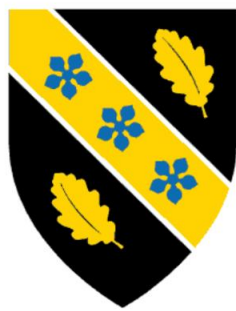


MODULE: ENGINEERING SKILLS

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ASSIGNMENT 1

Engineering Skills Technical Report



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1. Introduction

This short report will be written in mostly 3rd person with one section being in 1st person. This technical report will include a section on health and safety and will include a range of appropriate and relevant health and safety regulations and a risk assessment. It will also include a section on the advancements in automotive technology and the security threats that can arise. This section will also include a risk matrix that will organise the risks visually in terms of likelihood and severity. Further to this, a section on engineers' code of conduct, concerning the environmental issues engineers can face and how to conduct themselves in relation to sustainability. Additionally, different problem-solving options will be identified and discussed. To conclude, will be a section on team structures and why they are appropriate for their applications.

2. Health & Safety with Risk Assessments

In all aspects of engineering, health and safety must be considered. At UWTSD, there are a multitude of tools, equipment and machines in the workshops. One machine where health and safety is of the upmost importance is the Lathe. Below is a list of health and safety regulations and legislations that are relevant to the use of this machine.

- **Personal Protective Equipment at Work Regulations 1992 (PPE):** Requires employers to provide suitable PPE and requires employees to always use PPE when instructed, upon receiving the correct training. (HSE, 2022)
- **Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR):** Requires all reportable work-related injuries, diseases and dangerous events to be recorded and reported to HSE. (HSE, 2013)
- **Provision and Use of Work Equipment Regulations 1998 (PUWER):** Requires all equipment, tools and machinery are regularly inspected and pass safety standards. (HSE, 2024)
- **Manual Handling Operations Regulations 1992:** Covers carrying, moving, holding, pushing or pulling of objects by hand or using bodily force. Requires employees to carry out risk assessments where manual handling is required and requires the correct training to be provided. (HSE, 2020)
- **Health and Safety (Display Screen Equipment) Regulations 1992:** Requires employers to carry out a “DSE workstation assessment” for all employees who are required to use PCs or Laptops for over an hour a day. This assessment is used to reduce risks such as eye strain, back or neck problems. It also requires employers to provide the correct training, and an eye test is an employee asks. (HSE, 2019)
- **Workplace (Health, Safety and Welfare) Regulations 1992:** Covers a variety of issues such as: Workstations, heating, lighting, seating, cleanliness, doors, gates, windows and drinking water. (HSE, 2013)
- **Health and safety at work Act 1974 (HSWA):** “Introduced in the wake of the Pike River coal mine tragedy, in which 29 miners lost their lives” (Howell, 2019) Covers a wide range of laws and responsibilities for both employers and employees. (Legislation, 2024)

Table 2.1 – Risk assessment

What are the hazards and risks?	Level of risk	Who could this harm and who?	What control measures are already in place?	What further control measures can be implicated?
Rotating machinery - Entanglement	High	- The operator - Anyone who steps within the workspace	- Safety guard - Training provided - No loose clothing or accessories	- Full machine cover safety guard could be implemented across the whole machine
Swarf and shards of material	Medium	- The operator - Anyone who steps within the workspace	- Safety guard - Use of safety goggles - Long, fitted sleeves must be worn	- Full machine cover safety guard could be implemented across the whole machine
Slips, trips and falls	Low	- Anyone in the workshop	- PPE, anti-slip safety boots must be worn - Floors and walkways must be clearly marked, kept in good condition and free from obstructions - All wires taped down with clearly visible tape	- Anti-slip flooring could be fitted
Human error	Low to High (Dependant on if error incurs injury or if it only affects workpiece)	- The operator - Others in the workshop	- Training provided - Emergency stop button fitted in easy reach - Students are supervised during operation	- Full machine cover safety guard could be implemented across the whole machine - A reasonable amount of automation could reduce error

3. Security Risk Matrix

Modern vehicles are facing increasingly larger security threats and becoming more vulnerable due to the advancements of the technologies that are being implemented. Below are five security threats that are all becoming increasingly more common and concerning.

Remote hacking

Remote hacking is not a regular occurrence, however it is a possibility as proven by Chris Valasek and Charlie Miller in 2015. They remotely hacked a Jeep Cherokee with the use of a software program that could allow them to gain access to various systems within the vehicle, eventually rendering the car undrivable and forced it to come to a stop in a ditch. (Greenberg, 2015)

Theft of personal data

One example of personal data theft occurred in 2024, where “Toyota lost 240GB of data”. (Fosters, 2025), This was due to one of the manufacturers servers being hacked, which exposed customer details from millions of vehicles.

Driver not paying attention in an autonomous car

According to a study conducted by the university of Nottingham, when driving an autonomous vehicle, drivers are more likely to use their phone than pay attention to the road. (Jervis, 2024) This lapse in concentration can lead to accidents that can be fatal.

