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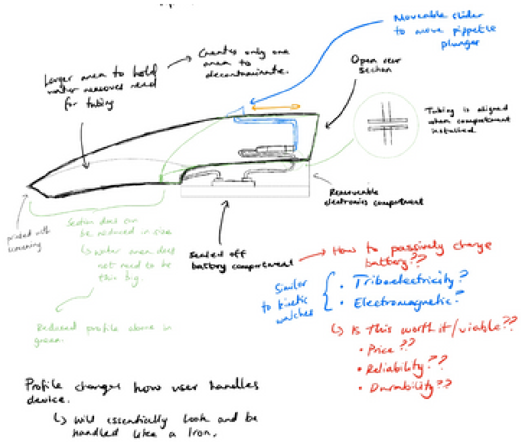
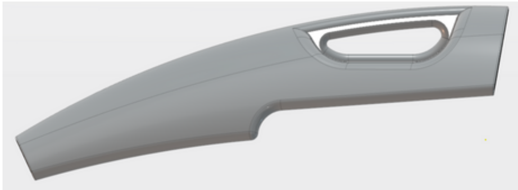
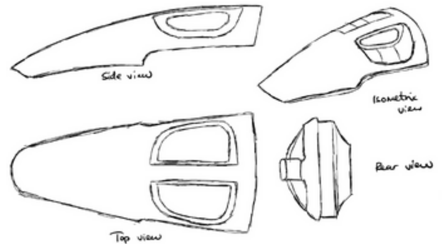
WATER SAFETY MEASUREMENT DEVICE - INITIAL DESIGN







What?

- Design the body of a device that will be capable of measuring water quality.
- Performed a **requirements analysis** to initiate the design process

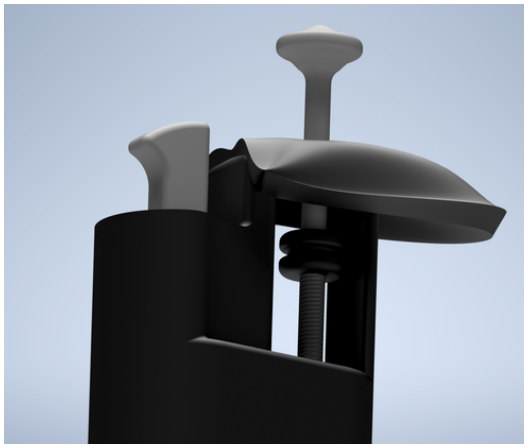
How?

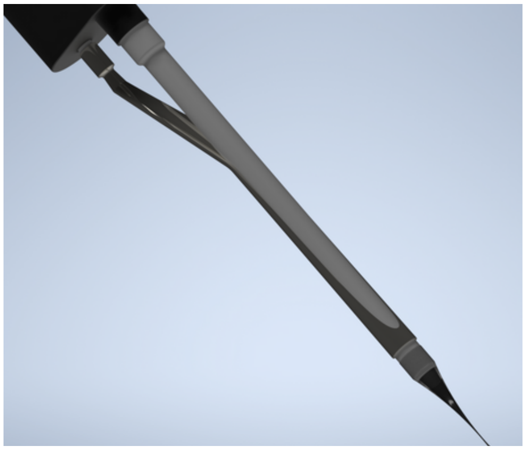
- Used **wireframe and surface design** workbench on **3DExperience CATIA** for the design.
- Inspired from design of a vacuum handle

Results

- Design was ergonomic and intuitive in how water samples were to be taken, however, porosity of PLA meant that the design was unsuitable for intended use.

WATER SAFETY MEASUREMENT DEVICE - CURRENT ITERATION





Changes

- Intake now uses a pipette-based approach.
- Moveable screw component to help dictate the amount of water intake.
- Rear push-button to disconnect pipette end to change the filter.

How?

- Used **AutoDesk Inventor** to model and model the device.

Results

- Reduced PLA contact with fluid results in a minimum of two additional **2 years** of usage of components.
- Filter in tip now easier to change.
- User has no physical contact with fluid being tested.
- Device now suited for **3D printing**.

