SP-20
A-86-123

# National Transportation Safety Board

Washington, D.C. 20594

## Safety Recommendation

**Date:** October 7, 1986

**In reply refer to:** A-86-123

Honorable Donald D. Engen
Administrator
*Federal Aviation Administration*
Washington, D. C. 20591

On November 1, 1985, a Beechcraft Bonanza A36TC, N366K, experienced an engine failure shortly after take off from the Bismarck Municipal Airport, Bismarck, North Dakota. (See attached Brief of Accident.) The airplane was damaged substantially as a result of the subsequent emergency landing and the pilot and passenger were injured seriously. The investigation of this accident by the National Transportation Safety Board revealed that the pilot may have inadvertently activated the emergency fuel pump switch while intending to retract the flaps, thereby flooding the engine. The switches for the emergency fuel pump and the flaps are located adjacent to each other.

A review of Safety Board accident statistics from 1980 through 1985 regarding the Beechcraft A36TC revealed six additional instances of engine failures that may have been the result of inappropriate selection or misuse of the emergency and/or auxiliary fuel pump. For example, on September 24, 1984, the pilot of a Beechcraft A36TC, N305MM, experienced a complete power loss at 2,300 feet m.s.l. while descending from 3,000 feet for an approach to the Lafayette Airport, Lafayette, Indiana. (See attached Brief of Accident.) The pilot stated that he had left the auxiliary fuel pump switch on during the cruise portion of the flight because the engine ran rough when the switch was turned off. The pilot stated that after the engine failed, he switched fuel tanks, changed to high fuel boost, and also activated the emergency fuel pump switch, but he was unable to restart the engine. The airplane subsequently was landed gear up in a field. The Safety Board's investigation revealed that the pilot may have retarded the throttle to idle during the descent without a corresponding leaning of the mixture, causing engine combustion to cease because of a too rich fuel-air mixture.

The Pilot Operating Handbook and Federal Aviation Administration (FAA) Approved Airplane Flight Manual for this airplane carries a caution note in its Normal Procedures section against retarding the throttle to idle during descent. The Emergency Procedures section of the handbook also carries a specific procedure, "Retarding Throttle to Idle," under the subject "Engine Failure." In fact, the sensitive nature of the fuel system of this airplane to other than optimum fuel flow conditions was demonstrated during the investigations of the above mentioned accidents. An engine runup, conducted after the airplanes were recovered, revealed that when high fuel boost (i.e. emergency fuel pump switch on) was supplied to the engines at various power settings with the mixture control at rich as well as lean positions, the engines would stop without warning due to engine flooding.

It is evident that the operation and procedures for the turbo-charged Beech Bonanza engine is quite unlike normally aspirated airplane engines and requires intimate knowledge of the fuel system and engine characteristics under various temperature, pressure altitude, and power setting conditions. Furthermore, there are certain human factors considerations--certain emergency procedures dealing with failures of the engine or fuel system components are conducive to inappropriate behavior and regression toward previously learned habit patterns, aggravating the emergency situation rather than resolving it. For instance, when experiencing engine problems, including a failure, it would be natural for a pilot to retard the throttle, advance the mixture control, and turn on the fuel boost pump, as part of the initial emergency procedure. In the case of the A36TC, however, such actions almost certainly will cause engine flooding, further aggravating the emergency. In fact, one particular procedure in the Pilot's Operating Handbook for restarting the engine instructs the pilot to turn off the auxiliary fuel pump, to advance the throttle, and to lean the mixture.

The Beech Aircraft Corporation is well aware of the sensitivity of the fuel system of the A36TC to other than optimum fuel flow conditions. It recently devised an engineering change to the fuel system. This change involves increasing the size of the fuel supply lines from the fuel tanks to the engine driven fuel pump from the present 3/8 inch size to a 1/2-inch diameter, eliminating the automatic feature for high auxiliary fuel boost, and removing the emergency fuel pump switch. This change was devised because Beechcraft's service operating experience showed that, despite several Executive Airplane Service Communiques and a Class II Service Instruction on the operation of the fuel systems, pilots continued to misuse the features of the fuel system. The fuel system modification was developed in Mandatory Service Bulletin No. 2033 and was issued on August, 1985.

