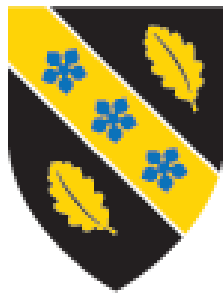


University of Wales Trinity Saint David

Wales Institute of Science & Art



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

Engineering Technical Report

Workshop and Practise (ACHA4011)

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Chapter 1 – Introduction

This reports aim is to examine key aspects of common engineering practice, focusing on health and safety, sustainability, problem-solving, and teamwork. It will highlight the importance of risk management tools, ethical conduct, and innovation in addressing challenges met during product development in professional settings.

Chapter 2 – Health & Safety risk Assessment

Understanding the risks involved in a task is crucial to maintain a safe and healthy environment for those affected. A great example of a time this needs to be considered carefully is when using a Machine Shop or Fabrication Bay. To ensure that all risks have been accounted for, in an application such as this, a risk assessment matrix is often used as it is a simple and effective method to both list and measure the possible dangers in both likelihood and severity.

Figure 1 shows a Risk Assessment Matrix developed using excel.

Figure 1

	Insignificant (1)	Minor (2)	Significant (3)	Major (4)	Severe (5)
Very Unlikely (1)	Very Low (1)	Very Low (2)	Low (3)	Moderate (4)	Moderate (5)
Unlikely (2)	Very Low (2)	Low (4)	Moderate (6)	Moderate (8)	High (10)
Possible (3)	Low (3)	Moderate (6)	Moderate (9)	High (12)	Very High (15)
Likely (4)	Moderate (4)	Moderate (8)	High (12)	Very High (16)	Extreme (20)
Very Likely (5)	Moderate (4)	High (10)	Very High (15)	Extreme (20)	Extreme (25)

Using a lathe can be a very dangerous task and have several risks that are higher than or equal to 'Moderate' on the risk assessment matrix. This is often due to lots of fast-moving parts combined with user input, however if the machinery is used correctly any risks beyond 'Significant' are no more than 'Possible'. This is kept to standard by rules within the workshop and more importantly, legislations involving the machinery used. For example, when using a metalwork lathe: the operator must ensure all safety measures are enabled, including wearing the correct PPE before operating the lathe. (HSE Network, 2024) The PPE to be worn while operating a metalwork lathe is as follows: Safety Goggles, covering clothing, Steel Cap boots/Sturdy footwear – It is important that the operator is not wearing any jewellery or clothing that could potentially be caught in any moving components. The lathe falls under the legislation of BS EN ISO 23125:2015 which directly refers to human operated revolving machinery. It states that "Every employer shall ensure that all persons who use work equipment have received adequate training for purposes of health and safety..." (Gov.uk, 2024) This is an industry legislation that must be carried out before an individual may use the machinery as protection to the individual's health and safety.

Chapter 3 – Engineers' roles in society

Engineers hold a large part in the current topic of sustainability and other environmental issues, positive and negative. McLaren Racing are a company who are very honest about both sides of this story. On 9th May 2024, they released a report on how *sustainable* 2023 had been as a company – in comparison to 2019, the overall usage of fuel throughout facilities had dropped by 25% meaning much lower emissions, too. Adding to emissions, a HVO Biofuel tank has since been installed at the McLaren Technology Centre (MTC) which is stated to "reduce emissions of outbound journeys by up to 90%..." (McLaren Racing, 2024)

However, McLaren are not the only to do this - several other large companies/firms publish their code of conduct in which is signed and accepted by all the engineers involved with said company/firm. Another example is Boeing's code of conduct being free and accessible for anyone who has interest. This is an important document for companies as it will act as a solid foundation in which the engineers should not only act but also work to a standard, such as "I will prioritize safety, quality, and integrity above profit,

schedule, or competitive edge. If I see something that raises a safety concern, I will speak up immediately.” Found in Boeing’s Code of Conduct document (15 Jan 2024). This shows the level at which many companies are advancing into sustainable engineering.

Chapter 4 – Problem Solving

Engineers are often faced with adversity and because of this, there are many strategies available to aid these issues. Sometimes issues can be found during the development stage of a product. A very good way to visualise and keep order is a fishbone diagram – this is a very effective way at viewing a problem and everything that stems into it. Figure 2 shows a basic fishbone diagram. Parties involved can use this in discussion to pinpoint the areas that have more/less impact on why there is an issue from which action can be taken to resolve it.

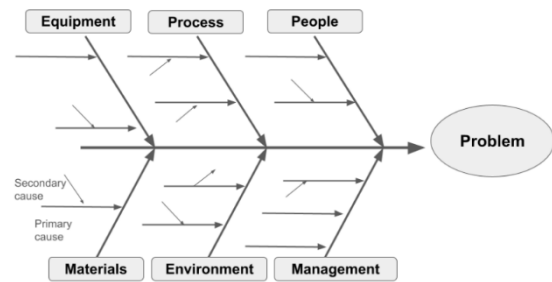


Figure 2 (Chernobuk, 2024)

Once a product has reached the market, depending on the severity of the problem, it is possible that the company at hand can go through a total redesign process, but this is not often the case. It is much more common that the engineers will gather data from consumers in attempt to understand where the issue is coming from. Once this has been identified, units are often recalled for maintenance/repair in which the engineering team will solve any faults present. With the issue found and solved, the production line can then continue as intended.