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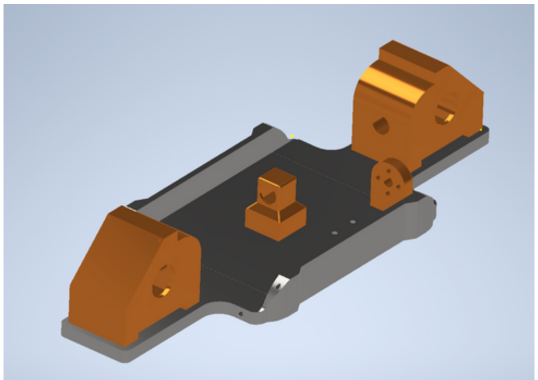
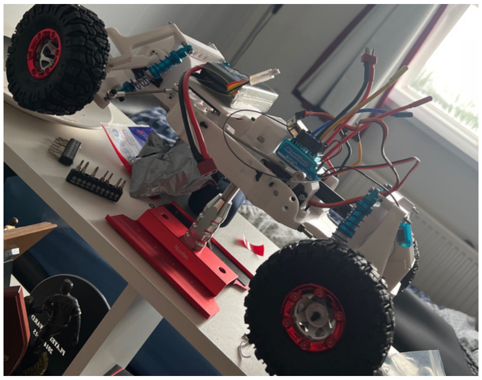
3D PRINTED RC CAR





What?

- Develop a working transmission and suspension system for a 3D-printed RC car.
- Minimise weight and filament usage.

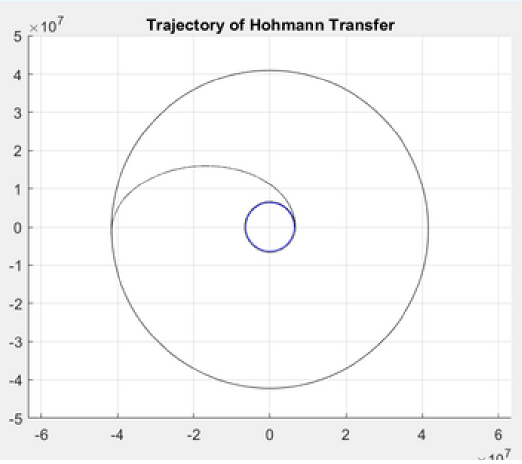
How?

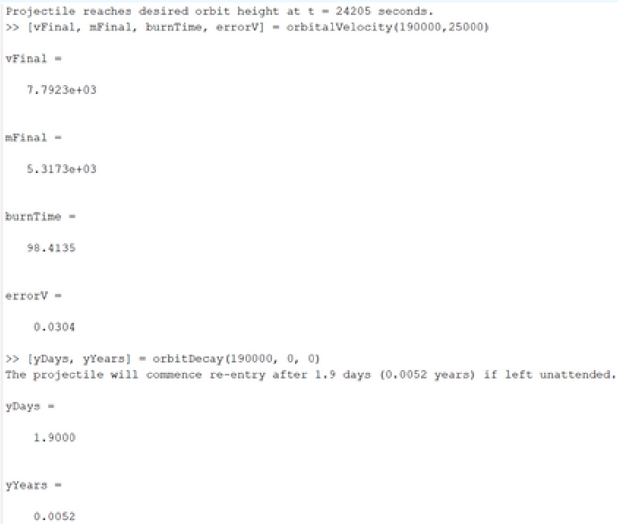
- Used **AutoDesk Inventor** to create and develop parts.
- Used **AutoDesk Nastran** and **Generative shape design** to optimise parts for specific uses.

Results

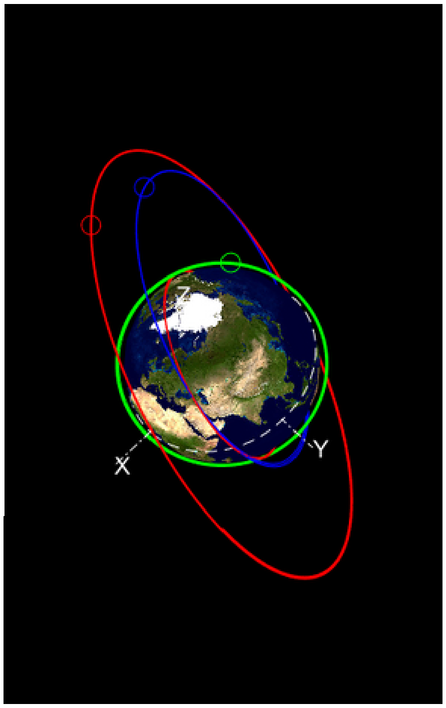
- Reduced initial vehicle weight by 5%.
- Created a working transmission and suspension system.

MATLAB SPACECRAFT MANOEUVERING





```
Projectile reaches desired orbit height at t = 24205 seconds.
>> [vFinal, mFinal, burnTime, errorV] = orbitalVelocity(190000,25000)

vFinal =

   7.7923e+03


mFinal =

   5.3173e+03


burnTime =

   98.4135


errorV =

    0.0304

>> [yDays, yYears] = orbitDecay(190000, 0, 0)
The projectile will commence re-entry after 1.9 days (0.0052 years) if left unattended.

yDays =

    1.9000


yYears =

    0.0052
```



What?

