. There was an impression in the ground approximately 3 feet aft of where the left wing rested. The impression measured 29 feet 3 inches in length.

The main wreckage consisted of the forward fuselage, cockpit, tail section, both wings from root to just inboard of the tips, propellers, and both engines. The main wreckage was oriented on a heading of 240 degrees. The right-hand winglet was found 62 feet from the main wreckage at a heading of 290 degrees.

The radome was located 56 feet away at a 250 degree heading, the "2L" seat was 21 feet away at 240 degrees, and the batteries were 29 feet away from the main wreckage on a 230 degree magnetic heading. The left winglet was 21 feet away at 130 degrees. (see attached Airworthiness Group Chairman's Report for the wreckage diagram).

The wreckage examination disclosed that fire had consumed the upper fuselage, cockpit, airframe center section and left wing. The right wing, forward nose section, and tail section were not consumed by fire. The wreckage lay canted to the left in a nose-down attitude. The cockpit and forward passenger compartment also sustained severe impact damage.

Examination of the fuselage disclosed that, fire damage extended from fuselage station 51.300 through station 342.00, and consumed the structure above waterline 100.00. A seat identified as "2L" was found separated from the fuselage lying on its back 21 feet forward of the main wreckage. The seat pan had a diagonal bend and the seat belt was fastened. The seat was not fire damaged. Two additional individual seat frames and one bench seat frame were located. All cushions from these seats were consumed by fire. The airplane had one door in the aft cabin, which was found closed and locked.

The damaged right wing was attached, with the exception of a hole in the leading edge from wing station 66.580 to 101.206, and free of fire damage. In addition, the wing exhibited compression bending along the lower leading edge from wing station 60.000 to 218.150. The right winglet separated at station 266.000, and the aft main spar was broken at wing station 27.000. There was no fuel in the wing integral fuel tank.

The left wing assembly was partially consumed by fire, but was also bent 170 degrees upward from wing station 170.000 to the tip. The forward and aft main spars were fractured inboard of the left engine nacelle at about wing station 27.000. The flap inter-connect bow-ties (which prevent asymmetrical flap settings) were found attached on both right and left sides.

The aft fuselage was partially consumed by fire up to about fuselage station 400.000 and was rotated to the left about 45 degrees. The tail section was also leaning to the left approximately 60 degrees and the vertical stabilizer was bent to the left an additional 15 degrees. The vertical stabilizer and left horizontal stabilizer and elevator were not fire damaged. The right horizontal stabilizer and elevator exhibited fire damage throughout but remained attached. The

left horizontal stabilizer outboard of about station 47.00\was touching the ground and bent upward approximately 20 degrees. Impact damage was noted on the leading edge of the left horizontal stabilizer, but the right stabilizer leading edge was not damaged.

Both left and right engines were found attached to their mounts, rotated 15 degrees nose down and 45 degrees to the right. Each engine had about 8 inches of soil embedded into the respective inlet. The propeller assemblies separated from their respective engine assemblies and were buried 18 inches into the ground underneath their engines. All four blades (4) remained attached to each propeller assembly. The engines and propellers were removed for further examination by the Powerplants Group.

All three landing gear actuating linkages were found in the down and locked position. The nose gear was separated from the fuselage and located on the ground along the right side of the mid fuselage. The landing gear control handle was down. Both main landing gear struts were collapsed rearward, and the main trunions remained attached to the airframe; both drag braces were broken.

All flight control surfaces-ailerons, flaps, rudder, stabilizer, and elevators were attached to the main wreckage in their normal locations. The left flap was extended 20 degrees; the right flap was also extended 20 degrees, but the right flap lockout valve was damaged and the flap was free-floating; the flap handle position could not be determined. Both elevator assemblies were deflected approximately 50 degrees trailing edge up. The right aileron was 19 degrees down. The stabilizer trim actuator shaft measured 5.75 inches from the end of the barrel to the center of the bolt on both sides. According to Fairchild, this corresponds to a trim setting of -0.8 degrees leading edge down, a setting which would be consistent with half or approach flaps. The trailing edge of the rudder was 0.25 inches to the left of neutral. Flight control continuity was established for all control surfaces.

