SPECIAL AIRWORTHINESS INFORMATION BULLETIN

Aircraft Certification Service
Washington, DC

U.S. Department of Transportation

Federal Aviation Administration

CE-05-51
April 29, 2005

http://www.faa.gov/aircraft/safety/alerts/

This is information only. Recommendations aren't mandatory.

Introduction

This Special Airworthiness Information Bulletin (SAIB) alerts you, owners and operators of **piston multi-engine airplanes**, of a condition where you could have the inability to continue **level flight with one engine inoperative (OEI)** with a windmilling propeller.

A piston multi-engine airplane experiencing an engine failure could result in a loss of power under the following conditions:

- The pilot is unable to feather the propeller on the inoperative engine.
- The airplane is unable to maintain level flight due to the windmilling propeller.

OR

- The pilot shuts down the failed engine and feathers the propeller.
- The pilot attempts a restart of the failed engine and un-feathers the propeller using the un-feathering accumulators or starter.
- The engine fails to restart.
- The propeller will not go back into feather as the propeller windmilling speed is below the start-lock disengagement speed.
- The airplane is unable to maintain level flight due to the windmilling propeller.

Background

A Swiss-registered Cessna 421 flying in France experienced an engine failure due to a failed crankshaft. The pilot initially continued towards his intended destination, but after several failed restart attempts, he attempted to divert to another airport. The pilot stated that he was unable to restart the engine and was no longer able to feather the propeller. The airplane continued to descend until it impacted the ground.

This could have happened because:

- The pilot was not able to feather the propeller due to the friction of the failed crankshaft that quickly slowed the propeller below the start-lock disengagement speed, or

- The pilot un-feathered the propeller for the start attempts. The pilot was unable to re-feather the propeller after the re-start attempts, due to the friction of the failed crankshaft that would not allow the propeller to rotate above the start-lock disengagement speed.

Aircraft performance is determined by the amount of available power and the total aircraft drag. The amount of available power in excess of the aircraft total drag determines the aircraft's ability to climb. The loss of an engine in a piston multi-engine airplane

dramatically reduces the amount of available power. The relationship of drag versus available power is shown in Figures 1 and 2.

