



# National Transportation Safety Board

Washington, D.C. 20594  
Safety Recommendation

LEG 2562A

Date: DEC 21 1995

In reply refer to: A-95-146

Mr. Edward Stimpson  
President

General Aviation Manufacturers Association  
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On March 18, 1994, a Swearingen SA-26AT, Merlin IIB, N20PT, crashed while attempting to land at the Winchester Regional Airport, Winchester, Virginia.<sup>1</sup> The pilot, the sole occupant, was killed. The flight had originated at Dulles International Airport, Washington, D.C., and was conducted under the provisions of Title 14 Code of Federal Regulations (CFR) Part 91. Visual meteorological conditions prevailed, and no flight plan had been filed for the visual flight rules (VFR) flight.

The airplane had departed Dulles Airport at 0029, and the pilot reported that he had Winchester Regional in sight several minutes later. A witness on the ground heard the pilot announce on the radio that he was on final approach. No further radio transmissions were heard. The airplane crashed into the ground 250 feet short and 1,100 feet to the left of the runway and was destroyed by impact forces. There was no evidence of fire, and the first responders to the crash did not observe fuel or detect the odor of fuel at the accident site.

The investigation revealed that the left wing fuel tank was empty, and only a minimal amount of fuel remained in the right wing tank. The Safety Board concluded that the left engine had lost power on final approach because of fuel starvation. Subsequently, the pilot did not properly follow the emergency procedure for single-engine operation, and lost control of the airplane, causing it to crash. The Safety Board determined that the probable cause of the accident was, "The pilot's decision to operate the airplane with known deficiencies in the fuel quantity measuring system which resulted in a power loss due to fuel starvation, followed by improper emergency procedures which resulted in a loss of control. Factors were the lack of a requirement

<sup>1</sup> For more detailed information, read Brief of Accident NYC94FA064 (attached).

for periodic recalibration of the fuel quantity measuring system from the manufacturer, and the erratic and inaccurate fuel quantity measuring system."

A copilot from the previous flight, who had deplaned just before the accident flight, indicated that there had been discrepancies with the airplane's fuel quantity measuring system for some time. He described the fuel quantity readings in both tanks as "erratic," with the left tank reading worse than the right tank. Also, he stated that both he and the pilot believed that the right tank typically read higher than the left, even when the fuel load was equal. Testing revealed that the fuel quantity system for the right tank overestimated the amount of fuel remaining.

The fuel quantity system in the SA-26AT uses four float-type transmitters in each wing. These transmitters have an electrical resistance that varies with the position of the float. When the float is at its lowest level (tank empty), the baseline resistance is approximately 0 ohms. When fuel is added, the float rises and resistance increases. The transmitters and an adjustable potentiometer used to calibrate the system are connected in series to form one circuit. Although the fuel quantity indicator measures the total resistance of the circuit in ohms, it displays that reading in terms of gallons of fuel remaining.

The SA-26AT fuel quantity indicator needle indicates 0 gallons when the resistance of the overall wing circuit is 68 ohms (comprised in part from the baseline resistance of the floats and wiring, with the remainder coming from the adjustable potentiometer) and indicate a full tank when the resistance is 152 ohms. To calibrate the system, the maintenance manual states that the airplane should be defueled and the potentiometer adjusted until the fuel gage needle indicates 0 gallons. The manufacturer's maintenance program does not require periodic recalibration of the system. Maintenance records for the accident airplane dating back to delivery had no entries to indicate that the transmitters had ever been replaced or that the system had ever been recalibrated.

Postaccident testing revealed that the resistance of the transmitters had increased significantly from their specified values. Instead of having a resistance of approximately 0 ohms with the floats in the down position, resistances of 1.2 to 13.5 ohms were measured. Upon disassembly, evidence of oxidation and discoloration was seen inside the transmitters. According to the transmitter manufacturer, it is not uncommon for the resistance of a transmitter to increase because of oxidation as the unit ages.

This increase in resistance causes the fuel quantity indicator to show more fuel remaining than is actually on board. Without periodic recalibration, this error will increase as the transmitters age. On the accident airplane, the increase in resistance on the right tank transmitters caused a (+) 41 gallon error in the fuel remaining indication. The Safety Board is concerned that without periodic recalibration of the

fuel quantity indicating system, the pilots of other SA-26AT, Merlin IIB airplanes may experience similar erroneous fuel quantity indications.

