Log 2438

National Transportation Safety Board

Washington, **D.C.** 20594

Safety Recommendation

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	IDLECUTOFF
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	ASREQUIRED
Continue Flight	LAND **AS** SOON **AS** POSSIBLE

ENGINE POWER OVERBOOST

If the turbocharger wastegate control fails in the CLOSED position, an engine power ovcrhoost condition may he 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*** he 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