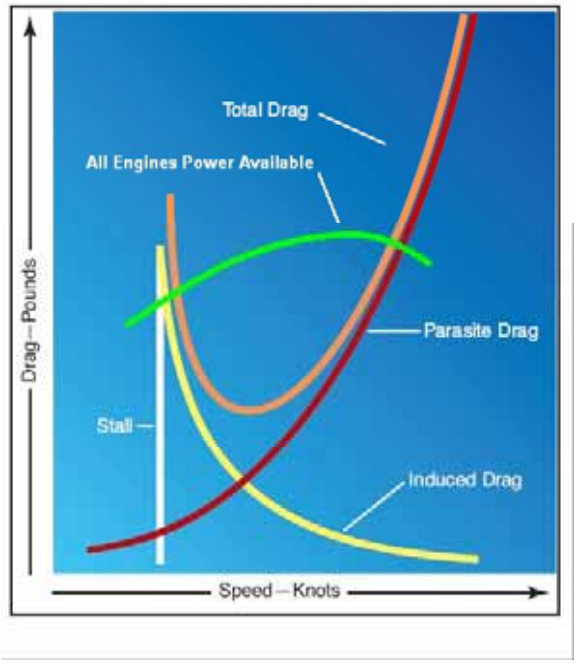

Figure 1: All Engines Operating

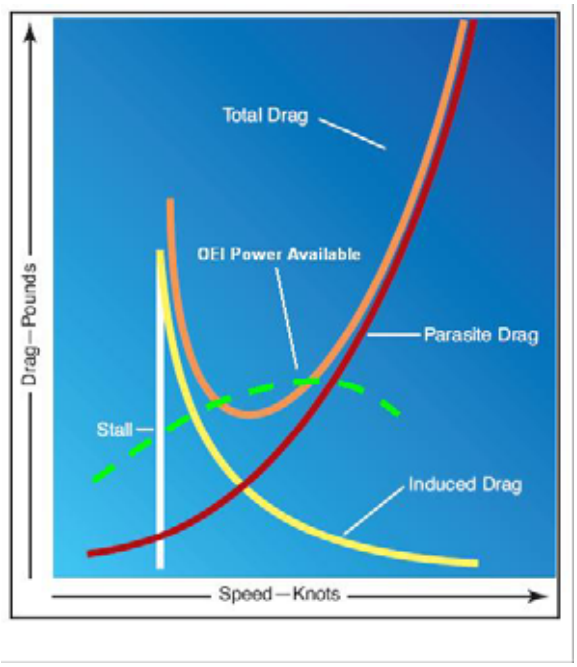

Figure 2: One Engine Inoperative

The OEI climb performance charts are contained in the **PERFORMANCE** section of the Pilot's Operating Handbook (POH). The OEI climb performance is affected by weight, altitude, temperature and aircraft configuration. The usual aircraft configuration for maximum OEI climb performance is as follows:

- Operating engine is at full throttle
- Landing gear is up
- Flaps are up
- Inoperative engine is propeller-feathered
- Wings are banked 5° towards operative engine

There are areas of the aircraft performance envelope where the airplane's climb performance is negative. A survey of the Pilot's Operating Handbook (POH) for several piston multi-engine airplanes revealed that that the following warning, or one similar, is contained in the **EMERGENCY PROCEDURES** section:

WARNING
Level flight may not be possible for certain combinations of weight, temperature and altitude.

The inability to maintain level flight is exacerbated by a windmilling propeller.

A windmilling propeller is a large producer of parasitic drag. The effect of a windmilling propeller on parasitic drag and total aircraft drag are shown in Figures 3 and 4.

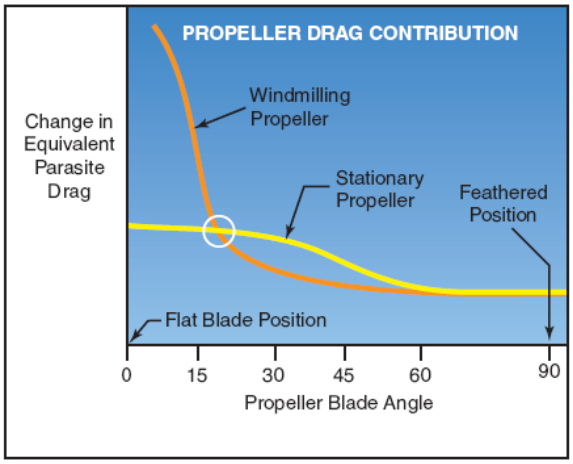

Figure 3: Windmilling Propeller Parasitic Drag

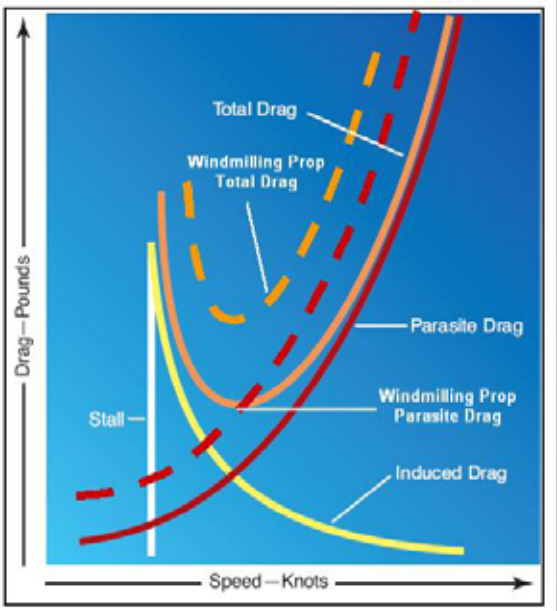

Figure 4: Windmilling Propeller Total Drag

In the case of a piston multi-engine airplane, the effect of a windmilling propeller is to increase the total drag of the airplane and induce an asymmetric drag about he yaw axis. The summation of the effects of OEI with a windmilling propeller are shown in Figures 5 and 6.