- To calculate accurately how a projectile would manoeuvre in space and visualise the trajectories in 3D.
- Limit future manoeuvres due to the propellant use in past manoeuvres.
- Account for orbital decay during circular orbit.

How?

- Used past knowledge of **orbital mechanics/astrodynamics** and the **Runge-Kutta** method to calculate state derivatives.
- Mathematically determined expected values before verifying them on **MATLAB**.

Results

- 3D visualisation plot of orbits and transfer manoeuvres in script '3DCircOrb'.
- Calculated possible future manoeuvres in 'orbVelocity' script.
- Made assumptions and performed a Hohmann Transfer manoeuvre.
- Used and modified some **MATLAB** built-in functions to such as 'comet' and 'comet3'.

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SNOWMOBILE SHAFT DESIGN

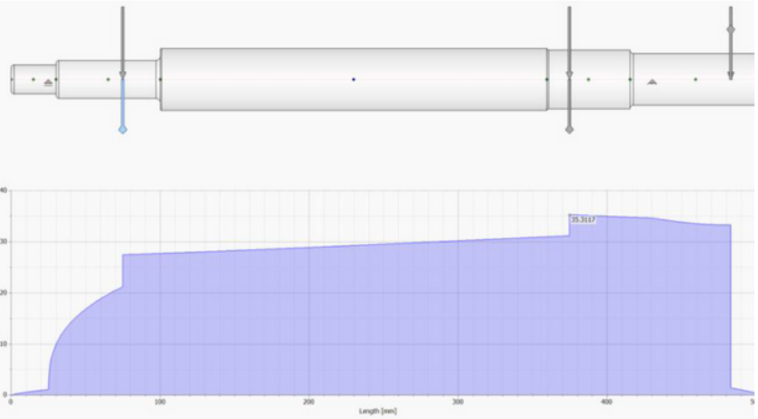


Figure 10 – Ideal diameters at different lengths along the shaft

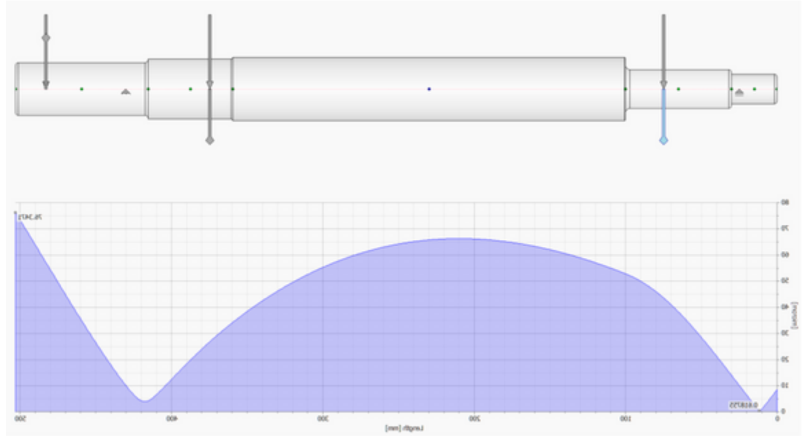


Figure 11 – Shaft deflection

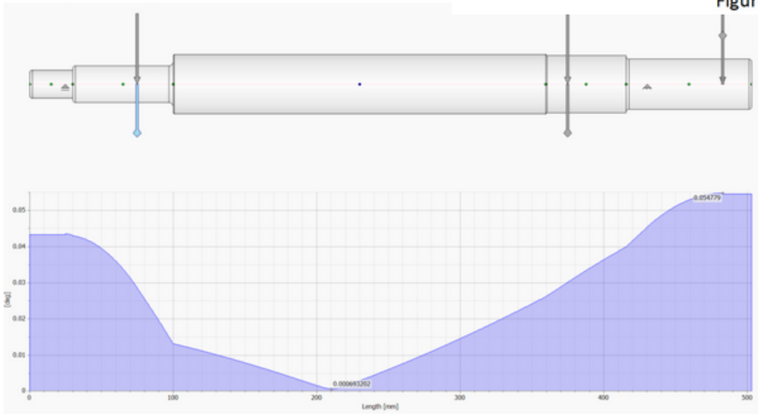


Figure 12 – Shaft deflection angle

What?

