

Introduction

- Demand for electrical power supply on-board sailing boats is growing rapidly.
- **SailGen**, a uniquely-designed hydrodynamic generator provides a clean, quiet and sustainable alternative to fuel-powered generators.
- Capable of providing 200 W under cruising speed using the energy carried by flowing water

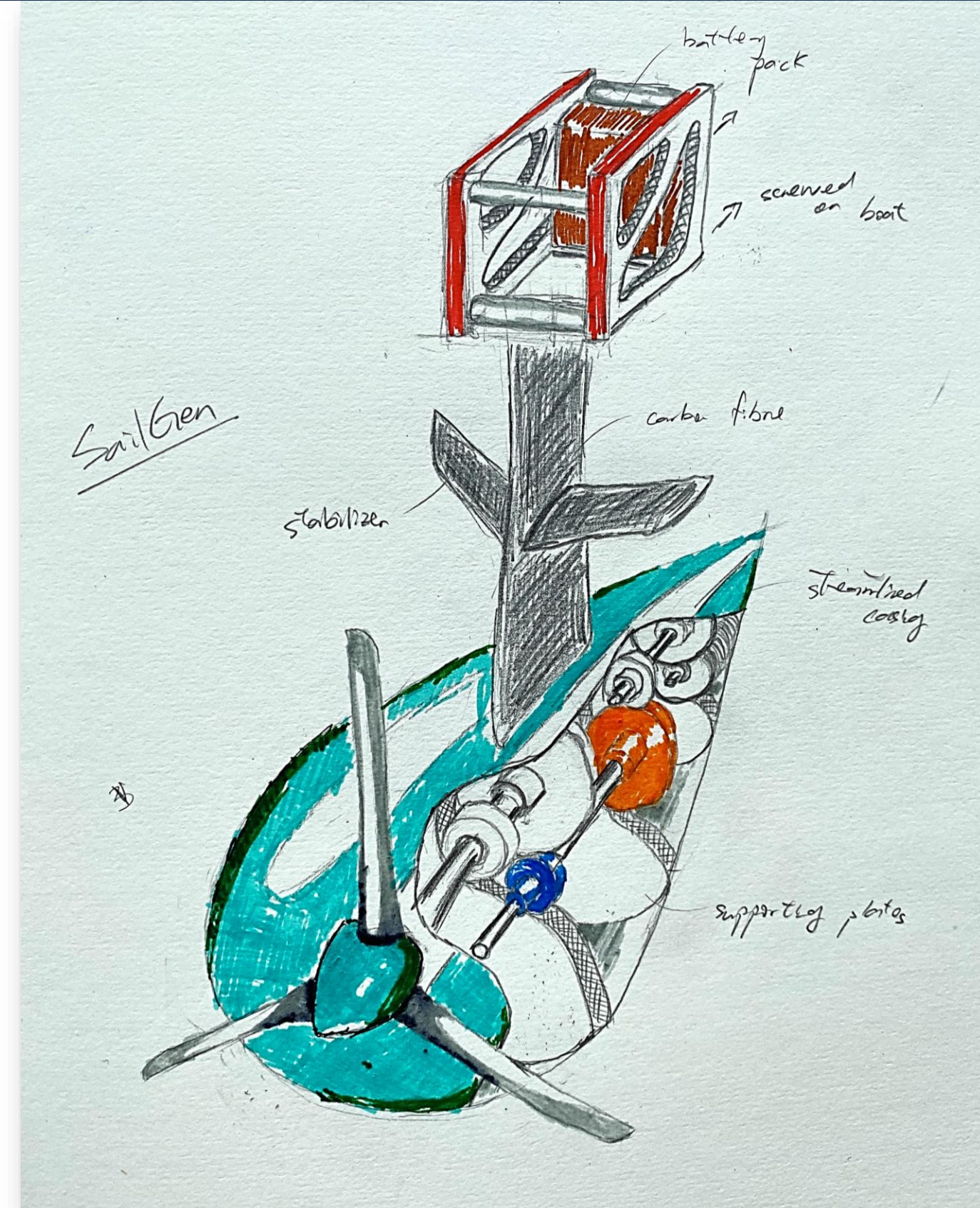
Transmission system

- Turbine material: carbon fibre epoxy matrix
- Turbine speed: ~70 RPM
- Gear ratio is calculated to be 1:219
- Triple reduction
- 1 Angular contact bearing supports in axial direction
- Gears fully constrained by keys and set screws
- Minimum shaft diameter:
turbine shaft: 14mm
intermediate shafts: 8mm
motor shaft: 6mm
- Shaft material: 316 Stainless steel
- Highly corrosion resistant
- Forged and turned, keyways milled

