

Technical Report [1]

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Workshop & Practice (ACHA4011)

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Chapter 1 – Introduction

This report will cover a broad range of topics related to engineering, discussing the impact they have on society and the world as a whole and the methodology they often use in projects. I will delve into deeper explanations to demonstrate a clearer understanding of topics and information discussed in this report.

During this report, a number enclosed in square brackets is the guide to the relevant reference found at the end of this report. E.g. [6]. This would be the reference marked [6] in the end list.

Chapter 2 - Health & Safety

During my first semester at UWTSD my course has undertaken a task involving lathes and various other workshop tools, which wield the potential to impose lethal damage to its users. To safely operate these machines, the lecturers and leaders of our workshop groups carefully and intrinsically explained each and every aspect of using the machines we were to utilise. Leading us to realise the risks ourselves through conversation, rather than just listing them off one by one. From obvious risks such as not putting hands underneath an active drill-bit, to more complex risks such as loosening handles in the correct way so as not to crush our hands against the walls of the machine when it suddenly loosens. I will provide a risk assessment matrix just below with a few of the risks that our groups were made aware of during our health and safety briefs.

[Risk Assessment on next page]

	Negligible	Minor	Moderate	Significant	Severe
Very Likely	Saying something daft				
Likely		Rolling up your sleeves when you get hot			
Possible	Dropping a file onto the floor		Forgetting to wear safety glasses whilst using a file	Bumping into the lathe-activation lever when leaning in	Stepping a foot underneath the emergency stop pedal (lathe)
Unlikely			Muscle cramp	Not seating a drill-bit entirely (Y-axis drill)	Putting a hand in the lathe
Very Unlikely	Leaving a sealed bottle of water on the flat/level table unattended				Putting a foot in the lathe Brain stroke

When it comes to using a lathe safely, there are multiple pieces of health and safety legislation that apply (in a workshop setting). There is the main piece of legislation: Health and Safety at Work etc Act 1974. HSWA, for short. For our groups, this ensures the university keeps the machinery in safe working condition, and provides us adequate training, however it doesn't regulate the use of PPE with regards to its operators.

Regarding PPE, we can find legislation on this within the Personal Protective Equipment at Work Regulations 2022 (PPER2022), an amendment of the PPER 1992. Within this, it states that this is not directly applicable to university students, however Section 3 of the HSW Act (Act 1974/HSWA) dictates that employers are required to ensure that those who may not be employees yet still possibly affected are not exposed to risks to their health & safety [3]. So our group, whilst we are not employees, are covered under the umbrella of these two acts working together; receiving both training and PPE equally.

This act includes regulations on the effectiveness and usage of safety glasses, goggles and face-shields. [4] Ensuring risks and threats imposed upon its operators are protected with adequate PPE. With risks of metal shards and flying debris, eye protection falls under the requirement of mitigating risks and becomes essential health and safety PPE.

Chapter 3 – Engineers Role in Society

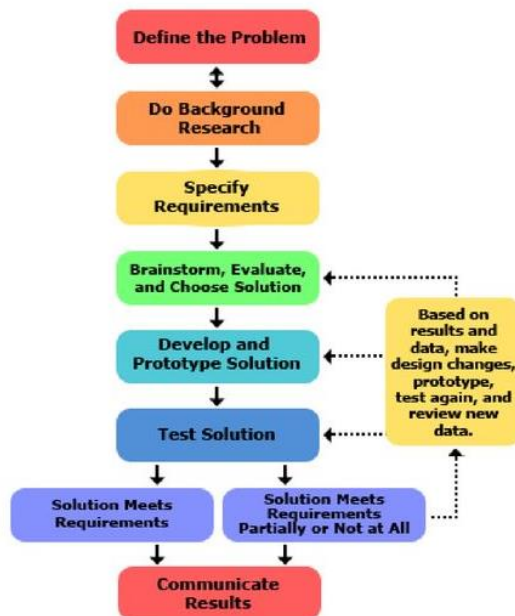
The **IAEA** (The Institute of Automotive Engineering Assessors) has published rules of conduct to govern their engineering members [5]. These rules govern many areas of an engineer's conduct, from how one should interact with other people, through to consciousness of sustainability in their work. Rule 3 within this CoC clearly stipulates an engineer shall not impose avoidable environmental nor societal impairment. An example of this could be engineering or designing a large-displacement engine vehicle with the capacity to house a catalytic converter, yet deliberately choosing to disregard air pollution by omitting one.

It's possible to perceive the goal of code of conduct regulating the consciousness of the environment to be essential towards achieving a greener future, for it can be easy to get tunnel-vision towards meeting design/project criteria and disregarding the waste which exits the sphere of influence of the project. Tying to my prior example, omitting the catalytic converter to save weight and meet a power/weight ratio request of the manufacturer.