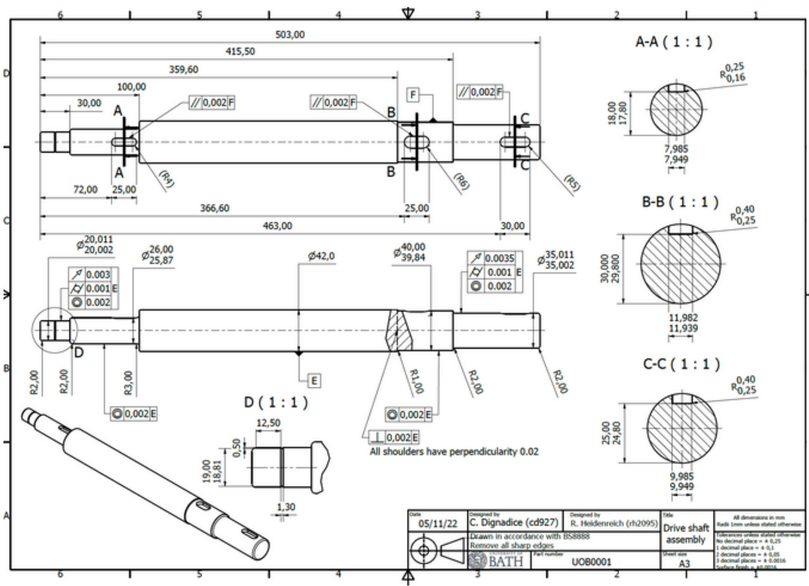
- Design a snowmobile shaft that adheres to the dimensional constraints set.
- Ensure that shaft components are fully located and if not, give justifications.
- Give justifications for all design choices made.

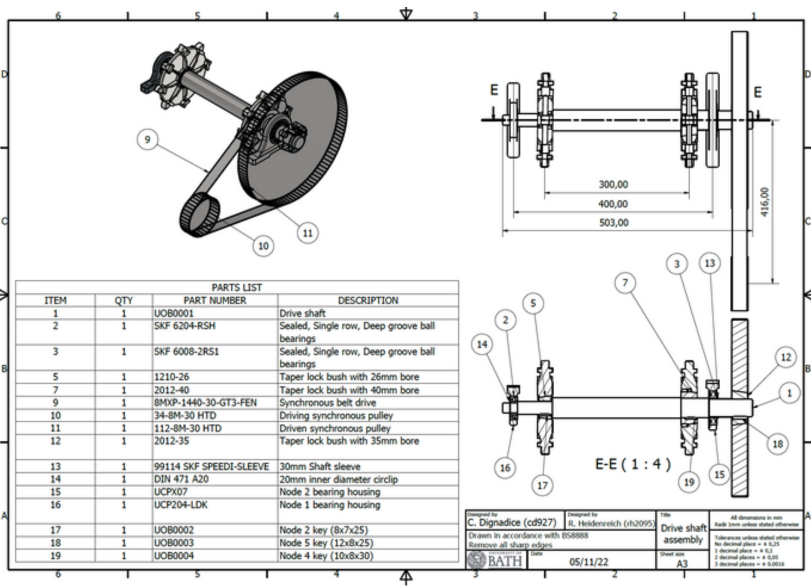
How?

- Created an initial design and further iterations using **AutoDesk Design Accelerator**.
- Calculated values for varying graphs such as deflected, optimal diameter, bending moment, shear stress and torque.

Results

- Successfully created the design of a shaft which could withstand varying loads.
- Decreased carbon emissions from the initial concept by 24%.
- Produced accurate part and assembly drawing with suitable tolerances.





PARTS LIST

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	UOB0001	Drive shaft
2	1	SKF 6204-RSH	Sealed, Single row, Deep groove ball bearings
3	1	SKF 6008-2RS1	Sealed, Single row, Deep groove ball bearings
5	1	1210-26	Taper lock bush with 26mm bore
7	1	2012-40	Taper lock bush with 40mm bore
9	1	8MXP-1440-30-GT3-FEN	Synchronous belt drive
10	1	34-8M-30 HTD	Driving synchronous pulley
11	1	112-8M-30 HTD	Driven synchronous pulley
12	1	2012-35	Taper lock bush with 35mm bore
13	1	99114 SKF SPEEDI-SLEEVE	30mm Shaft sleeve
14	1	DIN 471 A20	20mm inner diameter circlip
15	1	UCPX07	Node 2 bearing housing
16	1	UCP204-LDK	Node 1 bearing housing
17	1	UOB0002	Node 2 key (8x7x25)
18	1	UOB0003	Node 5 key (12x8x25)
19	1	UOB0004	Node 4 key (10x8x30)