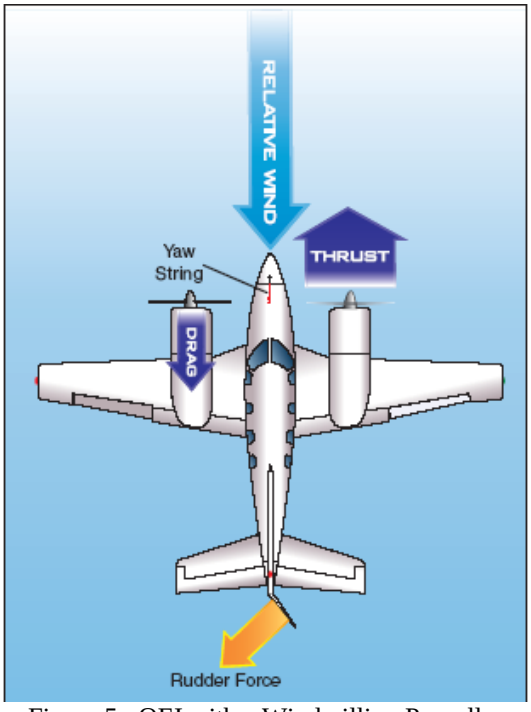

Figure 5: OEI with a Windmilling Propeller Asymmetric Drag

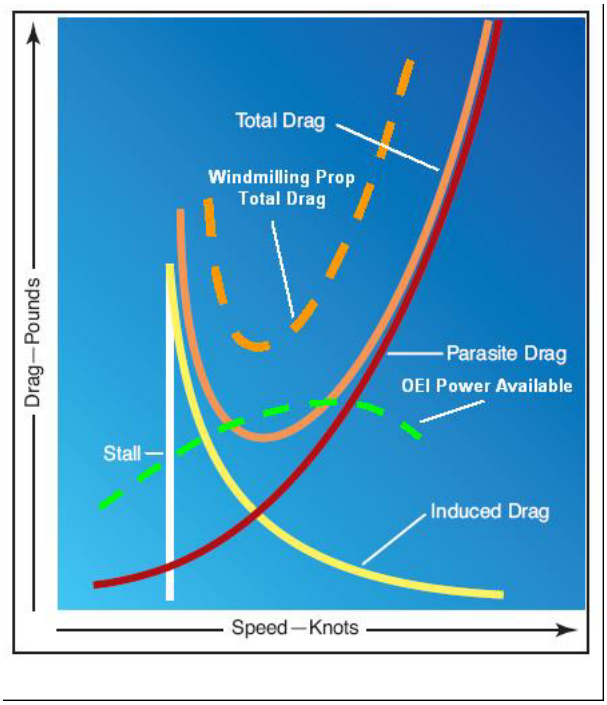

Figure 6: OEI with a Windmilling Drag and Power Effects

The net result of a windmilling propeller is the aircraft total drag exceeds the power available, thus the aircraft is no longer able to sustain level flight.

Our concern is with the pilot decisions about OEI operation.

The inability to feather a propeller on the inoperative engine can be a result of improper maintenance, failure of the propeller control, internal failure of the propeller components, or the propeller windmilling speed being below the start-lock disengagement speed.

A survey of various airplanes' Pilot's Operating Handbooks did show that there is guidance to land as soon as practicable following an engine failure; however, there wasn't definitive guidance when the pilot should conduct a re-start. One Pilot's Operating Handbook in the survey addressed the issue with the following statement:

CAUTION

The pilot should determine the reason for engine failure before attempting an air start.

Recommendation

We recommend that you do the following about **one engine inoperative (OEI) operation**:

1. Land as soon as practicable following an engine failure.
2. Once an engine is shut down and its propeller feathered, avoid un-feathering the propeller unless you know why the engine failed, are certain that the problem is resolved, and are reasonably confident that the engine can be re-started.

For Further Information Contact

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