The engine stop, feather control levers and the landing gear control handle were the only identifiable controls on the pedestal. The stop and feather control levers were bent to the right. The red plastic knobs had melted away. However, the shaft of the left control was extended 3/4 of an inch, while the shaft of the right control was extended 1 3/4 inches.

The annunciator panel was recovered and transported to the National Transportation Safety Board's laboratory in Washington, D.C for further examination. On this panel, warning lights are red, advisories are amber, and status information is presented in green. There are two light bulbs for each legend in the panel; all light bulbs were removed and inspected in the Safety Board Laboratory in Washington, D.C. Filaments from several light bulbs appeared stretched; both left and right engine intake heat light bulb filaments were stretched (see attached Airworthiness Group Chairman's Report for additional examination information).

De-ice boots were present on wing and horizontal stabilizer leading edges. Portions of the damaged pneumatic plumbing to the left wing and tail sections were located, but the de-ice distributor valve and plumbing to the left wing de-ice boots were destroyed by fire. All components of the Stability Augmentation System (SAS) (angle-of-attack vane, computer, stick

pusher servo) were destroyed either by impact forces or the post impact fire.

According to the flight manual, the SAS and stall avoidance system warns the pilot of an impending stall and applies forward force on the elevator. The light bulb examination revealed that the filament for the SAS fault warning was stretched. According to the flight manual, in the event of the illumination of the SAS fault warning light, the airplane will have undesirable stall characteristics at aft center of gravity loading. Therefore, very light elevator control forces will be required to maneuver the airplane at airspeeds below 135 knots indicated airspeed.

Engine and Propeller Examinations

Examination of the engine and propeller assemblies failed to reveal a mechanical malfunction or component failure. The external examination of the right engine, S/N-P-35214C, disclosed that it sustained minor impact damage but received some post-impact fire damage. This examination further revealed that in the vicinity of the gearbox and inlet section that a 180 degree portion of the propeller shaft thrust ball bearing carbon seal retainer was distorted and fire damaged. There was also a large hole in the nose case-cone at the 9 o'clock position. A 180 degree portion of the propeller shaft forward mount flange was also missing.

Examination of the intermediate gearbox assembly revealed that the diaphragm housing was fractured from the 3 to 6 o'clock position. The rear bull gear bearing liner was displaced rearward; the bull gear and sun gear assemblies rotated freely when moved by hand. The high-speed pinon gearshaft and accessory drive gears were not damaged and also rotated freely by hand.

The compressor section examination showed a light contour rub at the outboard end of the first stage compressor impeller blades and a small amount of dirt/debris was located between all of the impeller blades. The second stage impeller displayed contour rub and compressor-shroud-metal spray (CSMS) deposits on platforms between several of the impeller blades. The first-stage impeller shroud exhibited light scoring through approximately 90 degrees with accompanying fresh static witness marks on top in areas of the first-stage compressor impeller blades. The second stage impeller shroud exhibited light scoring through approximately 180 degrees with fresh static impact witness marks in the area adjacent to the second stage compressor impeller blades and there was contour rub and CSMS on the exit radius of the second stage compressor housing. The first stage compressor diffuser crossover duct exhibited debris/dirt between the vanes. The second stage compressor diffuser assembly also exhibited a buildup of CSMS in the area corresponding to the rub on the exit area of the shroud surface.

The combustion section examination disclosed that the combustion plenum exhibited compression wrinkles and light airflow tracks on the inside surface. Visual observation of the turbine section did not reveal extensive impact damage to the internal components. The accessory drive gear bearings, the bull gear bearing and others components rotated freely by hand.

Examination of the left engine, S/N P-35212C, revealed that it sustained impact and fire

damage similar to the damage observed on the right engine (see attached Powerplant Group Chairman's Report). Additionally, the fuel control units were examined and underwent functional examinations; both units operated to test specifications.

Propeller Assemblies

Examination of the left propeller assembly disclosed that on "start latch" pin was broken off and the mechanism was jammed. When both assemblies were cleaned they functioned normally. The front half of the hub was undamaged. In the rear half, an area of five inserts and one dowel/hole was impacted and damaged. Only three propeller-attachment bolts had remained on the flange.