Overall Concept

- The assembly involves:
 1. An attachment frame
 2. A carbon fibre rod
 3. A generator pod
- The rod is hinged around the supporting frame and can be deployed with ease
- Generates in the designed range of 4-7 knots
- Electricity can be directly supplied via a management circuit or used to charge a battery
- Battery pack fitted above waterline
- Stabilizing fins on the rod to maintain a operating position in water

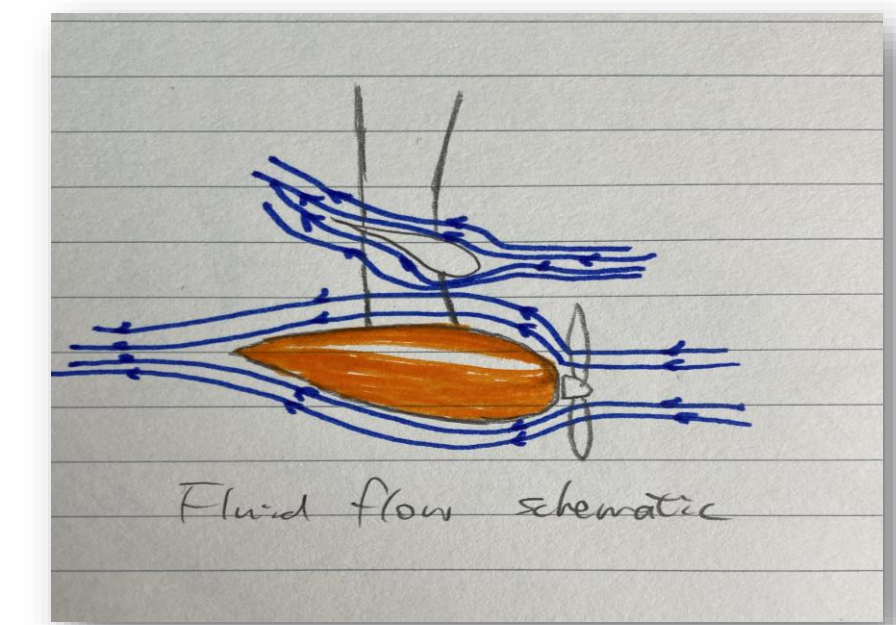
SailGen



Schematic sketch of SailGen

Casing

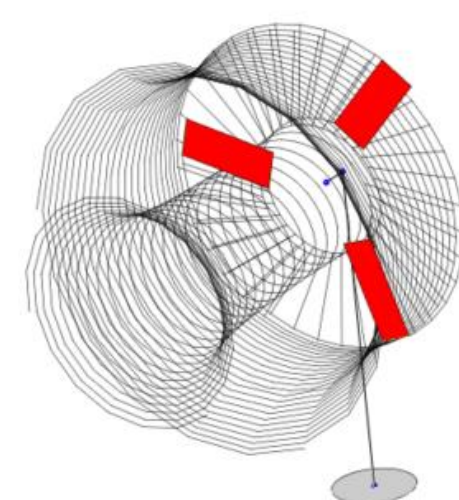
- Casted form aluminium alloy
- Lightness
- Strength
- Easy to manufacture
- Tough and ductile
- Reparable, recyclable, true eco friendly
- Supporting structures and bearing housings casted onto each half of the casing
- Rubber rings are clamped by two halves of the casing to provide seal
- Grooves for rubber rings at the edge of the casing
- Oil seal used on the rotor shaft



