

UWTSD

Wales Institute of Science and Art



Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

Engineering Project Technical Report
Workshop and Practice ACHA4011

Rhodri Jones

2305734

Contents

Chapter 1 – Introduction.....	i
Chapter 2 – Health & Safety and Risk Assessments.....	ii
Chapter 3 – Engineers Role in society.....	iv
Chapter 4 – Problem Solving.....	v
Chapter 5 – Team structure	vi
Chapter 6 – Personal development plan	viii
Chapter 7 – Conclusion	x
References	xi

Chapter 1 – Introduction

This technical report discusses many areas of what it is to be an engineer. It will go over health and safety, team work, problem solving, an engineer's role in society and personal development plans.

Chapter 2 – Health & Safety and Risk Assessments

The Health and Safety at work act 1974 is a framework for companies to follow and applies to all workplaces such as offices, factories and construction sites. The HSWA 1974 also acts as protection for employees and companies alike, to limit harm and injury in the work place.

Companies must follow the HWSA 1974 act and ensure all employees are aware of what it means, guaranteeing the protection of all stakeholders. The company must also make sure they are aware that should anything happen, they could be held responsible for any injury or misuse of machinery etc.

The act ensures that workplaces are made as safe as possible. Employers are required by law to provide safe work environments for all employees and ensure all equipment is safe to use and is regularly tested by inspectors.

In his publication 'Health and safety for engineers', M Barnard (1998, p.57) states that "A hazard is the potential for harm. Vehicles travelling on a road are a hazard, as is coffee spilled on a tiled office floor." He also defines a risk as "hazard effect (severity) x Likelihood of occurrence."

The lathe in the machining workshop, on IQ campus, can be extremely dangerous if misused without taking the necessary precautions for the users' safety. The correct PPE (personal protective equipment) must be worn by the user to ensure their safety when operating a lathe.

PPE that should be worn by the user:

Minimum:

- Steel toe cap shoes/boots.
- Eye protection.

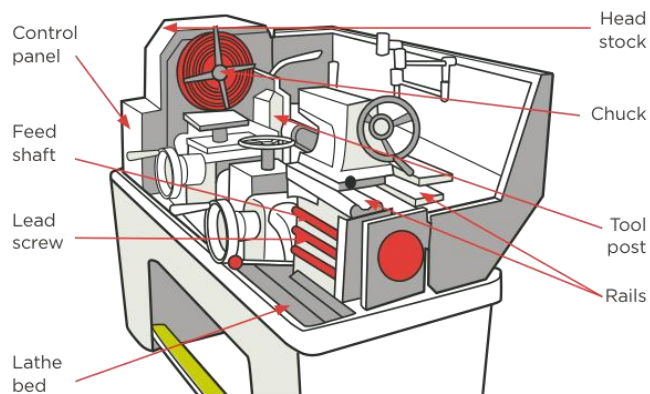
Optional:

- Gloves.
- Ear protection.

If the correct PPE is not worn, injuries can occur, some can be severe. Injuries can include deep cuts, bruising, loose hair or clothing getting caught by the spinning and moving parts, fractures or even minor amputations, such as having a finger amputated from the velocity of the spinning lathe.

Proper precautions and training should be administered before operating a lathe. The user should be trained by a professional on how to use all aspects of the lathe thoroughly and before use. Training should include how to use the lathe, how to change speeds and gears, how to adjust the cutting tools, how to adjust the piece to be cut, how to use the emergency brake and how to avoid injury while using a lathe. The user should also be aware what every part of the lathe does before using the machine.

An inbuilt safety precaution of the lathe is the shield that is lowered over the chuck to stop it from spinning while its up. It must be lowered to able to use the lathe. The shield prevents swarf and other debris from being propelled at the user.



This diagram is very useful as it informs the reader of all the necessary parts of a lathe. Every model of lathe can vary so it is the users' responsibility to ensure the diagram they are using is accurate to the model of lathe they are operating.

Figure 1 Diagram of parts of a lathe, worksafe.govt.nz, 5/9/2017

Chapter 3 – Engineers Role in society

Two organisations available to Professional Engineers are The Engineering Council and the Institution of Mechanical Engineers.

