E-PROPS PROPELLERS EFFICIENCY

A propeller must :
- be exactly adapted to the engine, its moment of inertia and the max RPM
- give the best thrust
- be ultra-light to be as reactive as possible, and to guarantee a long life to the engine
- be as silent as possible

The E-PROPS propellers are very different from the other propellers. They have special profiles, patented designs (example SCIMITAR), and special position of the blades to reduce the blades drag, so to obtain the best thrust.

1- Propeller efficiency

Propulsion efficiency factor is calculated from propeller diameter and engine power. This efficiency factor is the max achievable propeller efficiency. Then, it is up to the propeller designer to come closer to this limit.

Jérémie Buiatti is the head of the E-PROPS design department. He designs propellers since 2007 and has implemented the internal software *LUKY*.

This very complex software performs a detailed aerodynamic flows analysis and a mechanical behavior analysis of the propeller.

This software allows the team to imagine new propellers concepts, by using particular geometries and profiles developed inhouse. That is why E-PROPS propellers are very different from other propellers proposed at present on the market.

When we speak of efficiency, we obviously speak of thrust and also of fuel consumption.
A propeller which has a better efficiency allows to reduce the fuel consumption of the engine.

The E-PROPS propellers have a thin chord (chord = width of the blade). A thin chord generates less drag than a wide chord and leads to a better efficiency of the propeller, a better thrust, makes less noise and reduces fuel consumption.

On average, the use of a E-PROPS propeller allows to save between 6 and 9% of fuel at the same engine RPM (it depends on the blades geometries).

A best efficiency, it is also a less high noise level.

2- Number of blades

With E-Props designs and profiles, for the same diameter, more blades = more efficiency.
A 3-blade has a best efficiency (= a best thrust) than a 2-blade.

Example :
Static thrust measured with propellers for Rotax 912S engine red 2,43, all in diameter 170 cm =>
- 2-blade : 239 kg
- 3-blade : 254 kg
- 4-blade : 262 kg
- 5-blade : 272 kg

=> Please note :
This is true if the blade form is exactly adapted to the configuration : a blade of a 2-blades propeller mounted on a 3-blades or 4-blades hub would not give the best performances.

The "universal" blade for any configuration does not exist. Every propeller has a dedicated blade geometry, or the efficiency would not be the best.

3- Propeller Diameters

The increase of the diameter is better for the efficiency, because of the improvement of the pusher efficiency.
More static thrust is obtained with a propeller with a diameter of 180 cm than with a propeller with a diameter of 155 cm.
With the same number of blades, the thrust gap depends on the diameters and on the engine + reducer.

Examples :
Thrust measured with propellers for Rotax 912S engine gearbox 2,43, all 3-blade =>
- diameter 155 cm : 235 kg
- diameter 180 cm : 264 kg

=> Please note :
One data has to be verified : the peripherical speed (on tips) must not exceed Mach 0,75 (900 km/h), or the noise would be too high.

E-Props 4-blade propeller diameter 203 cm

4- Propellers 2-blade / 3-blade

Some people are saying that the wake of the third blade of a 3-blade propeller is crossing the wake of the 2 other blades, and this phenomenon decreases the efficiency of the propeller.
That's wrong.
The wakes of the different blades cannot crossed themselves. It is physically impossible, because the blade's wake is sweeped away by the wind.

Demonstration :

here the condensation trails materialize the wakes

There's only one case where the wakes of the blades cross: when the pitch of the blades on variable-pitch propellers is reversed. This is known as "reverse thrust". It's a device for directing the thrust of an engine forward, in order to slow down the aircraft and reduce braking distances on landing. During reverse thrust, the sound of the blades passing in their own wake is very characteristic.