NTSB Identification: LAX97FA082 .
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Nonscheduled 14 CFR
Accident occurred Sunday, January 05, 1997 in BULLHEAD CITY, AZ
Probable Cause Approval Date: 3/25/1998
Aircraft: Fairchild SA227-AC, registration: N165SW
Injuries: 2 Minor, 19 Uninjured.

After executing a missed approach at the Grand Canyon Airport, the pilots diverted to the Bullhead City Airport. The pilots reported that minimal icing conditions were encountered with about 1/8 inch of ice accumulating on the aircraft wings. The pilots stated they cycled the deice boots to shed ice. They did not observe ice on the propeller spinners, and they did not activate the engines' 'override' ignition systems, as required by the airplane's flight manual. Use of 'override' ignition was required for flight into visible moisture at or below +5 degrees Celsius (+41 degrees Fahrenheit) to prevent ice ingestion/flameouts. Subsequently, both engines flamed out as the airplane was on about a 3 mile final approach for landing with the landing gear and flaps extended. The aircraft was destroyed during an off-airport landing.

The National Transportation Safety Board determines the probable cause(s) of this accident as follows:

failure of the pilot(s) to use 'override' ignition as prescribed by checklist procedures during an encounter with icing conditions, which subsequently led to ice ingestion and dual engine flame-outs. Factors related to the accident were: the adverse weather (icing) conditions, the accumulation of airframe/engine ice, and lack of suitable terrain in the emergency landing area.

Full narrative available

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LAX97FA082

HISTORY OF FLIGHT

On January 5, 1997, at 1243 hours mountain standard time, a Fairchild SA-227-AC, N165SW, serial no. AC-514, collided with terrain about 1.5 miles south of the Bullhead City, Arizona, airport following the near simultaneous flame out of both engines. The aircraft was operated by FNG Aviation, d.b.a. Skylink Charters of Santa Monica, California, as an on-demand air taxi flight under 14 CFR Part 135. The aircraft was destroyed in the ground collision

sequence. The two pilots sustained minor injuries, and the 19 passengers were uninjured. Visual meteorological conditions prevailed at the departure point, and a VFR/IFR flight plan was filed.

The flight originated at Long Beach, California, at 0900 Pacific standard time as a non-stop flight to the Grand Canyon in Arizona. Instrument meteorological conditions prevailed at the Grand Canyon and the aircraft was cleared for a localizer instrument approach. The weather was below landing minimums and the pilot executed a missed approach. He then diverted to the company designated alternate airport at Bullhead City.

Both pilots reported they had experienced minimal icing at the Grand Canyon. The captain estimated about 1/8 inch had accumulated on the wings. The pilots stated that they exercised the deice boots one time. They also stated that they never used override ignition during the flight.

On January 6, 1997, the cockpit voice recorder (CVR), the only recorder onboard, was sent to the Safety Board's Laboratory for a readout. The tape contained 32 minutes of recording, starting about the time the aircraft was leaving the Grand Canyon for Bullhead City.

According to the CVR, at 6.5 miles out on final approach for runway 34, the aircraft was at 150 knots. At 1239:54, the captain called for full flaps and requested the first officer advise the tower that they were slowing to 130 knots for traffic.

At 1240:41, both engines started spooling down. At 1240:44, the captain said "dual failure. Feather, feather 'em, feather 'em." The first officer asked which engine? The captain stated "both of 'em." At 1241:48, the first officer stated "no attempts on re-starts." The captain responded "yes, go through it. Go through the check list quick." At 1243, the CVR recording ended.

According to a postaccident interview of the first officer; there were no

mechanical malfunctions encountered during the entire flight. No annunciator lights were illuminated, and all systems were (ok).

A review of the Fairchild SA-227 FAA Approved Flight Manual (AFM) revealed that there are no procedures in the AFM that addresses a dual engine flameout.

PILOT INFORMATION

CAPTAIN

The captain was hired on September 7, 1994, and at the time of the accident he reported a total flight time of 3,200 hours with 300 hours in type. The captain was FAA type rated in the SA-227 aircraft. Examination of the pilot training records reveal that on September 17, 1993, he attended a 19.5 hour Allied Signal Aerospace TPE331 Engine Pilot Familiarization Course. On May 18, 1996, the pilot was awarded a certificate after 45 hours of ground school training on the Metro III / SA227 aircraft. On June 9,1996, the captain successfully passed an Airman Competency/Proficiency Check Ride for Part 135.293, 135.297, and 135.299.

FIRST OFFICER

The first officer was hired on September 6, 1996, and at the time of the accident he reported a total flight time of 640 hours with 56 hours in the make and model. The records indicate that since the hire date he has received about 93 hours of training recommended in the FNG Aviation training manual on the Fairchild SA-226 and SA-227 aircraft and the general FAA approved operations manual of procedures. The records also indicate that he successfully passed two Airman Competency/Proficiency Check Rides for second-in-command Part 135.293 in the SA-226/SA-227 aircraft by the operators chief pilot, both in September 1996.