A review of the Safety Board's accident data base revealed that in the 7 years from 1988 to 1994, there were 15 fuel starvation accidents in which inaccurate or unreliable fuel quantity gaging systems were determined to be a factor. The airplanes involved included Cessna Models 150, 172, and 210, Beech Models 23 and 55, and Piper Models 24 and 31. The Safety Board notes that, following a series of fuel starvation accidents involving the Cessna Model 210, the FAA issued Airworthiness Directive (AD) 94-12-08, which required a one-time recalibration of the fuel quantity indicating system on that airplane. Based on the March 1994 accident, data base review, and the FAA's previous action, the Safety Board believes that periodic recalibration of the fuel quantity system on all general aviation airplanes with float-type transmitters would have a positive effect in reducing the number of fuel starvation accidents.

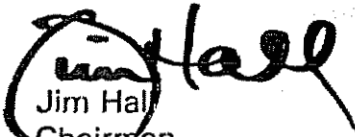
The Safety Board has asked the Federal Aviation Administration (FAA) to issue an AD to require periodic recalibration of the fuel quantity system on all Swearingen SA-26 series airplanes. Also, the Board has asked the FAA to identify general aviation aircraft, other than the Swearingen SA-26, that use float-type transmitters in their fuel quantity systems and do not have a requirement for periodic recalibration specified in their maintenance manuals and to issue an AD to require periodic recalibration of these systems.

While awaiting response from the FAA regarding these recommendations, the Safety Board believes that manufacturers should also initiate corrective action to reduce the number of fuel starvation accidents. Therefore, the National Transportation Safety Board recommends that the General Aviation Manufacturers Association:

Determine which manufacturers do not require a recalibration of their fuel quantity measuring systems, and encourage them to include this procedure in their maintenance manuals. (Class II, Priority Action)  
(A-95-146)

The National Transportation Safety Board is an independent Federal agency with the statutory responsibility "to promote transportation safety by conducting independent accident investigations and by formulating safety improvement recommendations" (Public Law 93-633). The Safety Board is vitally interested in any action taken as a result of its safety recommendations. Therefore, it would appreciate a response from you regarding action taken or contemplated with respect to the recommendation in this letter. Please refer to Safety Recommendation A-95-146 in your response.

Chairman HALL, Vice Chairman FRANCIS, and Members HAMMERSCHMIDT and GOGLIA concurred in this recommendation.

By:   
Jim Hall  
Chairman

National Transportation Safety Board  
Washington, D.C. 20594

Brief of Accident

Adopted 11/18/1994

NYC94FA064  
FILE NO. 372  
03/18/94  
WINCHESTER, VA  
AIRCRAFT REG. NO. N20PT  
TIME (LOCAL) - 00:50 EST

MAKE/MODEL - SWEARINGEN SA-26AT  
ENGINE MAKE/MODEL - GARRETT TPE-331-1-151  
NUMBER OF ENGINES - 2  
OPERATING CERTIFICATES - None (General Aviation)  
TYPE OF FLIGHT OPERATION - Positioning  
REGULATION FLIGHT CONDUCTED UNDER - 14 CFR 91

AIRCRAFT DAMAGE - Destroyed

FATAL 1  
SERIOUS 0  
MINOR/NONE 0

CREW 0  
PASS 0

LAST DEPARTURE POINT  
DESTINATION

- WASHINGTON, DC  
- Same as Accident

CONDITION OF LIGHT - Night (dark)

AIRPORT PROXIMITY  
AIRPORT NAME  
RUNWAY IDENTIFICATION  
RUNWAY LENGTH/WIDTH (Feet)  
RUNWAY SURFACE  
RUNWAY SURFACE CONDITION

- Off airport/airstrip  
- WINCHESTER REGIONAL  
- 32  
- 5500/ 100  
- Asphalt  
- Unk/NR

WEATHER INFO SOURCE- Weather observation facility

BASIC WEATHER - Visual (VMC)  
LOWEST CEILING - Unk/NR  
VISIBILITY - 0010.000 SM  
WIND DIR/SPEED - 270 /005 KTS  
TEMPERATURE (F) - 36  
OBSTR TO VISION - None  
PRECIPITATION - None

PILOT-IN-COMMAND  
CERTIFICATES/RATINGS  
Commercial  
Single-engine land, Multi-engine land  
INSTRUMENT RATINGS  
Airplane

AGE - 39

FLIGHT TIME (Hours)  
TOTAL ALL AIRCRAFT - 3382  
LAST 90 DAYS - 67  
TOTAL MAKE/MODEL - 568  
TOTAL INSTRUMENT TIME - 807