Each of these organisations has a code of conduct:

Institution of Mechanical Engineers (IMECHE)

IMECHE state that they have a code of conduct to cover all elements that need to be adhered to by their professional members.

Code of conduct:

<https://www.imeche.org/about-us/imeche-governance/governance-and-finance-reviews/code-of-conduct-explained>

https://www.imeche.org/docs/default-source/1-oscar/About-us/governance/code_of_conduct_02_03_02.pdf?sfvrsn=2

The Engineering Council

Code of conduct:

<https://www.engc.org.uk/media/4352/guidance-for-institution-codes-of-conduct-2017-1.pdf>

<https://www.engc.org.uk/guidance>

<https://www.engc.org.uk/sustainability>

<https://www.engc.org.uk/ethics>

Within this organisation there are two documents which include both Sustainable and Environmental guidance, built around six principles which support Professional Engineers and Technicians.

Six principles:

https://www.engc.org.uk/media/3555/sustainability-a5-leaflet-2021-web_pages.pdf

In relation to the Motorsport industry and the engineers within it, there are several key environmental and sustainability responsibilities that are outlined by both institutions.

Both the Engineering council and the Institute for Mechanical Engineers have a commitment to:

1. Creating products and services from sustainable and environmentally friendly sources, which support the environment and the community, now and for future generations. **Currently motor vehicles are not produced using recycled or sustainably sourced materials, however the production methods and energy used in the production process are evolving and becoming more sustainable, with plans to increase this. The product lifecycle should also be a consideration, the length of time the product can be utilised as well as the end-of-life disposal of the item.**
2. Engineers must comply with legislation relating to a sustainable environment, whilst developing sustainable thinking in all areas and continue to develop and build knowledge

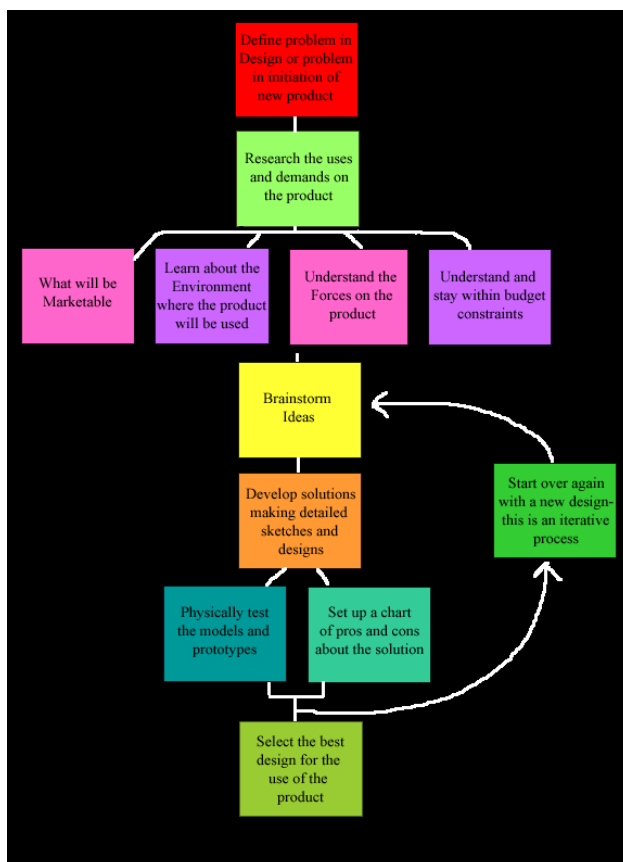
and exceed the targets. – The organisations have committees set up to develop the policies relating to the industry, which aim to achieve targets set by the Climate Change committee to achieve net zero by 2050.

3. Any detrimental effects on the surrounding environment are to be managed and minimised so that no deliberate, irreparable or unacceptable damage is done. – Car manufacturers are working towards reducing tail pipe emissions which will contribute to minimising the effects on the environment.