The Beech Aircraft Corporation evidently strongly believed that the modifications embodied in Service Bulletin No. 2033 should be made as demonstrated by its designation of the Service Bulletin as mandatory, and by assuming all costs for the parts and the labor necessary to accomplish the change. Additionally, Beech developed a staff study in support of a request to the FAA's Aircraft Certification Office for an Airworthiness Directive (AD) on the A36TC fuel system. The staff study emphasized the fact that a loss of power may occur on takeoff when the high/low switch position of the auxiliary fuel pump is selected improperly prior to takeoff. Four accidents were cited in which this switch position might have been a factor. The request for an AD was forwarded to the FAA's Central Region on March 11, 1985.

On April 16, 1985, the FAA denied the request for an AD. The letter cited the lack of information to determine conclusively that misuse of the auxiliary fuel pump switch was the cause of accidents; it also cited the lack of data from FAA and Safety Board sources in support of the AD request.

The Safety Board is of the opinion that the issuance of an AD should not be based on the number of accidents that have occurred. Rather, the need for an AD should be based on the failure potential of equipment and components as embodied in the design.

In this particular case, the Safety Board's examination of the A36TC fuel system, the normal and emergency procedures associated with that fuel system, and the clear potential for inappropriate procedural pilot behavior, have convinced the Safety Board that the Beech Aircraft Corporation acted prudently in requesting the issuance of an AD to enforce compliance with the Mandatory Service Bulletin. The Safety Board believes that the FAA was remiss in denying the AD request.

As a result, the National Transportation Safety Board recommends that the Federal Aviation Administration.

> Issue an Airworthiness Directive to owners and operators of A36TC Beech Bonanza airplanes serial No. EA-1 through EA-241 and EA-243 through EA-272, requiring compliance with the fuel system modifications specified in Beechcraft Mandatory Service Bulletin No. 2033 on or before a date no later than the next scheduled airplane inspection. (Class II, Priority Action) (A-86-123)

BURNETT, Chairman, GOLDMAN, Vice Chairman, and LAUBER, and NALL, Members, concurred in this recommendation.

By: Jim Burnett
Chairman

National Transportation Safety Board
Washington, D.C. 20594

Brief of Incident

File No. - 5060 9/24/84 LAFAYETTE,IN A/C Reg. No. N305MM Time (Lcl) - 0945 EST

----Basic Information----
Type Operating Certificate-NONE (GENERAL AVIATION)
Type of Operation -BUSINESS
Flight Conducted Under -14 CFR 91
Incident Occurred During -LANDING

Aircraft Damage
MINOR
Fire
NONE

| | Injuries | | | |
|---|---|---|---|---|
| | Fatal | Serious | Minor | None |
| Crew | 0 | 0 | 0 | 1 |
| Pass | 0 | 0 | 0 | 3 |

----Aircraft Information----
Make/Model - BEECH A36TC
Landing Gear - TRICYCLE-RETRACTABLE
Max Gross Wt - 3600
No. of Seats - 6
Eng Make/Model - LYCOMING TSIO-520-UB
Number Engines - 1
Engine Type - RECIP-FUEL INJECTED
Rated Power - 300 HP
ELT Installed/Activated - YES/NO
Stall Warning System - YES

----Environment/Operations Information----
Weather Data
Wx Briefing - FSS
Method - TELETYPE
Completeness - FULL
Basic Weather - IMC
Wind Dir/Speed- 210/006 KTS
Visibility - 4.000 SM
Lowest Sky/Clouds - UNK/NR
Lowest Ceiling - 700 FT BROKEN
Obstructions to Vision- FOG
Precipitation - NONE
Condition of Light - DAYLIGHT