The hub flanges were fractured and bent moderately in line with the propeller centerline. One blade hub port was undamaged. There was a witness mark on the rear of the hub port face where the counterweight contacted it when it was close to the "feather" section, just outboard of the rear hub-half. The rearward extension of the journal was measured as 2.5 inches.

Three of the blades had one or more crosshead flange-impact marks consistent with the following approximate blade angles. One blade exhibited blade impact marks outside the normal operating range, as its operating pin was fractured which allowed free rotation. The blade angles recorded were as follows:-

Blade S/N A138468	81 degrees	Blade S/N A138476	only one mark observed but
outside of normal operating		range and ignored	Blade S/N A138471
degrees	Blade S/N A138470	87 degrees	86

Note:-The blade angles were determined by using transparent overlays provided by Dowty Propellers in the presence of the NTSB group members.

The right propeller assembly was covered with dried mud. The protruding portion of one "start latch" pin was broken off and the mechanism was jammed. When both assemblies were cleaned they started functioning normally. The front portion of the hub was undamaged. Sixty percent of the rear hub flange was damaged and only three propeller attachment bolts remained with the hub. The half-seal flanges for three blades were fractured and moderately bent inward and in line with the propeller.

Three of the blade butt ends had at least one crosshead flange impact impression which equated to the following blade angles. One blade butt-end did not exhibit any crosshead impressions.

Blade S/N A140562	82 DEGREES	Blade S/N A140571	no impression	Blade
S/N A140569	85 degrees	Blade S/N A140567	87 degrees	

Note:-The blade angles were calculated from the blade butt-end impressions using the

Dowty Propeller transparent overlays in the presence of NTSB Powerplant group members. According to the Dowty Official, the normal feather blade angle range is 83 degrees, 40 minutes to 84 degrees 20 minutes.

MEDICAL AND PATHOLOGICAL INFORMATION

Post mortem examination of the pilot was performed by Dr. William F. McCormick, at the East Tennessee State University, College of Medicine, on April 2, 1993. The reported cause of death was massive trauma due to impact forces. The toxicological examinations were negative for drugs and ethanol.

ADDITIONAL INFORMATION

On February 24, 1988, the Garrett Engine Division Of Allied Signal, issued an operating information letter to all owner/operators, airframe manufacturers, distributors, sales and service organizations and field service representatives regarding all TPE331 engines. The purpose of the operating information was to emphasize the purpose and use of engine inlet anti-ice systems. The operating information provided additional information on the use of the engine ignition in icing conditions.

The operating information was the result of reported TPE331 engine flameouts during or following operation in icing conditions. The operating information stated that in some cases, flameouts have occurred after the flights entered clear weather conditions during the descent into warmer air. Garrett Engine Division suggested that the engine inlet anti-ice should be used during all flights into potential icing conditions. Icing conditions should be considered to exist when flying in precipitation or visible moisture with outside air temperatures of 40 degrees or colder.

On June 24, 1988, Fairchild revised the systems description section of the flight manual for the SA227TT, to address the engine flameouts. Fairchild concluded that, the continuous ignition systems, the same type installed in N500AK, were developed to provide a source of ignition to ensure immediate relight if either air or fuel flowing to the combustion chamber is interrupted temporarily. The flight manual states that if icing conditions are encountered with the icing protection system off the following procedures should be followed:

1. Ignition mode Switches..override
2. Left Engine Heat Switch.....Eng & prop heat

Note Determine that first engine operates satisfactorily before selecting engine and prop heat for second engine.

EGT will increase slightly and torque will decrease when engine and propeller heat is selected. Power lever adjustment may be required.

- 3. Pitot Heat/ SAS Heat.....on
- 4. Windshield Heat switch.....high
- 5. De-ice Boots Switch.....as required
- 6. Right Engine Heat Switch..... Eng & Prop Heat

Note-- The flight manual does not advise or warn the pilot, in this section, of a possible flameout if the above mentioned procedures are not followed.

