Log 2438A

National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date. April 11, 1994

In reply refer to: A-94-83

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On January 13, 1992, a Cessna T210L, N22592, was involved in an accident at tlie 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 liad sustained a partial loss of engine power during cruise, but that lie could not determine the nature of tlie 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, tlie cockpit and cabin areas filled with **smoke** and the engine was secured The Safety Board determined tlie 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 tlie 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 tlie 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 nornially produced by the turbocharger was no longer available, use of tlie 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 tough 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 . . . . . ASREQUIRED
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 The Safety Board further believes that if a specification for such information were included in GAMA Specification No 1, most aircraft manufacturers would adopt it

Therefore *the* National Transportation Safety Board recommends that the General Aviation Manufacturers Association:

Amend the Specification for Pilots Operating Handbook (GAMA Specification No 1) by including in Section 3 9 (g), "System Emergencies," procedures for coping with turbocharger failure (Class 11, Priority Action)(A-94-83)

Also, as a result of its investigation, the Safety Board has issued Safety Recommendations A-94-8 1 and -82 to the Federal Aviation Administration

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 actions taken as result of its safety recornmendations and 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-94-83 in your reply

Chairman VOGT, Vice Chairman COUGHLIN, and Members LAUBER, HAMMERSCHMIDT, and HALL concurred in this recommendation

By: Carl W. Vogt
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