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Timothy W. Monville
Sr. Air Safety Investigator
Office of Aviation Safety-Eastern Region

Date: April 25, 2024

Subject: ERA22FA387, Propeller Blade Angle vs. Engine RPM

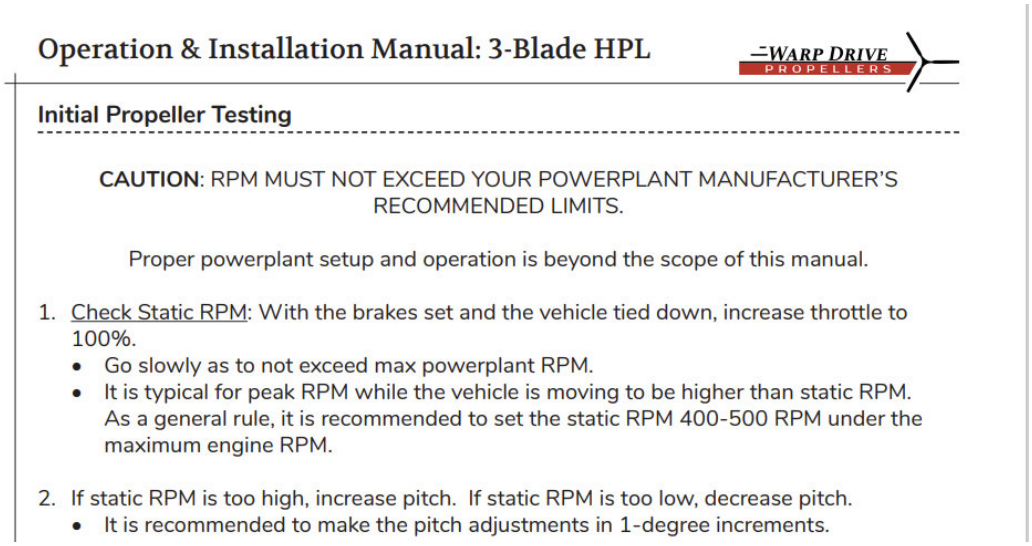
Contact: Dale Kjellsen, President of Warp Drive, Inc.

As part of the investigation, Mr. Dale Kjellsen, President of Warp Drive, Inc., was contacted on April 25, 2024. He was called at [redacted] He provided an e-mail address of [redacted]

At the beginning of the conversation he was advised that I was investigating a fatal weight-shift control (WSC) aircraft accident and had some questions regarding the propeller and engine combination and static rpm and takeoff or dynamic propeller rpm. He was informed that the accident aircraft was powered by a Rotax 912UL engine, and equipped with a Warp Drive, Inc., 68L-NX-HPL3 (three-bladed standard) propeller[1].

With respect to the procedures for setting propeller blade angle to achieve specified takeoff rpm, 5,800, he referred to the Operation and Installation Manual:3-Blade HPL document on their web site. An excerpt of that document specified that for a general rule, to set the propeller blade angle to achieve a static rpm of between 400 and 500 under the maximum engine RPM (Figure 1). He indicated that with the engine and propeller combination, if an owner/operator/pilot wanted to achieve 5,800 rpm during takeoff, the likely static rpm setting would be about 5,600. He cautioned that if 5,800 was the desired takeoff rpm, set the propeller blade angle initially high to avoid an engine overspeed condition during takeoff. He also indicated that he is aware that some owner/operators of aircraft choose to set the propeller blade angle at a higher setting which reduces the engine rpm to a value lower than the specified takeoff value as if de-rating, or loading the engine.

[1] This propeller was ground adjustable.



Operation & Installation Manual: 3-Blade HPL

WARP DRIVE PROPELLERS

Initial Propeller Testing

CAUTION: RPM MUST NOT EXCEED YOUR POWERPLANT MANUFACTURER'S RECOMMENDED LIMITS.

Proper powerplant setup and operation is beyond the scope of this manual.

1. Check Static RPM: With the brakes set and the vehicle tied down, increase throttle to 100%.
   - Go slowly as to not exceed max powerplant RPM.
   - It is typical for peak RPM while the vehicle is moving to be higher than static RPM. As a general rule, it is recommended to set the static RPM 400-500 RPM under the maximum engine RPM.
2. If static RPM is too high, increase pitch. If static RPM is too low, decrease pitch.
   - It is recommended to make the pitch adjustments in 1-degree increments.

Figure 1: Excerpt from Propeller Operation & Installation Manual.

He indicated that the propeller, serial number N20745 was sold to an individual in Minnesota. He also indicated that in June 2021, the aircraft owner/pilot bought a protractor from them.

He was asked the following questions:

Is there a minimum propeller blade angle when trying to achieve takeoff rpm?
No. This is not necessary because a blade-pitch setting that is too low would result in a lack of vehicle motion and/or the engine RPM max-limit being exceeded.

Do you know the airspeed value where the maximum propeller rpm would occur for takeoff?
No. The airflow around the vehicle, engine power output, blade pitch, vehicle weight, atmospheric conditions, etc.. make knowing this value very difficult.

Can you determine the loss of propeller thrust for a certain rpm during flight?
No. Thrust varies with airspeed. The airflow around the vehicle, engine power output, blade pitch, vehicle weight, atmospheric conditions, etc.. make determining this value very difficult.

The DRAFT Memorandum For Record was e-mailed to him for review on April 25, 2024. He replied the same day at 2111 EDT, with comments that were incorporated into the digest. The FINAL version was e-mailed to him on April 29, 2024.