Relay attacks

Relay attacks allow criminals to gain access to a vehicle without drivers' knowledge and without obtaining the physical key. This is when a criminal uses a device to manipulate the signals from a key, to the device and then to the target vehicle, granting them unauthorised and full access. (IMI, 2023)

Table 3.1 - Security Risk Matrix

	Low	Medium	High	Very High	Extreme
Rare				Remote Hacking	
Unlikely					
Possible					
Likely	Theft of personal data		Relay attacks		

Almost Certain					Driver not paying attention in autonomous car
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As automotive manufacturers such as tesla are constantly advancing with self-driving capabilities, there are many safety concerns that can be raised. With all new innovations, including self-driving vehicles, there is and always will be risks.

2018 saw, 49-year-old Elaine Herzberg as the first death caused by an autonomous vehicle being road tested by Uber. A news report by CNBC stated that to reduce this risk, they now require two backup drivers, they have reduced the length of the route allowed to be used for testing and testing could only be performed under ideal weather conditions. (Reuters, 2019)

From an engineering perspective, this risk can be further reduced by an automatic emergency braking system. Another way this risk can be reduced is by using onboard cameras that can detect drivers state of awareness using AI, triggering an alarm when concentration of the driver has been lost and bringing the vehicle to a safe and controlled stop.

4. Engineers Role in Society

The IMECHE and Engineering Council (and the Royal academy of Engineering) are two organisations that publish a code of conduct for engineers. This section will be covering both organisations' responsibilities towards sustainability and will also cover environmental issues for motorsport.

Engineering Council

The Engineering Council states that engineers have a responsibility to respect the “environment and public good”. They also state that engineers must take care of both “built and natural environments” and to improve them where and when it is possible. They must also be mindful of natural resources and the limited availability of them as well as be aware of the environmental effects their actions can have in the present and the future. (Engineering Council, 2017)

Institution of Mechanical Engineers (IMECHE)

The IMECHE states that engineers must “engage responsibly with the environment”. Further to this, engineers are to be mindful of the needs of present and future generations and to “balance” those needs accordingly. They also state that engineers must never be wasteful in using natural resources and are obligated to protect the environment. (Institution of Mechanical Engineers, 2023)

Fédération Internationale de l'Automobile (FIA)

In 2020, the FIA announced that they are committed to become net-zero by 2030, setting out clear goals and objectives. In the FIA Environmental Strategy 2020 – 2030, their three main goals are to:

- “Develop and improve environmental sustainability across motorsport and mobility”
- “Guide FIA members and championships towards competitive and sustainable practices”
- “Promote sustainable motorsport and mobility to contribute to global targets”

The FIA has also stated that they will take a “Proactive and leadership role in environmental sustainability”. (Fédération Internationale de l'Automobile, 2020)

5. Problem Solving

During the development of a product that is being engineered, it is very common that issues will be faced. This section will show how these issues can be solved using various problem-solving options and techniques.

One technique that can be used to solve a problem is the Feynman Technique, named after Richard Feynman. This technique involves first teaching or explaining what is already known and breaking it down into smaller parts to gain a further understanding of the concept. This then allows for the exploration of knowledge gaps. If there is a part of the problem that cannot be explained, more research is required. Once the problem can be fully understood and explained, the next step is to come up with a clear plan. Finally, the plan must be dissected into smaller parts, dividing the more complicated steps into smaller, simpler steps that work towards the same plan. (TEDx Talks, 2024)

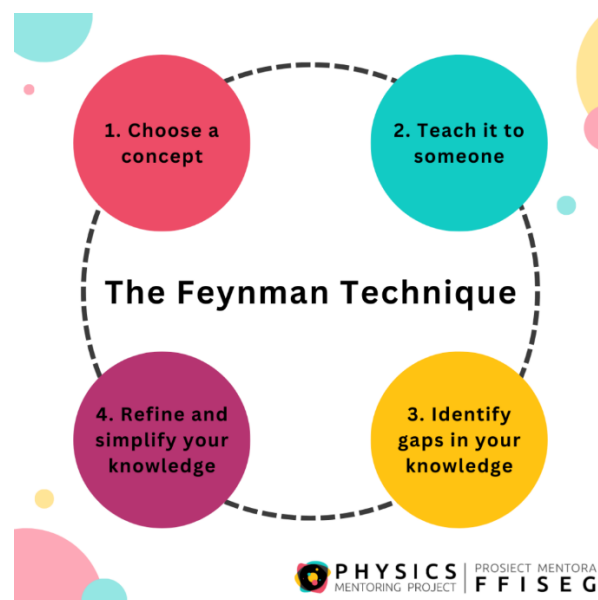


Figure 5.1 - Feynman Technique (Nirō and Physics Mentoring Project, 2024)

Another problem-solving option is the Five Whys. The Five Whys technique is another simple but effective problem-solving method as it allows for the root of a problem to be identified. As the name suggests, it involves asking why, five times or until the root of the issue is found. For example, Engine will not start. Why? Because the starter motor has failed. Why? Because the pinion isn't engaging with the flywheel... and so on. This process encourages critical thinking and is an accurate way of finding the cause of a problem that can be recorded in an organised and detailed manner. (Henike, 2025)

