

# Propeller Design Research Part 2

Date: 09/17/24

## Meeting goals

- Calculator for approximate propeller thrust given motor specifications
- Learn how to use a simulator to simulate propeller performance
- Compare calculator results to simulator results

## Meeting Notes

- Propeller thrust can be calculated using:
  - $\text{Thrust} = (\text{Motor power} * \text{Propeller efficiency}) / \text{Flow velocity}$
  - Source: [Propeller Performance: An introduction, by EPI Inc. \(epi-eng.com\)](http://www.epi-eng.com)
- Flow velocity can be calculated using:
  - $\text{Speed (inches/minute)} = \text{Pitch} * \text{RPM} * (1 - \text{Slip})$
  - Source: [http://dunnritepropellers.co.nz/images/prop\\_tips\\_03.pdf](http://dunnritepropellers.co.nz/images/prop_tips_03.pdf)
  - **Factors contributing to propeller slip and how to reduce propeller slip:**
    - Boat weight and design: The weight and design of your boat can affect how much resistance the propeller encounters in the water, which can impact prop slip.
    - Engine power: If your engine is producing more power than your boat can handle, it can cause the propeller to slip in the water.
    - Propeller size and design: The size and design of your boat's propeller can impact how efficiently it moves through the water and how much resistance it encounters.
    - Water conditions: Rough water or strong currents can increase the resistance your propeller encounters, which can lead to higher prop slip.
    - Source: [How To Reduce Prop Slip: Tips and Techniques For Better Boat Performance - Waves Weekender](#)
    - A slip of 1 or 100% means that the propeller will not advance in water.
    - "Calculated propeller slip within the

- range of 5% to 25% is typical and acceptable. If slip is greater than 25%, there is likely an issue with the propeller." [Prop Bite: Understanding Propeller Slip | Mercury Marine](#)
- **Propeller efficiency is related to propeller diameter.** The greater the diameter, the more efficient the propeller (The propeller will be able to move more water/ produce more thrust per revolution). But the greater the propeller diameter, the more drag. So for low-speed craft, a higher diameter propeller is preferred whereas for a higher-speed propeller, a smaller diameter propeller is preferred. [How Propeller Pitch and Diameter Affect Boat Performance \(citimarine.com\)](#)
  - "The main opportunities for propulsion efficiency improvements are in hull efficiency (typically 0.95–1.3), propeller open water efficiency (typically 0.55–0.70) and relative rotative efficiency (typically 0.98–1.07)" [Propeller Efficiency - an overview | ScienceDirect Topics](#)
- Selected motor: [APISQUEEN 70167 7.5KW internal rotor brushless waterproof motor for hydro - Underwater Thruster](#)

## What was completed?

- The calculator:  
[https://docs.google.com/spreadsheets/d/1fZU8p28u3xLca4Ge9oelJ2ioDH1f\\_wty5EOEalN\\_yU/edit?usp=sharing](https://docs.google.com/spreadsheets/d/1fZU8p28u3xLca4Ge9oelJ2ioDH1f_wty5EOEalN_yU/edit?usp=sharing)

## What is in progress?

- Learn how to use a simulator to simulate propeller performance
- Compare calculator results to simulator results

## What is the goal for the next meeting?

- Simulate a propeller and compare results with the calculator

### Images

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Revision #1

Created 6 May 2026 00:25:09 by Caicheng Li

Updated 6 May 2026 00:25:25 by Caicheng Li