



National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Log 2438

Date. April 11, 1994

In reply refer to: A-94-81 and -82

Honorable David R. Hinson
Administrator
Federal Aviation Administration
Washington, D C 20591

On January 13, 1992, a Cessna T210L, N22592, was involved in an accident at the Temple Bar Airport, Temple Bar, Arizona, as the pilot attempted to execute an emergency landing. Two of the five persons aboard were killed and three were seriously injured when the airplane struck the ground short of the runway. The pilot reported that the airplane had sustained a partial loss of engine power during cruise, but that he could not determine the nature of the problem. While descending to the airport, he turned the fuel boost pump on and the engine lost additional power. Just before arriving over the airport, the cockpit and cabin areas filled with smoke and the engine was secured. The Safety Board determined the probable causes of the accident to be fatigue failure of the turbocharger's turbine shaft due to inadequate maintenance, and the pilot's improper in-flight planning/decision after experiencing a turbocharger failure. Additionally, the lack of written instructions or an emergency procedure in the Cessna T210L Pilot's Operating Handbook (POH) relating to turbocharger malfunctions or failures was determined to be an important factor contributing to the accident.

From January 1, 1988, to May 4, 1993, there were 88 accidents and incidents involving aircraft engine turbochargers, resulting in six fatalities and 35 injuries. Many of these occurrences, in both single and twin-engine airplanes, involved loss of engine power, fire in flight, or smoke in the cockpit. Moreover, from January 1, 1986, to May 4, 1993, the Federal Aviation Administration (FAA) received 580 Service Difficulty Reports (SDRs) regarding aircraft turbocharging systems. The reports contained detailed system malfunctions that, in many cases, were attributed to inadequate installation, inspection, maintenance, service, or overhaul. The Safety Board noted, in connection with a significant number of the accidents, that improper pilot remedial actions following the turbocharger malfunction or failure may have contributed to these occurrences. For example, because compressed air to the engine normally produced by the turbocharger was no longer available, use of the boost pump, as evidenced in N22592, aggravated an already overly rich fuel mixture condition. This resulted in a further reduction in engine

power and subsequent inability to sustain flight. Other inappropriate pilot actions or responses cited in accident reports that may also have exacerbated the loss of engine power or caused an in-flight fire because of turbocharger failure include the following: use of an inadequate emergency procedure, improper adjustment of the fuel mixture, improper use of the throttle control, and operating with known deficiencies in equipment.

Except for the Models M20K and M20M produced by the Mooney Aircraft Corporation, the Safety Board is not aware of any other pilot operating handbooks applicable to airplanes produced by various manufacturers, including the Cessna Aircraft Company, the Beech Aircraft Corporation, and the Piper Aircraft Corporation, that contain written procedures addressing turbocharger failures in either the emergency procedures or systems description sections. Nor does the Specification for Pilots Operating Handbook (GAMA Specification No. 1) prepared by the General Aviation Manufacturers Association refer specifically to this subject. The pilot's operating handbook for the Mooney M20M addresses the potential loss of engine power and fire hazards due to turbocharger failure as follows:

WARNING

If a turbocharger failure is a result of a loose, disconnected or burned through exhaust, then a serious fire hazard exists. If a failure in the exhaust system is suspected in flight, shut down the engine and LAND AS SOON AS POSSIBLE. If a suspected exhaust system failure occurs before takeoff, DO NOT FLY THE AIRCRAFT.

NOTE

A turbocharger malfunction at altitudes above 12,000 ft. could result in a overly rich mixture which could cause a partial power loss and rough running engine or a complete loss of engine power.

COMPLETE LOSS OF ENGINE POWER

If a suspected turbocharger or turbocharger waste gate control system failure results in a complete loss of engine power the following procedure is recommended:

Mixture	 IDLE CUTOFF
Throttle	 CRUISE
Propeller	 FULL FORWARD
Mixture	 ADVANCE slowly until engine re-starts
Continue Flight	 LAND AS SOON AS POSSIBLE

PARTIAL LOSS OF ENGINE POWER

If turbocharger wastegate control fails in the OPEN position, a partial loss of engine power may result. The following procedure is recommended if a suspected turbocharger/wastegate control failure results in a partial loss of engine power.