If the issue was to stem from the supplier, the simplest way to get around this would be to source a new supplier. However, this is not always viable due to tight deadlines or possibly contractual agreements. An effective alternate solution would be to co-operate with the supplier, better optimizing their workload – for smaller companies/engineers this would not be possible. Dual sourcing from another supplier (temporarily or permanently) can ensure that the necessary materials/components will be distributed.

Chapter 5 – Team Structure

During the 2023/24 of the SRCC Sports2000 Championship, I got the chance to work as a team with fellow students at the University of Wales Trinity Saint David. This experience was incredibly exciting and filled with challenge. As the season ended, we produced a list of several jobs to complete on the MCR Race cars, multiple of which I got assigned to by team management. The first task at hand was disassembling two steering racks for general maintenance and slight modification. I found this task to be very educational and I learnt a lot as I shared the job with one other student, so I had a lot of chance to work independently when necessary as well as with a team. I found the structure of the team during this time was very effective as there was always several people working on the cars at the same time as me.



Figure 3

Following the steering racks, I was assigned to stripping and rebuilding the bottom end of an engine. This was very challenging as I had never done this before. During this rebuild there was poor communication between us; this made certain aspects taxing when it came to recalling where specific bolts went or where certain parts of the engine were located, for example. Figure 3 shows the engine, bottom end stripped, and fluids drained. On the other hand, I found this task very useful as I learnt a lot during my time spent on the engine.

The team structure previously revolved around 1 Team leader with 1 additional Leader for each car, whereas this year the team will be comprised of 5 leaders that are taking up equal responsibility amongst both cars. Working as a team during the racing season was

paramount last year, with several challenges to overcome and many obstacles to approach. I found this very useful as I started the season with little to no knowledge on the cars but through observing others and sharing jobs with people much more experienced than myself, it was very quick and easy to pick up. This is something that I do not feel would have been as straightforward as if I was to experience this alone.

Chapter 6 – Personal development plan

Name – Evan Arthur

Degree – Motorsport Engineering BEng

Previous Qualifications – Mathematics, Physics, Product Design at A-Level.

Previous Experience – N/A

Long Term Goals (5 to 10 years)				
In this large of a timeframe, I wish to have cemented myself a job in the world of motorsport as an aerodynamicist. More specifically, I am interested in the way that Formula 1 is moving forward.				
Short Term Goals (0 to 5 years)				
In this time I am aiming to graduate University, gathering a very good understanding of aerodynamics and motorsport as a topic to carry me into my first working role in motorsport. It is also important to me to have built a lot of real world motorsport experience in the next two years within the MCR race team.				
Goal	Objective	Resources Required	Measurement	Target Date
Graduate University	Graduate UWTSD Motorsport Engineering with a first class with hons.	A good attitude towards work and dedication to a high degree.	The grade at the end of the course.	June 2027
Land my first job in motorsport	Secure a job working at/with a race team, to learn and develop my skills.	A positive result with my University degree and positive motivation to work.	If I have a job after university.	2027 Onwards.
Help the MCR finish higher in the standings	Win a round of the SRCC Sports2000 championship.	Time and dedication put into getting the cars to be in the best they can be pre race/season.	Whether or not car #40 finishes P2 or higher at the end of the championship.	By October 2025.
Have a leadership role in the MCR Team	Be given a leadership role, such as head of one of the cars	High commitment and a broad knowledge involving the cars.	Whether or not I have lead of one of the race cars.	2025/2026 Season.
Turbocharge my Toyota Starlet	Prepare for and turbocharge my Starlet all done by myself to produce more power.	A good knowledge and experience of the challenges involved.	How independent this project will be, with little help being ideal.	2025 Onwards.

Chapter 7 – Conclusion

This technical report has explored several fundamental aspects of engineering practice, underscoring the critical nature of health and safety, the essential role of engineers in society, the strategies for problem-solving, and the dynamics of teamwork. The discussions have demonstrated that understanding and mitigating risks using tools like the risk assessment matrix is vital for creating a safe working environment, particularly in high-risk areas such as machine shops.

Through multiple examples, including the sustainable changes made by companies like McLaren Racing, the report has highlighted how engineers significantly contribute to addressing environmental issues and sustainability goals in their practices. Furthermore, problem-solving strategies such as the fishbone diagram have been shown to be instrumental in identifying and addressing challenges during product development phases, ensuring continuous improvement and innovation.

Teamwork within engineering settings has also been emphasized as crucial, as illustrated by personal experiences in the SRCC Sports2000 Championship. Collaborative efforts, clear communication, and structured team roles have proven to be key elements that support the success of engineering projects and personal development within the field.

In conclusion, the report reaffirms the multiple roles of engineers in advancing technological and societal progress while adhering to ethical standards and prioritizing safety and sustainability. As the engineering field continues to evolve, the foundational principles discussed herein will remain relevant and guide future engineers towards effective and responsible practice.

Reference List

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