Another engineering organisation with a code of conduct is the famous **IMechE** (The Institution of Mechanical Engineers). Discoverable on their website is their CoC [6] and 4 driving principles. To paraphrase, they seek to ensure competency, integrity, sustainability and leadership. We can find on page 3 of this CoC it explicitly mandates environmental responsibility. One aspect of sustainability which is mentioned here but not in the IAEA (above) is that of natural resources. More specifically, wasting them. Linking an example to motorcycle engineering, we could imagine a motorcycle engine constructed exclusively with rarer metals like titanium. Where we could use cheaper/more available metals for parts which do not require the strength nor thermal capability provided by titanium. An example part could be engine covers. A clutch cover made of titanium instead of a composite is recklessly expensive and wasteful. If we used titanium for a clutch cover for its overall strength, we would be potentially risking heat issues. Titanium is not the best heat conductor (9.0 BTU/hr ft²F) [9], compared to aluminium's 136 BTU/hr ft²F [10].

Chapter 4 – Problem Solving

During any engineering project, it is almost guaranteed that the design team will encounter hurdles to overcome. Rarely do things go smoothly, especially with how tight tolerances can be within engineering as a whole. We can visualize the work pattern/progression of a project using flow charts. Here is one I found online [7]:



Using this chart, we can identify what happens in various scenarios. If we found an issue during development, which would produce a test failure, we can track the next step back to potentially requiring brainstorming a total design change. Whatever changes are made, we'd return to the flow-charts main route of prototypes and testing to understanding if the change meets the design requirements.

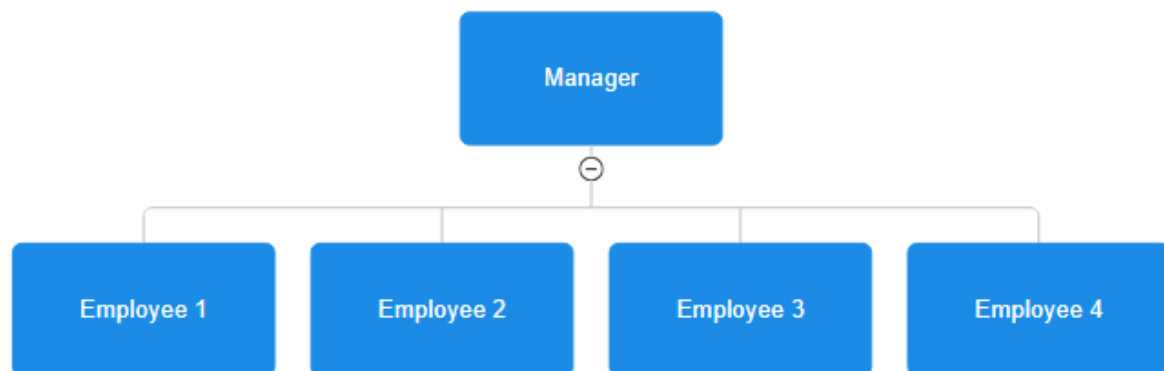
If all goes well however an issue arises once our product is on the market, we can dial back to the flow chart still. The first step is to diagnose the problem which has arisen, from there we track the flow chart until the issue is solved and the recipient is satisfied. For example, a weak joint on a folding fork. We know the problem; we know the requirement.

Should there be a supplier issue during production, that would potentially be within the control of our engineering team. For example, an insufficient supply of a composite material used for a part of the project. If we could swap the material out for another, such as aluminium, our team could track back on the flow chart to the middle "choose solution" step and proceed as normal from there.

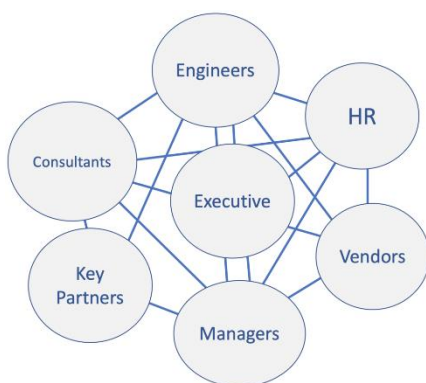
Chapter 5 – Team Structure

To provide a memorable teamwork occasion I immediately think back to when I worked at Specsavers, a few years ago. I worked the shop floor for years and thus acquired knowledge and understanding on every role outside of the eyetest-rooms. As a result, I gained credibility and respect amongst the team. I did not hold a managerial position but that mattered not, people sought my leadership when things got busy as any sort of management was glued to their chairs upstairs. I would typically guide 3-5 colleagues within the department handling patient pre-testing/arrivals. Assigning each of us roles so handovers were optimised; arranging us based on a balance of necessity, ability and happiness within our positions.