In addition, the Engineering council believes that considering changes in any sustainability information, engineering developments in relation to sustainability, the view of non-engineers and supply chain, should be considered for a well-rounded view. The Institute for Mechanical Engineers also encourages the need to include members of the wider environment, other engineering professionals and the public.

Chapter 4 – Problem Solving

During product development, the design and engineering process is often a long and intricate process that requires several hours to complete. During the design process, certain aspects could be overlooked and issues with the design can occur, requiring adjustments or a total redesign of the product.



This simple flow chart shows the general design process of any product. It follows a step by step process of the design process from the beginning to the final design.

One method of problem solving during the design process is brainstorming, this method can be used in a group or team to pass ideas around and put everyone's ideas, good and bad, to find the best solution for the issue.

Another method is to look at similar products already on the market. This method is a bit more dependent on the product being designed and the current market. Designers must also be aware to not directly copy other designs and products or they may be liable for breaking copyright and patent laws.

The flow chart includes prototyping and a pros and cons list. These methods can be very useful for solving design issues with any product.

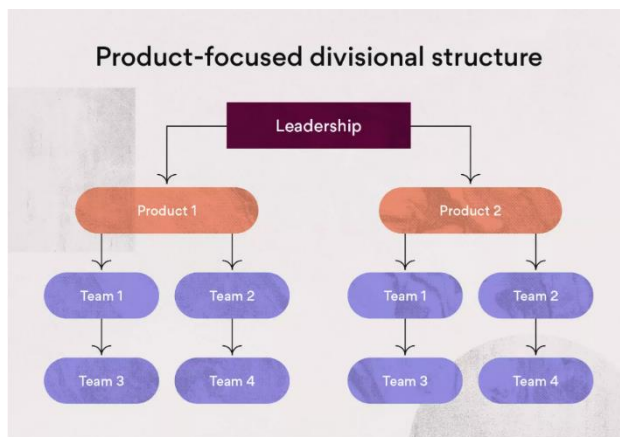
Figure 2 Flow chart showing the design process step by step.
<https://www.lehigh.edu/~amb4/wbi/kwardlow/designprocessfd.htm>

Prototyping can be used to get a physical look at the product and physically test it under the conditions and environments that it will be used in. Prototyping will assist the designers to more accurately find issues in a product.

A pros and cons list can help designers and engineers to weigh the good against the bad. The pros side can be used to find all the positive aspects of a product or design whereas the cons list can be used to find and understand what areas need improvement and further development.

Chapter 5 – Team structure

During the foundation year of university, we were tasked with a group project of designing a soap box racer. For this project, we had to come up with several ideas and ideas of a soap box racer, create a technical report about the project and the team, then we had to create a presentation that we had to pitch to our lecturer.



The team structure we used was a product focused divisional structure based on giving one role to each member of the team to focus on different areas of the soap box racer. The roles were team manager, design, finance, materials, aerodynamics and driveability. I believe this is the structure we followed as we had one team manager instructing and guiding other roles in the team.

Figure 3 Product-focused divisional structure diagram, Team Asana, January 25th, 2024. <https://asana.com/resources/team-structure>

In his publication 'Engineering project management', N.J. Smith (2002) states that team working is

defined as "working together as a team for the mutual benefit of all by achieving the common goals whilst minimising wasteful activities and duplication of effort." I feel like we met this standard as our team structure worked well because each person had one job to focus on and could put all their effort into that one area. Each member of the team chose the role they thought they would be best at to maximise the ability and efficiency of the team.

One issue the team had was communication; we did not communicate as efficiently as we could have. When it came to creating the technical report and the presentation, three of us worked on the report while two of us worked on the presentation. There was a lack of communication between us while working on this part which resulted in the presentation being lacklustre and needing to be completely remade the morning of the presentation pitch.

I believe a matrix structure would have been more efficient for our team as this structure provides more balance in leadership and organisation. This structure is best for teams that require fluid balance in leadership and improved collaboration

and communication. I believe our team would have benefitted from this structure due to the main issue with our team was communication. This structure would have helped improve this issue and helped us work better on the presentation.