AIRPLANE INFORMATION

The aircraft was being maintained on a continuous airworthiness program. The last phase inspection occurred on December 27, 1996, 20.7 hours prior to the accident. The total time on the airframe was listed as 25,110 hours. According to the pilots, there were no unresolved maintenance items.

At the accident site the Hobbs meter indicated 4,023.8 hours, and the fuel used meter indicated 1,385 pounds.

ENGINE EXAMINATIONS

Accident site engine examinations were conducted by the Safety Board with engine manufacturer representatives prior to removal of the wreckage to a secure storage area.

Prior to the beginning of the formal examination, the FAA participants from the Scottsdale Flight Standards District Office opened both engine cowls to gain access to the engines. According to their statement: " The left and right upper ignitor leads safety wire was removed and leads loosened at the ignitor attach points. The upper ignitors were removed, visually inspected and placed in appropriate bags and marked left and right." Subsequently, the ignitors were reinstalled at the direction of the Safety Board.

The main left engine fuel line from the firewall to fuel pump was loosened at the fuel pump attach and fuel was observed flowing from this line. The main right engine fuel line from the firewall was loosened at the firewall (for accessibility to the fuel pump). Fuel was observed flowing from the fitting on the firewall, with residual fuel in the line. Both left and right engine lines were loosely reinstalled.

The right engine fuel line was loosened at the engine electro/mechanical fuel shutoff valve downstream of the valve. No fuel was observed in the line. The

line was left loosened. The right engine combustion chamber aft upper plug safety wire was removed.

Continuity for the power and speed levers was established at both engines control linkage assembly. Levers were returned to their original positions.

On March 6, 1997, the right engine was installed into a test cell at the Allied Signal facility in Phoenix, Arizona. The engine was test run to a test plan. After the first test run the engine was shut down. A used fuel filter that was removed at the accident site was installed into the fuel system during the engine test cell run. The used filter had no effect on the fuel flow to the engine during the second test run. The fuel shutoff valve was manually operated.

The left engine was impact damaged and not runable. The left engine's compressor and transition duct was internally boroscoped for damage and no operational damage was found during that examination.

WRECKAGE AND IMPACT INFORMATION

The accident site examination revealed that the aircraft first contacted the ground with it's tail fin. The next visible signs of contact were the right main gear dual wheels and the left dual wheels. The extended landing gears separated, leaving gear doors and belly antennas along the wreckage path, which measured to be 285 feet long on a magnetic heading of 355 degrees.

The left engine propeller was found separated from the engine drive shaft flange. Examination of the propeller blades revealed some rotation at the time of ground contact. The spinner dome revealed an impact to the dome without signs of rotation.

Examination of the right propeller revealed no rotational signatures at ground contact, with two propeller blades bent aft.

Both main fuel tanks were found ruptured. Fuel evidence was found in the soil in the area of both wings and forward of the aircraft towards lower ground. The left firewall shutoff was found in the closed position; the right firewall shutoff valve was found in the open position. According to both pilots, there was 500 pounds of fuel per side remaining at the time of the approach into Bullhead City. Subsequent field calculations indicated 965 pounds remaining between both fuel tanks.

According to the operator the aircraft departed Long Beach with 2,345 pounds of fuel, which is the normal load for the flight to the Grand Canyon and back to Long Beach with reserve.

TESTING AND RESEARCH

On April 30, 1985, the engine manufacturer Garrett Turbine Engine Company, issued Operating Information No. 01 331-11. The application was for all TPE331 engines, except TPE331-14. The information was to emphasize proper use of inlet anti-ice and to provide additional information on the supplemental use of engine ignition in icing conditions.

On November 15, 1994, the engine manufacturer Garrett/ Allied Signal Aerospace, issued a Pilot Advisory Letter "Operating Information" No. 331-04R1, for operations in icing conditions. This letter provides additional emphasis on the coincident use of engine ignition when operating in icing conditions. The letter states: " regardless of whether operating in textbook icing conditions, engine ignition should be "ON" or 'ARMED/AUTO (if equipped with AUTO)' any time ice is observed to be collecting on the propeller spinners the wing leading edges or unheated inboard propeller blade cuff areas. Remember, ice accumulation can, under some conditions, be difficult to see." This aircraft does not have an ignition "ON" position, however, it does have an OVERRIDE position which provides continuous ignition.

On November 1, 1993, November 6, 1995, and April 25, 1997, Allied Signal

(formerly Garrett) issued Operating Information Letter 01-331-11 R1 through R3. PURPOSE: To emphasize proper use of engine inlet anti-ice and provide additional information on the use of engine ignition in icing conditions. This operating information is only sent out to operators that are on the Allied Signal mailing list.

The issuance of the operating information followed several reported incidents where TPE331 engines flamed-out 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/Allied Signal Aerospace 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 temperature of + 5 degrees Celsius (+ 41 degrees Fahrenheit) or colder.