Itinerary
Last Departure Point
CHICAGO,IL
Destination
LAFAYETTE,IN

ATC/Airspace
Type of Flight Plan - IFR
Type of Clearance - IFR
Type Apch/Lnds - FORCED LANDING

Airport Proximity
OFF AIRPORT/STRIP

Airport Data
LAFAYETTE
Runway Ident - N/A
Runway Lth/Wid - N/A
Runway Surface - N/A
Runway Status - N/A

----Personnel Information----
Pilot-In-Command
Certificate(s)/Rating(s)
COMMERCIAL
SE LAND,ME LAND
Instrument Rating(s) - AIRPLANE

Age - 58
Biennial Flight Review
Current - UNK/NR
Months Since - UNK/NR
Aircraft Type - UNK/NR

Medical Certificate - UNK/NR
Flight Time (Hours)
Total - UNK/NR
Make/Model- UNK/NR
Instrument- UNK/NR
Multi-Eng - UNK/NR
Last 24 Hrs - UNK/NR
Last 30 Days- UNK/NR
Last 90 Days- UNK/NR
Rotorcraft - UNK/NR

----Narrative----
THE PLT REPORTED THAT WHEN HE LEVELED OFF AT 3000 FT MSL, THE AUX FUEL BOOST SWITCH WAS STILL ON, SO HE SWITCHED IT 'OFF.' WHEN THE SWITCH WAS TURNED OFF, THE ENG BEGAN TO RUN WITH A BIT OF VIBRATION, SO HE RETURNED THE SWITCH TO 'ON' & LEFT IT IN THAT POSITION FOR THE REMAINDER OF THE FLT. THE EN ROUTE PORTION OF THE FLT WAS UNEVENTFUL. DURING A DESCENT THRU 2300 FT, IN IFR CONDITIONS NEAR THE DESTINATION, THE ENG STOPPED RUNNING. THE PLT WAS UNABLE TO RESTART THE ENG. HE REPORTED THAT THE ACFT BROKE OUT OF THE OVERCAST AT A LOW ALT. THE PLT SAW A SUITABLE FIELD & LANDED, BUT THE ACFT RECEIVED MINOR DAMAGE. THE ENG OPERATED NORMALLY DURING A RUN-UP. NO REASON FOR THE LOSS OF POWER WAS IDENTIFIED.

File No. - 5060 9/24/84 LAFAYETTE,IN A/C Reg. No. N305MM Time (Lcl) - 0945 EST

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Occurrence #1 LOSS OF POWER
Phase of Operation DESCENT - NORMAL

Finding(s)
1. UNDETERMINED

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Occurrence #2 FORCED LANDING
Phase of Operation DESCENT - EMERGENCY

Finding(s)
2. WEATHER CONDITION - LOW CEILING

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Occurrence #3 ON GROUND COLLISION WITH TERRAIN
Phase of Operation LANDING

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5 ----Probable Cause----

The National Transportation Safety Board determines that the Probable Cause(s) of this incident is/are finding(s) 1

Factor(s) relating to this incident is/are finding(s) 2

National Transportation Safety Board
Washington, D.C. 20594

Brief of Accident

File No. - 2554 11/01/85 BISMARCK,ND A/C Reg. No. N3663K Time (Lcl) - 1600 CST

----Basic Information----
Type Operating Certificate-NONE (GENERAL AVIATION)
Type of Operation -BUSINESS
Flight Conducted Under -14 CFR 91
Accident Occurred During -LANDING

Aircraft Damage
SUBSTANTIAL
Fire
NONE

| Injuries | Fatal | Serious | Minor | None |
|---|---|---|---|---|
| Crew | 0 | 0 | 1 | 0 |
| Pass | 0 | 0 | 1 | 0 |

----Aircraft Information----
Make/Model - BEECH A36TC
Landing Gear - TRICYCLE-RETRACTABLE
Max Gross Wt - 3650
No. of Seats - 4
Eng Make/Model - CONTINENTAL TSIO-520-UB
Number Engines - 1
Engine Type - RECIP-FUEL INJECTED
Rated Power - 300 HP
ELT Installed/Activated - YES/YES
Stall Warning System - YES

