Engineering Portfolio

Attila Haas – 2023.10.16

Projects from Imperial College

Battery Pack for hybrid Go-Kart

Third year design make and test project Teammates: Aditya Vencatesan Basu, Edward Lee, Edward Wang

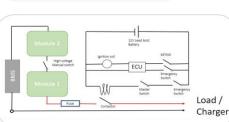
High Voltage Switch

Technical Requirements

- 1. Life: Battery needs to last 30 minutes on the track.
- 2. Safety: Withstand debris and vibration; fully insulated
- 3. Battery Voltages: In range 50-120V for motor controller and 12V battery for engine control
- 4. Temperature: To operate within 10°C to 60°C
- 5. Cost: £1000 allocated

Molicel INR-21700-P42A

- · Nominal voltage: 3.6V
- · Capacity: 4200mAh
- · Maximum current: 45A
- · Maximum temperature: 60 C



Chassis

Single-cell discharge tests were conducted to verify the cell's ability to meet the power delivery

requirements and to gain insights into the cell's thermal behaviour during high current draw

Over-charge/discharge protection

- · Current limit protection
- · Overheat protection
- · Voltage balance between cells

Battery Management System (BMS)

12V Lead Acid Battery

Master Switch

Contactor

· Live Bluetooth monitoring

Module test

Module discharge tests were conducted on both modules separately to examine their manufacturing quality and thermal characteristics.

Emergency

Battery Pack

Module Assembly

bolted aluminium clamps.

constraining and additional safety.

· 2 identical modules of 10S 2P connected using

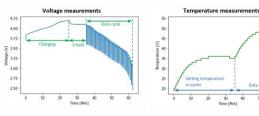
· TIG Welded H shaped Copper busbars were used

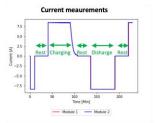
· 3D Printed insulation coupled with acrylic sheets for

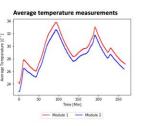
for cell connections to minimise contact resistances.



Single Cell test







My

Roles:



Project Management



Mechanical design



Engineering Analysis



Reporting

Second year design project – Spring Teammates: Alexander Christopherson, Jansen Papworth, Kayman Krishnamohan

Colours for illustrative purposes only

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Torque Transmission Coupling

Electronics

torques.

Battery and electronics

systems mounted in this

space, between ribs.

Hexagonal sections

Pin through assembly

used for torque

transmission.

to secure vertically- not

interlock to transmit high

Aim

Develop a sailing vessel energy harvester which powers onboard electrical systems including navigation, lights and a laptop while also charging a battery to allow continued use of electronics while stationary.

· 1 full week project

Target Market & Expected Use

Initially designed for 30+ ft sailboats (14% of US sailboat market). Boats this size are often used for day trips with pauses at tourist locations or scenic spots.

- · In use during comfort sailing, i.e. 5-10 knots (2.57- 5.14 m/s)
- · Suitable for use in both fresh and saltwater conditions
- · Used for 12 hours a day, 30 weeks of the year; 30ft+ sailboats often chartered for trips so in continuous use
- · Must power navigational systems (110W, 12V), lighting (122W, 12V) and a laptop (60W, 19.5V)
- · Can be mounted easily and safely by 2 people (18kg)
- · Retail price approximately £3000

Technical Specifications

- 290 W generated at 5 knots, 440 W at 10 knots using 4 RS-655VA-28118 motors.
- Battery capacity of 81 Ah.
- Made up of 81 18650 cells, in a hexagonally close packed arrangement.
- 4 stage reduction gear box using helical
- Total reduction ratio of 1:525.
- Bearing L₁₀ life 82000 hours, 33 years of expected use

Embodiment Design

Stainless steel input shaft

(CNC machined) resistant

to corrosion, high strength.

Stainless steel insert bonded

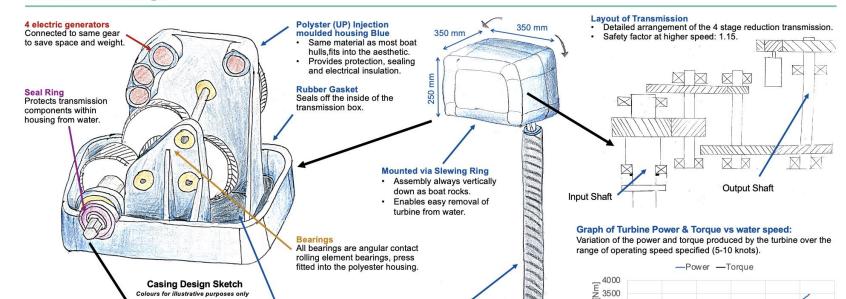
Shafts of different lengths can

be purchased and swapped to

account for different boat sizes.

fibre shaft.

with epoxy adhesive to carbon



Lower Shaft Design:

- · Designed to break under serious rock impact scenario (0.2 x Boat Weight) to prevent damage to transmission components.
- Ø 55mm ID, Ø75mm OD × 1.4m length. · 8.3 Safety factor during normal
- operation at 12 knots.
- · Carbon Fibre construction
- · Low weight (low inertia)
- · Resistant to corrosion.