As a result of a number of ice ingestion caused engine flameouts, the FAA issued Airworthiness Directive (AD) 86-25-04, which applied to all Fairchild model SA-227 (all serial number) airplanes certificated in any category. The AD required additions to the AFM which stressed the importance of selecting the proper ignition mode during all operations in actual or potential icing conditions. "Potential icing conditions in precipitation or visible moisture meteorological conditions: (1) Begin when the OAT is plus 5 degrees Celsius (+ 41 degrees F) or colder, and (2) end when the OAT is + 10 degrees Celsius (+ 50 degrees F) or warmer." An alternate means of compliance with the AD was approved with the AFM revision B-4, dated, March 13, 1987. The AFM requires the ignition switches to be in the "OVRD" position at any time in visible moisture below + 5 degrees Celsius. It also contains the following warning:

WARNING: ENGINE HEAT AND CONTINUOUS IGNITION IN THE OVERRIDE MODE (IGNITION MODE SWITCH) OR AUTO POSITION (AUTO/CONT IGNITION SWITCH), MUST BE USED AFTER LEAVING

ICING CONDITIONS UNTIL THE PILOT IS CONFIDENT THAT ANY RESIDUAL ICE ON PROPELLERS, SPINNERS, INTAKE LIPS, OR INTAKE THROATS WILL NOT BE SHED INTO THE ENGINES.

FAA accident, incident, and Service Difficulty Reports (SDR's) databases, and Safety Board's files were reviewed. From 1974 to the present, 25 reported incidents of ice ingestion induced engine flameouts were recorded, with many of those dual engine failures. This number included one fatal accident involving four fatalities. (Conversations with commuter flight departments operating this model aircraft revealed that their may be a significant number of ice ingestion induced flameouts that were unreported).

A review of previous accident and incident Safety Board Probable Causes of engine flameouts was conducted. According to the manufacture's information, ice from the unheated propeller spinner dome, which is difficult to detect or discern visually, is shed into the engine inlets after descent into warmer air during the approach phase. The ice ingestion disturbs the air flow which then causes the flameout when the ignition is not on.

WEATHER INFORMATION

According to information obtained from the Hawthorne Automated Flight Service Station (AFSS), on January 4, 1997, at 2129, a man walked into the AFSS and requested to file eight flight plans for N165SW. After filing the flight plans, he requested and was given outlook weather information for the following day's flight.

On January 5, 1997, at 0844, a pilot of N165SW called Hawthorne AFSS by telephone and requested surface observations for Ontario and Chino. He was given that information, as well as weather advisories for the Los Angeles basin area.

On January 5, 1997, at 0917, a pilot of N165SW called the Hawthorne AFSS

on the radio to activate a VFR flight plan from Long Beach to Grand Canyon. The flight plan was activated, weather advisories were given, and VFR flight was not recommended into Grand Canyon. At 0928, while 25 miles north of Ontario at 15,000 feet, a pilot of N165SW contacted the Los Angeles Air Route Traffic Control requesting to pickup an IFR clearance to the Grand Canyon.

At 1054, the Grand Canyon Augmented Automated Surface Observation System (ASOS) was reporting: wind as 300 degrees at 3 knots; visibility 6 miles; present weather light snow mist; sky condition overcast 900 feet; temperature 0 degree C; dew point 1 degree C; altimeter setting 29.89 inHg; remarks - snow began 0918, ceiling 700 feet variable 1,300 feet.

At 1223, the ASOS was reporting a special observation: wind 210 degrees at 10 knots; visibility 1/2 mile; present weather moderate snow freezing fog; sky condition-broken 300 feet overcast 700 feet; temperature minus 1 degree C; dew point minus 1 degree C; altimeter setting 29.85 inHg; remarks - ceiling 100 feet variable 500 feet.

At the time of the missed approach, the surface temperature was reported as 0 degree Celsius. According to the nearest radiosonde location located at Flagstaff, Arizona, the 1100 upper air sounding was reporting at 16,004 feet msl, - 20.7 degrees Celsius; at 12,002 feet msl, it was -11.2 degrees Celsius; and at 8,002 it was -3.5 degrees Celsius. At the time of the accident, the Bullhead City surface temperature was 10 degrees Celsius. There were numerous pilot reports (PIREPS) of light to moderate rime icing relevant to central and northern Arizona during the accident flight.

According to the radar data, after the missed approach at 1139, the aircraft started a climb from 8,700 feet msl, and reached cruise flight at 16,000 feet msl at 1156. At 1204, the aircraft started a descent to 12,000 feet where it cruised until the descent into Bullhead City at 1228. The radar coverage ended at 1236 and 8,300 feet. According to the CVR tape at 1237, the pilot

reported out of 7,200 feet msl. The CVR recording ended at 1243.

ADDITIONAL INFORMATION

The wreckage was released to the insurance company representative on April 4, 1997.

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