Fluid flow schematic

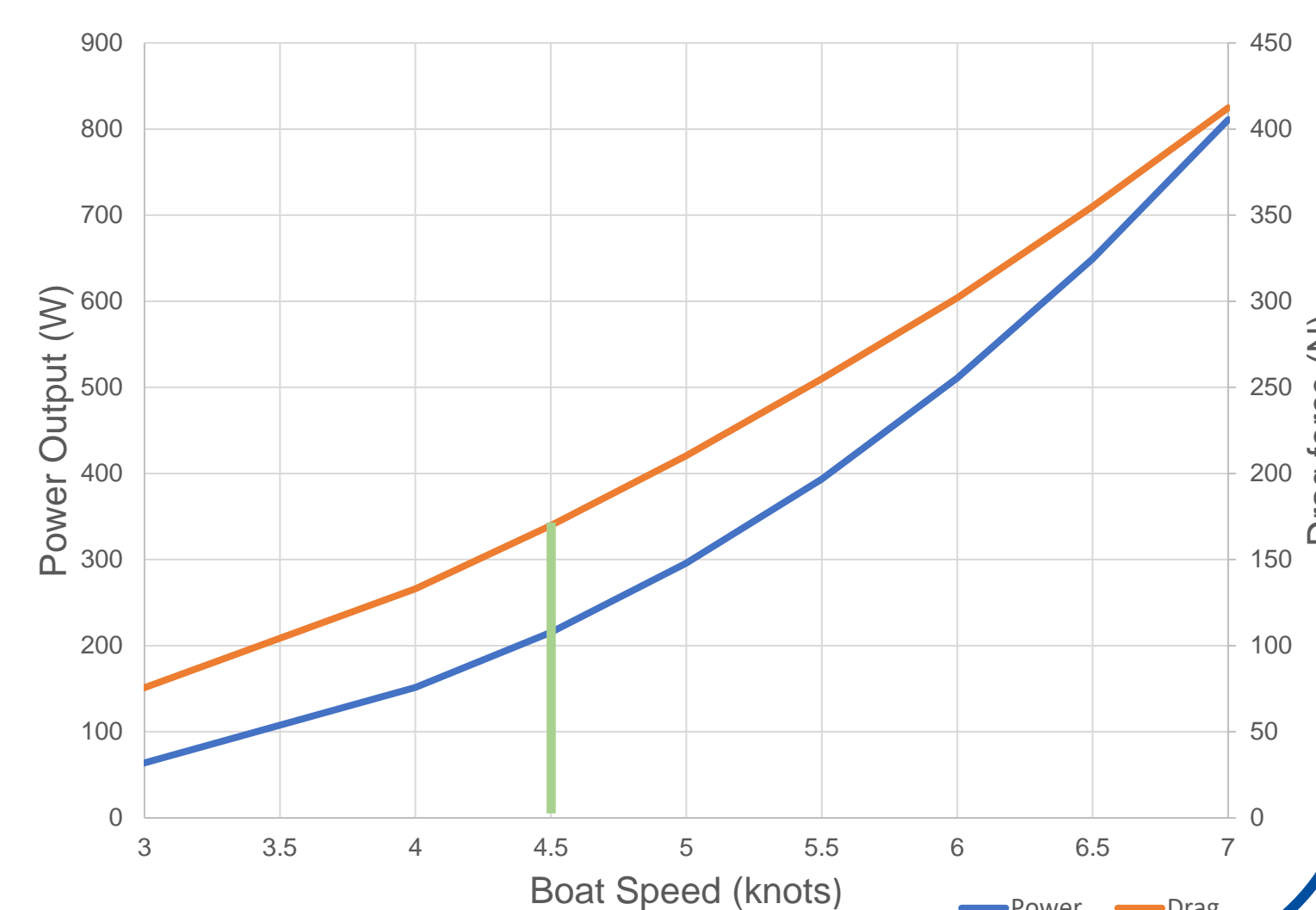
Generator Performance

- A balance of efficiency, power and drag considered
- Rated power achieved at 4.5 knots
- Electric machine: RZ- 8BAWA- AWG
- Nominal voltage: 19.8V
- operating point: ~15000RPM
- 0.26N*m
- Generator efficiency: ~60%
- boat slows down by 5-15%