Throttle	AS REQUIRED
Propeller	AS REQUIRED
Mixture	AS REQUIRED
Continue Flight	LAND AS SOON AS POSSIBLE

ENGINE POWER OVERBOOST

If the turbocharger wastegate control fails in the CLOSED position, an engine power overboost condition may be experienced. The following procedure is recommended for an overboost condition.

Throttle. REDUCE as necessary to keep manifold pressure within limits

NOTE

Expect manifold pressure response to throttle movements to be sensitive

Propeller	AS REQUIRED
Mixture	AS REQUIRED
Continue Flight	LAND AS SOON AS POSSIBLE

The Safety Board believes that a significant number of accidents and incidents involving turbocharger failures could be prevented if an abbreviated emergency procedures checklist similar to this one were included in all pilot operating handbooks

Therefore the National Transportation Safety Board recommends that the Federal Aviation Administration.

Require the amendment of pilot operating handbooks and airplane flight manuals applicable to aircraft equipped with engine turbochargers by including in the "Emergency Procedures" section information regarding turbocharger failure. The information should include procedures to minimize potential hazards relating to fire in flight and/or loss of engine power. (Class II, Priority Action)(A-94-81)

Publish an article in Advisory Circular No 43-16, "General Aviation Airworthiness Alerts," outlining potential hazards that may be associated with turbocharger failure. The article should emphasize the importance of

correct turbocharger installation, inspection, maintenance, service, and overhaul as well as the operational procedures that should be employed to minimize the hazards of turbocharger failure in flight (Class II, Priority Action)(A-94-82)

Also, as a result of its investigation, the Safety Board has issued Safety Recommendation A-94-83 to the General Aviation Manufacturers Association.

Chairman VOGT, Vice Chairman COUGHLIN, and Members LAUBER, HAMMERSCHMIDT, and HALL concurred in these recommendations.



By: Carl W Vogt
Chairman

Safety Recommendation History for A-94-081 FAA

[Close](#)

Page 1 of 1
6 records found

Response Date:

6/14/1994

From:

Addressee

Response:

THE FAA IS CONDUCTING A POLICY REVIEW OF APPROPRIATE AIRPLANE FLIGHT MANUAL EMERGENCY PROCEDURES REGARDING TURBOCHARGER FAILURE.

Response Date:

8/4/1994

From:

NTSB

Response:

THE BOARD NOTES THAT THE FAA IS CONDUCTING A POLICY REVIEW OF APPROPRIATE AIRPLANE FLIGHT MANUAL EMERGENCY PROCEDURES REGARDING TURBOCHARGER FAILURE. THEREFORE, THE BOARD CLASSIFIES A-94-81 "OPEN--ACCEPTABLE RESPONSE."

Response Date:

7/3/1995

From:

Addressee

Response:

THE FAA AGREES WITH THE INTENT OF THIS RECOMMENDATION BUT DOES NOT BELIEVE THAT THERE IS SUFFICIENT BASIS TO ISSUE AN AIRWORTHINESS DIRECTIVE APPLICABLE TO ALL AIRPLANE FLIGHT MANUALS OR PILOT OPERATING HANDBOOKS WITH TURBOCHARGER INSTALLATIONS. TO ADDRESS THIS RECOMMENDATION, THE FAA WILL REVISE AFM POLICY REGARDING MINIMUM SAFE OPERATING PROCEDURES FOLLOWING TURBOCHARGER FAILURE DURING THE NEXT REVISION OF ADVISORY CIRCULAR 23-8A, FLIGHT TEST GUIDE FOR CERTIFICATION OF PART 23 AIRPLANES, & REQUEST TYPE CERTIFICATE OR SUPPLEMENTAL TYPE CERTIFICATE HOLDERS TO REVISE THEIR AFM'S POH'S OR AFM SUPPLEMENT, AS APPROPRIATE, TO COMPLY WITH THE BOARD'S RECOMMENDATION.