WHILE ON APP AT NIGHT, IN VMC, THE LEFT ENG LOST PWR DUE TO FUEL STARVATION. THE PROP WAS NOT FEATHERED, THE L/G WAS LEFT DOWN, AND THE A/C DRIFTED LEFT OF CRS, STRUCK TREES, AND THEN THE GND. ONE GAL OF FUEL WAS DRAINED FROM THE RT WING, ENG, & FUEL LINE. NO FUEL WAS FOUND IN THE LT WING, ENG & FUEL LINE. THE CO-PILOT SAID THE FUEL QTY SYS WAS ERRATIC WITH THE LT SIDE MORE ERRATIC, AND THE RT SIDE READING ABOUT 10 GAL MORE THAN THE LT SIDE. TESTING FOUND THE RT SIDE INDICATED ABOUT 45 GAL MORE THAN WAS PRESENT WHILE THE LT SIDE WAS INOP. THERE WAS NO REQUIREMENT FOR PERIODIC RECALIBRATION OF THE FUEL QTY SYSTEM. THE OWNER/PILOT HAD OPERATED THE A/C ON 32 FLTS, OVER 23 HRS, AND REFUELED 23 TIMES USING PARTIAL FILLS, SINCE HE HAD FULL TANKS. THE PILOT WAS CHECKED OUT 17 MONTHS PRIOR AND THE INSTR SAID THE PILOT WAS FINE, HOWEVER, HE WAS CAUTIONED HIM TO ENROLL IN RECURRENT TRAINING. THERE WAS NO RECORD HE DID. THE PILOT HAD RECEIVED AN FAA CHECKRIDE 19 MONTHS PRIOR TO THE ACCIDENT, WHICH HE PASSED.

NYC94FA064  
FILE NO. 372 03/18/94 WINCHESTER, VA AIRCRAFT REG. NO. N20PT TIME (LOCAL) - 00:50 EST

Occurrence# 1 LOSS OF ENGINE POWER (PARTIAL) - NON-MECHANICAL  
Phase of Operation APPROACH - VFR PATTERN - FINAL APPROACH

Findings

1. - FUEL SYSTEM, FUEL QUANTITY FLOAT/SENSOR - ERRATIC
2. - FUEL SYSTEM, FUEL QUANTITY FLOAT/SENSOR - FALSE INDICATION
3. - OPERATION WITH KNOWN DEFICIENCIES IN EQUIPMENT - PERFORMED - PILOT IN COMMAND
4. - FLUID, FUEL - STARVATION
5. - IN-FLIGHT PLANNING/DECISION - INADEQUATE - PILOT IN COMMAND

Occurrence# 2 LOSS OF CONTROL - IN FLIGHT  
Phase of Operation APPROACH - VFR PATTERN - FINAL APPROACH

Findings

6. - EMERGENCY PROCEDURE - IMPROPER - PILOT IN COMMAND
7. - DIRECTIONAL CONTROL - NOT MAINTAINED - PILOT IN COMMAND
8. - AIRSPEED - NOT MAINTAINED - PILOT IN COMMAND
9. - STALL/MOSH - INADVERTENT - PILOT IN COMMAND

Occurrence# 3 IN FLIGHT COLLISION WITH OBJECT  
Phase of Operation DESCENT - UNCONTROLLED

Findings

10. - OBJECT - TREE(S)

Occurrence# 4 ON GROUND/WATER ENCOUNTER WITH TERRAIN/WATER  
Phase of Operation DESCENT - UNCONTROLLED

The National Transportation Safety Board determines that the Probable Cause(s) of this Accident was:  
THE PILOT'S DECISION TO OPERATE THE AIRPLANE WITH KNOWN DEFICIENCIES IN THE FUEL QUANTITY MEASURING SYSTEM WHICH RESULTED IN A POWER LOSS DUE TO FUEL STARVATION, FOLLOWED BY IMPROPER EMERGENCY PROCEDURES WHICH RESULTED IN A LOSS OF CONTROL INFLIGHT AND UNCONTROLLED CONTACT WITH THE GROUND. FACTORS WERE THE LACK OF A REQUIREMENT FOR PERIODIC CALIBRATION OF THE FUEL QUANTITY MEASURING SYSTEM FROM THE MANUFACTURER, AND THE ERRATIC AND INACCURATE FUEL QUANTITY MEASURING SYSTEM.