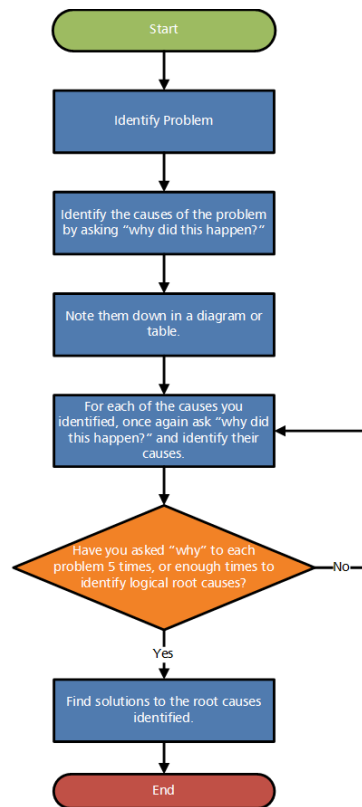


Figure 5.2 - 5 Whys Flow Diagram (Buffer, 2019)

6. Team Structure

In employment with a local karting track, I collaborated with my fellow team members to provide a safe karting experience to customers. My role as a track marshal saw myself working with a team of more than 7 people.

With there only being one manager and 7 other staff members, there was a flat type team structure, where everyone could communicate to each other and the manager effectively. This type of team structure worked well as it ensured that everyone knew what they were doing and the customer remained informed throughout the experience. In terms of job roles, the manager would provide the safety briefings, bookings and payments as well as oversee the operation of the track. Everyone else was a track marshal, ensuring track safety with the extra responsibilities of serving in the Café and helping in the arcade when required, cleaning, ensuring each customer is informed and maintaining the track, fuel levels and tyre pressures, while reporting mechanical faults when they arise. Apon research, I found that this type of team structure is ideal for smaller businesses and teams. (Scherer, 2025)

Below is a table containing the pros and cons of the use of this team structure.

Table 6.1 - Pros and Cons of using a flat team structure

Pros	Cons
Workload was spread out, ensuring each member of staff had a similar amount of responsibility.	Due to the low number of staff, staff members could feel “stretched too thin” which overall lowered team moral.
Customer safety was high due to the communication of the team and standard operating procedures and health and safety guidelines.	With a lower number of staff at times, customers could become impatient as the workload becomes challenging and the track begins to fall behind schedule

What is a different team structure that may have also worked?

The hierarchical team structure is one of the most widely used team structures. This is because it allows for easy identification of responsibilities and authority and allows for clear lines of communication.

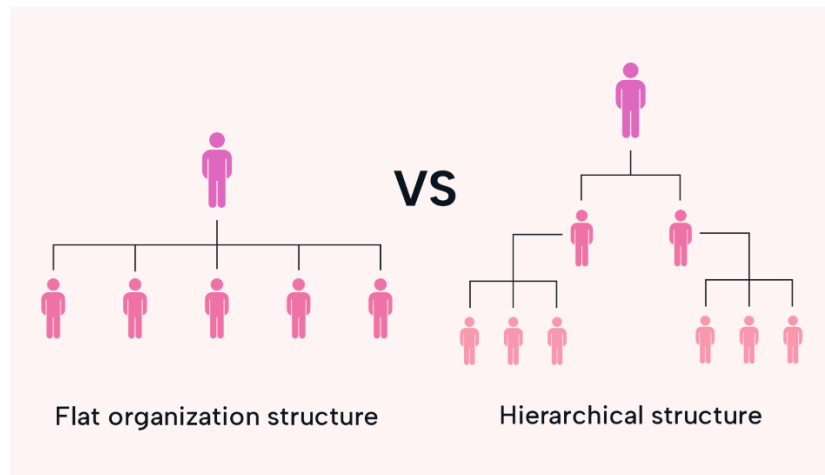


Figure 6.1 - Flat vs Hierarchical Structure (Motion, 2023)

While this team structure would be appropriate to use for a karting track, in this case it wouldn't have worked as there were not enough members of staff. However, if the karting track ever became a franchise, with multiple tracks in different locations, this structure would have been appropriate. The hierarchical structure would allow each track to operate in the same way, offering a familiar experience for new and returning customers.

7. Conclusion

To conclude, in this technical report a range of research was carried out along with the use of tables, images and flow diagrams. Health and safety regulations along with a risk assessment has been included with careful consideration to which regulations apply to the use of the lathe and being in a workshop environment. Further to this, security threats regarding more technically advanced and autonomous vehicles have been carefully considered and identified through the use of research and creating a risk matrix. A range of code of conduct for engineers have been researched and discussed, both have been found to have similarities in terms of environmental issues and sustainability. Problem solving options have been explored and researched with the use of flow diagrams for visual representation. Team structure has also been researched and discussed in terms of where they would be appropriate and why they work and do not work as affectively in other settings. Prior to this, a personal review was also written

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