flow field simulation at 5 knots

SailGen Performance

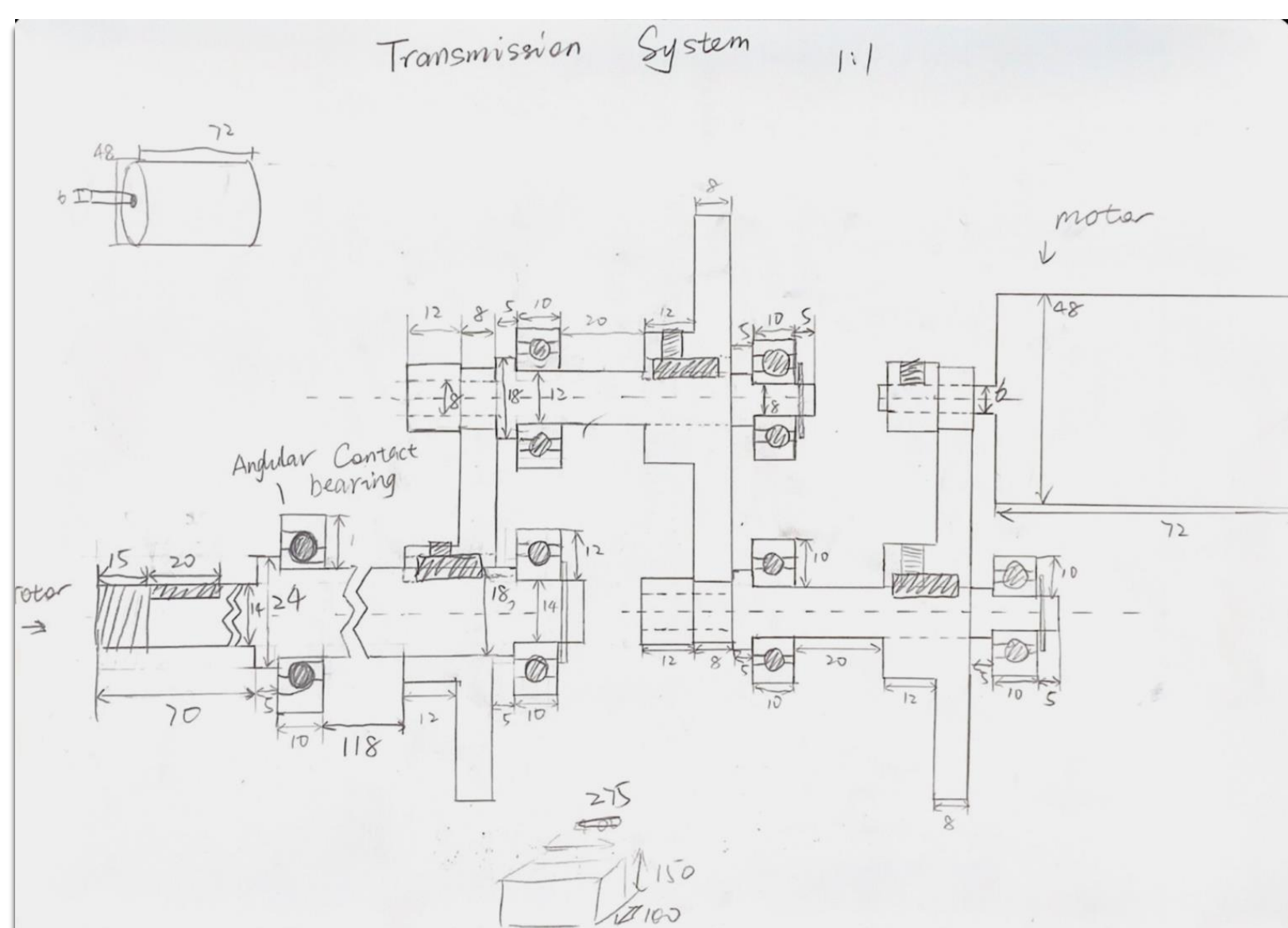


Power Output

- It was assumed the laptop, navigation system and lights would require approximately 200W to power.
- At the operating boat speed of 4.5 to 7 knots, the generator is producing over 200W.
- This ensures all devices can be powered simultaneously in this range.
- Any additional power generated can be utilised to charge the battery pack integrated into the SailGen.
- The battery pack can be used to charge and power the onboard devices when the sail-boat is stationary or at speeds below 4.5 knots.

References:

[1]: : Design Week 2021/2022 Project Assignment – Sailing vessel energy harvester. Version 1.0, 14 February 2022



Drawing of the transmission system