The aircraft wreckage was released to Mr. Sam Henderson, an insurance adjustor, with CIGNA Aviation Insurance.

Additional Persons Participating In This Accident/Incident Investigation (con't from page 5)

Fraser, Edgar 490 L'EnFant Plaza East SW Washington, DC 20594

Aaron, Jim Dowty Aerospace Sterling, VA 22170

Morgan, Jack Fairchild Aircraft Services Arlington, TX 76004

Pilot Information

Certificate:	Airline Transport; Commercial	Age:	48, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	
Instrument Rating(s):	Airplane	Second Pilot Present:	No
Instructor Rating(s):	None	Toxicology Performed:	Yes
Medical Certification:	Class 1 Valid Medical--no waivers/lim.	Last FAA Medical Exam:	06/29/1992
Occupational Pilot:		Last Flight Review or Equivalent:	
Flight Time:	19105 hours (Total, all aircraft), 235 hours (Total, this make and model)		

Aircraft and Owner/Operator Information

Aircraft Make:	Fairchild	Registration:	N500AK
Model/Series:	SA227-TT SA227-TT	Aircraft Category:	Airplane
Year of Manufacture:		Amateur Built:	No
Airworthiness Certificate:	Normal	Serial Number:	TT-527
Landing Gear Type:	Retractable - Tricycle	Seats:	9
Date/Type of Last Inspection:	08/07/1992, Continuous Airworthiness	Certified Max Gross Wt.:	13230 lbs
Time Since Last Inspection:	50 Hours	Engines:	2 Turbo Prop
Airframe Total Time:	2294 Hours	Engine Manufacturer:	Garrett
ELT:	Installed, not activated	Engine Model/Series:	TPE331-10U513
Registered Owner:	BROOKS, ROBERT H.	Rated Power:	940 hp
Operator:	BROOKS, ROBERT H.	Operating Certificate(s) Held:	None
Operator Does Business As:	EASTERN FOODS INC.	Operator Designator Code:	

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	Condition of Light:	Night/Dark
Observation Facility, Elevation:	TRI, 1519 ft msl	Distance from Accident Site:	6 Nautical Miles
Observation Time:	2045 EST	Direction from Accident Site:	228°
Lowest Cloud Condition:	Unknown / 0 ft agl	Visibility	6 Miles
Lowest Ceiling:	Broken / 3500 ft agl	Visibility (RVR):	0 ft
Wind Speed/Gusts:	13 knots /	Turbulence Type Forecast/Actual:	/
Wind Direction:	250°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	29 inches Hg	Temperature/Dew Point:	8°C / 7°C
Precipitation and Obscuration:			
Departure Point:	KNOXVILLE, TN (TYS)	Type of Flight Plan Filed:	IFR
Destination:	(TRI)	Type of Clearance:	IFR
Departure Time:	2100 EST	Type of Airspace:	Class E

Airport Information

Airport:	TRI-CITY REGIONAL (TRI)	Runway Surface Type:	Asphalt
Airport Elevation:	1519 ft	Runway Surface Condition:	Dry
Runway Used:	23	IFR Approach:	ILS
Runway Length/Width:	7999 ft / 150 ft	VFR Approach/Landing:	

Wreckage and Impact Information

Crew Injuries:	1 Fatal	Aircraft Damage:	Destroyed
Passenger Injuries:	3 Fatal	Aircraft Fire:	On-Ground
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	4 Fatal	Latitude, Longitude:	

Administrative Information

Investigator In Charge (IIC):	PHILLIP POWELL
Additional Participating Persons:	JOHN W DELISI; WASHINGTON, DC CYNTHIA L KEEGAN; WASHINGTON, DC LYNN W LAFEVER, SR; NASHVILLE, TN PETER B BAKER; PHOENIX, AZ
Investigation Docket:	NTSB accident and incident dockets serve as permanent archival information for the NTSB's investigations. Dockets released prior to June 1, 2009 are publicly available from the NTSB's Record Management Division at pubinq@ntsb.gov , or at 800-877-6799. Dockets released after this date are available at http://dms.nts.gov/pubdms/ .