The only downside to this team structure is you need a sizeable team to effectively use it. Our team for the soap box racer was only 5 people and while I believe we could have done it with enough time, it wouldn't have been as easy with a smaller team.

Chapter 6 – Personal development plan

Long Term Goals (5 to 10 years)				
Compete in rallying as a potential career path. Consider other career paths in the motorsport world, such as F1 engineer or designing cars for a manufacturer.				
Short Term Goals (0 to 5 years)				
Gain more experience and knowledge with cars and engineering. Begin making my own rally car. Begin competing in rally. Successfully complete my university degree.				
Goal	Objective	Resources Required	Measurement	Target Date
Build a rally car to compete with.	My objective is to build a rally car from a normal car and use it to compete in rally championships.	A budget to use to buy the cars and parts. A second hand car that is easy to work on. Knowledge and experience with cars.	A list of all things that will need to be done to the car to make it race ready. Tick each job off as progress is made until everything is completed. Potentially use a GANTT chart.	June 2025
Begin rallying next race season.	Begin rallying in class 1 1400cc championships in the UK.	RS Inter Club – Stage Rally Licence. BARS license. Rally car.	Keep track of dates and rally lessons using a standard calendar. Proof of holding the license after passing all tests and exams.	July-September 2025
Potentially work as a race engineer, F1 or WRC.	My objective is to work as a race engineer after university in one of the major race series.	University degree. Experience and knowledge of advanced motorsport vehicles.	Keep track of all potential teams that I could work for and their contact info.	2027-2028

Competing in local or international rally championships.	To compete in more advanced championships around the world. Potentially WRC.	Race experience. A rally team. Time and money to fund the team. Potential investors.	Keep up to date with all events happening that I am eligible to enter. Get to know people in the industry so they can help me achieve my goals.	5-10 years' time. (2029-2034)
Alternatively work for a car manufacturer.	Design cars at a car company such as Koenigsegg.	Experience in the car design and manufacturing business. Qualifications that are relevant to the career.	Send out a CV to manufacturers and keep track of which manufacturers I have contacted and their contact details using a database or notepad.	2027-2030

Figure 4 Personal development plan, R Jones, 2024.

Chapter 7 – Conclusion

In this report, I have discussed many topics surrounding engineering and what it is to be an engineer. Health and safety is an essential part of being an engineer that everyone must adhere to and respect. The health and safety at work act 1974 is what all employers and employees must follow. An engineer's role in society is to innovate and improve society while having sustainability and ethical responsibilities. In the problem solving chapter, I discuss several methods of how engineers solve problems such as brainstorming, developing a pros and cons list and more.

The team work chapter discusses a group project that I participated in and how we worked well and areas we can improve in the future and how we will achieve this. My personal development plan goes over my goals and aspirations for the future going forward and how I will achieve these goals.

Overall, this technical report talks about all aspects of what it is to be an engineer in detail and how to improve these areas of the profession.

References

Figure 4 Diagram of parts of a lathe, worksafe.govt.nz, Accessed 25/11/2024.

<https://www.imeche.org/about-us/imeche-governance/governance-and-finance-reviews/code-of-conduct-explained>

https://www.imeche.org/docs/default-source/1-oscar/About-us/governance/code_of_conduct_02_03_02.pdf?sfvrsn=2 IMechE, Accessed 27/11/2024

<https://www.engc.org.uk/media/4352/guidance-for-institution-codes-of-conduct-2017-1.pdf>

<https://www.engc.org.uk/guidance>

<https://www.engc.org.uk/sustainability>

<https://www.engc.org.uk/ethics>

https://www.engc.org.uk/media/3555/sustainability-a5-leaflet-2021-web_pages.pdf

The Engineering Council, Accessed 28/11/2024

Figure 5 Flow chart showing the design process step by step.

<https://www.lehigh.edu/~amb4/wbi/kwardlow/designprocessfd.htm>, Accessed 29/11/2024

Figure 6 Product-focused divisional structure diagram, Team Asana, January 25th, 2024. <https://asana.com/resources/team-structure>, Accessed 30/11/2024

Figure 4 Personal development plan, R Jones, 2024.