Assembly drawing Colours for illustrative purposes only

Darrieus Helix Turbine Design:

Hydrofoil fins at 40° azimuthal angle minimises the initial torque required to start rotation.

Relative water speed [m/s]

- Ø 0.2m × 0.2m height to minimise cross sectional area and increase ease of handling when removing from water or cleaning.
- Fibre glass construction

₽ 3000

S 2500

□ 2000

1500 ∑₁₀₀₀

- · Easily moulded to create complex shapes.
- Inexpensive relative to other composites or polymers; cheap to replace if damaged or lost when lower shaft snaps.
- Resistant to corrosion.

Roles:



Mechanical design



Engineering **Analysis**



Reporting

Gravity light
Second year design project – Autumn
Teammates: Ore Pelumi, Ashay Dhingra, Diego Sanchez Loarte, Suheyb Adam

Problem:

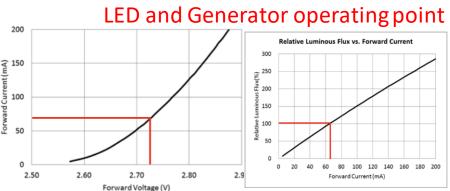
"Design, build, and test a so-called gravity-light: a reading light powered by a suspended mass that is slowly lowered, for use in locations where access to mains power and/or batteries is limited."

Group 3-month project

Solution:

Sheet metal box houses the generator, transmission and pulley to release potential energy at an optimal pace:

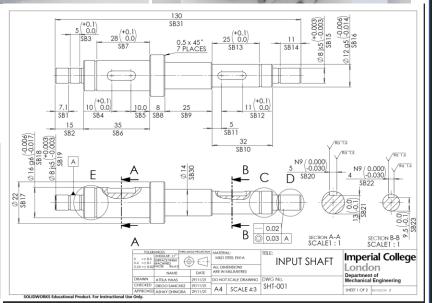
- Provides about 6 minutes of light
- Simplistic design allows for cheap manufacturing methods
- A prototype has been built in the workshop











My

Roles:



Project Management



Mechanical design



Engineering Analysis



Reporting

Problem:

"Given a support structure and motor, design an actuation method and transmission to raise 50 bricks between single floors of a house!"

• Individual, 3-month project

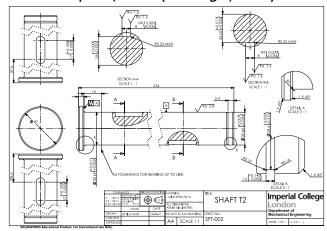
Solution:

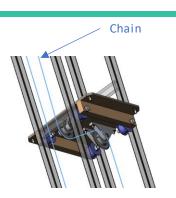
H-bridge inspired chain drive drives the platform

Leaves the packing area open, and allows for fully lowering

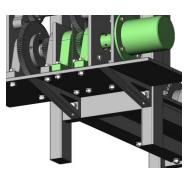
Triple reduction gearbox provides the coupling between motor and the chain

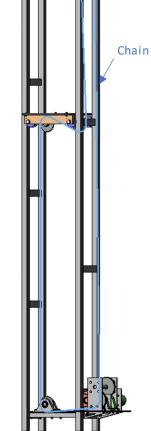
Compact, cheap design, easy to maintain

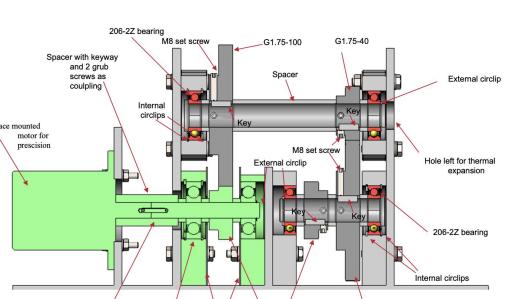




6404 bearing







G1.75-40

Thin sheet metal shielding for bearings to withstand pressure washing

G1.75-100

My

Roles:



Mechanical design



Engineering Analysis



Presenting