----Environment/Operations Information----
Weather Data
Wx Briefing - NO RECORD OF BRIEFING
Method - N/A
Completeness - N/A
Basic Weather - VMC
Wind Dir/Speed- 210/007 KTS
Visibility - 12.0 SM
Lowest Sky/Clouds - 5000 FT SCATTERED
Lowest Ceiling - NONE
Obstructions to Vision- NONE
Precipitation - NONE
Condition of Light - DAYLIGHT

Itinerary
Last Departure Point
SAME AS ACC/INC
Destination
DICKINSON,ND

ATC/Airspace
Type of Flight Plan - NONE
Type of Clearance - NONE
Type Apch/Lnds - NONE

Airport Proximity
OFF AIRPORT/STRIP

Airport Data
BISMARCK MUNICIPAL
Runway Ident - 31
Runway Lth/Wid - N/A
Runway Surface - DIRT
Runway Status - DRY

----Personnel Information----
Pilot-In-Command
Certificate(s)/Rating(s)
COMMERCIAL
SE LAND,ME LAND
Instrument Rating(s) - AIRPLANE

Age - 53
Biennial Flight Review
Current - YES
Months Since - 14
Aircraft Type - UNK/NR

Medical Certificate - VALID MEDICAL-WAIVERS/LIMIT

| Flight Time (Hours) | | | |
|---|---|---|---|
| Total - | 702 | Last 24 Hrs - | 2 |
| Make/Model- | 241 | Last 30 Days- | UNK/NR |
| Instrument- | 148 | Last 90 Days- | 26 |
| Multi-Eng - | 50 | | |

----Narrative----
SHORTLY AFTER TAKEOFF, THE PLT OF THE BEECH A36TC ACFT ACTIVATED WHAT HE BELIEVED WAS THE FLAP RETRACTION LEVER, AND THE ENG QUIT. THE PLT MADE A FORCED LANDING APRX 1000 FT FROM THE RWY DEPARTURE END. DURING THE INVESTIGATION, THE ENG WAS STARTED AND FUNCTIONED NORMALLY, UNTIL THE EMERG FUEL PUMP (EFP) SWITCH WAS ACTIVATED, WHICH RESULTED IN THE ENG QUITTING DUE TO FLOODING. THIS STEP WAS REPEATED SEVERAL TIMES WITH THE SAME RESULTS. THE EFP SWITCH AND FLAP RETRACTION LEVER ARE APRX TWO INCHES APART.

File No. - 2554 11/01/85 BISMARCK,ND A/C Reg. No. N3663K Time (Lcl) - 1600 CST

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Occurrence #1 LOSS OF POWER(TOTAL) - MECH FAILURE/MALFUNCTION
Phase of Operation TAKEOFF - INITIAL CLIMB

Finding(s)
1. FUEL SYSTEM - INCORRECT
2. FUEL BOOST PUMP SELECTOR POSITION - INADVERTENT USE - PILOT IN COMMAND
3. AIRCRAFT/EQUIPMENT,INADEQUATE DESIGN(STANDARD/REQUIREMENT),CONTROL LOCATION - MANUFACTURER

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Occurrence #2 FORCED LANDING
Phase of Operation TAKEOFF - INITIAL CLIMB

Finding(s)
4. LIGHT CONDITION - DAYLIGHT

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Occurrence #3 HARD LANDING
Phase of Operation LANDING - FLARE/TOUCHDOWN

Finding(s)
5. AIRPORT FACILITIES,RUNWAY/LANDING AREA CONDITION - ROUGH/UNEVEN
6. STALL - INADVERTENT - PILOT IN COMMAND

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----Probable Cause----

The National Transportation Safety Board determines that the Probable Cause(s) of this accident is/are finding(s) 2

Factor(s) relating to this accident is/are finding(s) 1,3,6