This structure was effective but had a weakness. The issue with this was sometimes I was unreachable for support or questioning due to being with patients often. Using the chart below, I would be the role of the manager.



Understanding this flaw, I tried to adapt the structure. We adopted more of a *network* team structure.



This structure, seen left [8], ensures a level understanding of all processes between everyone. What this meant for me was freedoms such as the team swapping within their positions without feeling the need to confer with me. If one was stood, one sat, and wanted a break from either – they don't need me to approve that. Ultimately I held the same rank as them, my role was guidant. Built solely on the respect that I kept the department organised efficiently and respectfully. I keep them in the loop and they keep me in the loop.

Not having official management instructing us meant the department had freedom to move where we desired, though meant people weren't sure which people/areas needed support. With me occupying a leadership role, it gave stability and organisation. So as not to be the sole head of the team bossing people about, restricting flexibility, a network structure was adopted which aids flexibility whilst maintaining the organisation provided through a leader being present.

Chapter 6 – Personal Development Plan

Name – Will Gabriel

Degree – Motorcycle Engineering

Previous Qualifications – A-Levels

Previous Experience – Outdoor Educational Activity Leader, Underwriting Senior Analyst, Teaching Assistant, Logistics Operative, Glazing Lab Technician, Optical Assistant

Long Term Goals (5 to 10 years)				
I aspire to be part of a racing team, in a core role with hands on the vehicle itself. Ideally motorcycle racing of course though motorsport such as GT3 wouldn't be terrible. I know it's not going to be easy with an ever-shrinking job market for young people like me, my opportunities reduce every day. But my goal is to make it with a racing team, make a good go of it all.				
Short Term Goals (0 to 5 years)				
Entering the world of motorsport in any regard would be a good step towards my long-term goals. Maybe start off with a more beginner role within a team, something at the level of being an intern. Simply just getting a foot in the door of the career-room. I'd also like to afford a nice sport bike and try out track racing. I do love a 2021 Yamaha R6.				
Goal	Objective	Resources Required	Measurement	Target Date
Afford to live a healthy, complete, lifestyle.	Get money.	Money. Planning. Mental fortitude.	Bank balance. Belt size. Mental health.	Jan 2027.
Become a motorcycle engineer.	Achieve a HND in motorcycle engineering, if not push ahead for a degree.	Student loan. Library. Internet. Good food.	Piece of paper with a stamp and signature confirming completion of qualification.	June 2026.
Become racing technician/part of racing team.	Join a racing team in a hands-on regard.	Motorcycle Engineering HND/Degree.	Job contract.	Jan 2027.
Leave the UK.	Live in a country with a more prosperous future.	Money. Motorcycle qualification.	Home address.	By 2030.
Use my skills to be remembered.	Innovate, improve, upgrade. Create something remarkable.	Engineering knowledge/skills. Support from family & friends. Commitment.	IMechE publishes an article about something I was involved in.	By 2060.

Chapter 7 – Conclusion

This has been my technical report on various engineering topics from their roles in society, the environmental impact their conduct has on current and future generations via sustainability and their methodology of problem solving. An engineer bears many responsibilities which often go inconsidered, such as making common household items/devices more efficient. A refrigerator's efficiency impacts the environment and also the home-owner/user, every small improvement is hardly appreciated when shopping for a new fridge but the achievement is remarkable and essential.

Thank you for reading.

Reference list

- [3] H.S.E Government Regulators, PPER 1992 (2022 Amended), Section 21, Page 8.
- [4] H.S.E Government Regulators, PPER 1992 (2022 Amended), Section 91 (a)-(e), Page 22.
- [5] The Institute of Automotive Engineer Assessors (2020), Rules and Conduct of Members. Available at: <https://www.iaea-online.org/about/code-of-conduct>
- [6] Institution of Mechanical Engineers (2021), Code of conduct regulations. Available at: https://www.imeche.org/docs/default-source/1-oscar/About-us/governance/code_of_conduct_02_03_02.pdf?sfvrsn=2
- [7] Teachers Pay Teachers (2020), Engineering design process flowchart. Available at: <https://www.teacherspayteachers.com/Product/Engineering-Design-Process-Flowchart-7526489>
- [8] Pingboard Blog (2021), 8 Types of Business Organizational Structures, Available at: <https://pingboard.com/blog/types-business-organizational-structures/>
- [9] Donachie, M. (1988) Titanium: A Technical Guide. Page 11.
- [10] Engineers Edge (2022) Properties of Metals. Available at: https://www.engineersedge.com/properties_of_metals.htm