Important Values:
Diameter: Size of the propeller (governs the cylinder of air passing through it)

Pitch: The distance the propeller travels in one rotation

Pitch Speed: Most efficient speed / RPM for a propeller where the airspeed and rotational speed match so that it creates an effective zero angle of attack on the airfoil (greatest lift/drag)

Advance Ratio: The ratio of the speed of the aircraft to the tip speed of the propeller. Essentially, how far the aircraft moves with each revolution of the propeller

Important Considerations:
Diameter of propellor: The max propellor diameter possible will be based on the amount of clearance the plane has above the ground as well as any limitations based on the current year's challenge.

Weight: Having an optimal center of mass is important in having a stable plane, meaning the propeller's weight has to be taken into account when designing the rest of the plane.

Understanding a Propeller's Name

All propellers will have a name that is composed of one number, followed by an "x" then another number and optionally some will have a letter at the end (Such as "11x10E"). The first number represents the diameter of the propeller and the second number represents the pitch which is a rough estimate of how far forward the prop will travel through the air per revolution (Image below). And the letter at the end (E in this case) is a descriptor that tells you a little more information about the prop.

In our example of an "11x10E" propellor, the propellor has a diameter of 11 inches, pitch of 10 inches per revolution and the "E" means it is for electric planes only.

Visualization of pitch

List of Propeller Letters
E: "Electric only". These propellers are not designed to be used with gas powered aircrafts either due to their size or material and thus must be used for electric aircrafts. However, for our purposes we don't have to use props with "E" at the end.
P: Stands for "Pusher", meaning the propellor will rotate in the opposite direction and thus must be mounted in the rear of the aircraft

Useful Equations:

Advance ratio (J): J = $\frac{V}{nD}$

V: the freestream fluid velocity in m/s. In other words, typically the true airspeed of the aircraft
n: the rotational speed of the propeller in revolutions per seconds
D: the propeller's diameter in meters

Momentum theory thrust: $T = \dot{m} * A_{disk} * (V_{out} - V_{in})$

$\dot{m}$: Mass flow rate, or the amount of mass flowing through the propeller over time

A_{disk}: Diameter of the propeller

V_{out}: Velocity of the air exiting the propeller

V_{in}: Velocity of the air entering the propeller (the aircraft's true airspeed)

Power, Thrust, Torque Coefficients

Coefficient of Thrust: $Ct = \frac{T}{\rho n^2 D^4}$

Coefficient of Power: $Cp = \frac{P}{\rho n^3 D^5}$

Coefficient of Torque: $Cq = \frac{Q}{\rho n^2 D^5}$

Q: Torque
P: Power
T: Thrust
ρ: atmospheric density
n: Revolutions per second
D: Diameter of the propeller

Thrust can be roughly estimated as a linear equation, decreasing from static thrust down to zero at its max airspeed (https://www.electricrcaircraftguy.com/2013/09/propeller-static-dynamic-thrust-equation.html)

Quick and easy calculator (not very scientific) http://www.rcpro.org/rccalc/PitchSpeed.aspx