Response Date:

8/29/1995

From:

NTSB

Response:

THE BOARD NOTES THAT WHILE THE FAA DOES NOT BELIEVE THAT THERE IS A SUFFICIENT BASIS TO ISSUE AN AIRWORTHINESS DIRECTIVE, IT AGREES WITH THE INTENT OF THE RECOMMENDATION & IS TAKING ALTERNATIVE ACTION. THIS INCLUDES REVISION OF ADVISORY CIRCULAR 23-8A, "FLIGHT TEST GUIDE FOR CERTIFICATION OF PART 23 AIRPLANES," TO REFLECT CHANGES TO MINIMUM SAFE OPERATING PROCEDURES FOLLOWING TURBOCHARGER FAILURES. THE REVISION WILL ALSO REQUEST TYPE CERTIFICATE & SUPPLEMENTAL TYPE CERTIFICATE HOLDERS TO REVISE THEIR AFMS, POHS, OR AFM SUPPLEMENTS, AS APPROPRIATE, TO COMPLY WITH THE BOARD'S RECOMMENDATION. BECAUSE THIS ACTION COMPLIES WITH THE INTENT OF A-94-81, THE RECOMMENDATION IS CLASSIFIED "OPEN--ACCEPTABLE ALTERNATE RESPONSE," PENDING RECEIPT OF COPIES OF THE RELEVANT MATERIAL FOR REVIEW.

Response Date:

6/9/1997

From:

Addressee

Response:

THE FAA AGREES WITH THE INTENT OF THE RECOMMENDATION, & IS IN THE PROCESS OF REVISING ADVISORY CIRCULAR (AC) 23-8A, FLIGHT TEST GUIDE FOR CERTIFICATION OF PART 23 AIRPLANES, TO ADDRESS APPROPRIATE INFO THAT MUST BE INCLUDED IN AIRPLANE FLIGHT MANUALS ON THE MINIMUM SAFE OPERATING PROCEDURES FOLLOWING TURBOCHARGER FAILURE. IT EXPECTS THE AC REVISION TO BE COMPLETED BY DECEMBER 1997. IN THE INTERIM, THE FAA ISSUED A POLICY LETTER ON 2/16/95, WHICH ESTABLISHED A LIST OF SYSTEMS THAT SHOULD BE CONSIDERED WHEN EVALUATING THE EMERGENCY PROCEDURES SECTION OF THE AIRPLANE FLIGHT MANUAL. THE LIST INCLUDES TURBOCHARGER FAILURE PROCEDURES, & THE POLICY LETTER IMPLEMENTS INFO THAT WILL BE INCORPORATED INTO AC23-8A THAT IT IS CONTINUING TO REVISE. THE LETTER EXPANDS ON THE INFO REQUIRED FOR SAFE OPERATION OF AN AIRPLANE IN COMPLIANCE WITH 14 CFR 23-1585 (A).

Response Date:

8/15/1997

From:

NTSB

Response:

A-94-81 ASKED THE FAA TO AMEND PILOT OPERATING HANDBOOKS & AIRPLANE FLIGHT MANUALS APPLICABLE TO AIRCRAFT EQUIPPED WITH ENGINE TURBOCHARGERS BY INCLUDING IN THE "EMERGENCY PROCEDURES" SECTION INFO REGARDING TURBOCHARGER FAILURE. THE INFO SHOULD INCLUDE PROCEDURES TO MINIMIZE POTENTIAL HAZARDS RELATING TO FIRE IN FLIGHT &/OR LOSS OF ENGINE POWER. BASED ON FAA'S ISSUANCE OF THE POLICY LETTER & ITS REVISION OF AC 23-8A, THE BOARD CLASSIFIES A-94-81

"CLOSED--ACCEPTABLE ALTERNATE ACTION."

Note:
Please note that the Addressee's incoming letter's text is not posted until the NTSB's outgoing letter is posted as well.