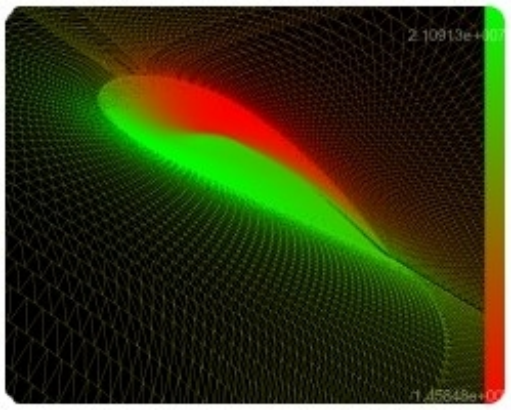
DESIGN of E-PROPS PROPELLERS

1 – Propellers Design

The design department establishs the specifications of each propeller by taking into account :
- characteristics of the engine (power, torque, thrust, RPM)
- airframe which is going to be equipped with this optimized engine + propeller (tractor or pusher configuration, aerodynamic characteristics, wings / fuselage interaction...)
- required performances of the aircraft
- conditions of use and missions of the aircraft

E-PROPS propellers are designed to be as light as possible and as strong as possible. They must deliver the best possible performance, with low noise levels.

The team uses successful CAD softwares, and have developed an iterative program called LUKY.



2 - Optimization process

To optimize a propeller, for a specific engine and a specific aircraft, is a complex task because :

- flight speed, engine RPM and power are compulsory
- propeller diameter is limited either by aircraft geometry (ground clearance or fuselage clearance) or by peripheral speed (supersonic issues).

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.

The available optimization parameters are :

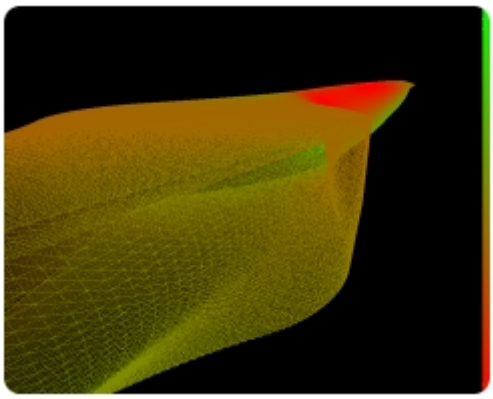
- number of blades
- blade loading distribution vs span
- chord distribution
- pitch distribution
- airfoil vs span

To increase number of blades allows reducing lift of each blade. So the induced drag of each blade is reduced. But, with a constant chord, this increases the friction drag. And if chord is reduced, Reynolds number decreases and airfoils characteristics are degraded. Use of small chords also leads to mechanical strength issues.

When looking for the optimum load distribution, induced drag must be taken into account. For example, blade tip cannot generate high lift without high induced drag.

Chord optimization leads to use each airfoil at best lift/drag ratio, without forgetting Reynolds variation effects and checking airfoil matching to CL conditions (Reynolds and Mach).

Pitch distribution is used to maintain an optimum lift coefficient to each airfoil in order to get the chosen lift distribution with the optimized chord and airfoil distribution



Linked to this complex process, propeller design is an iterative calculation. The modification of one parameter leads to change the others.