

UWTSD

WISA



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Engineering Technical Report

ACHA4011

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Introduction

Engineering is an essential part of society. This engineering technical report will focus on health and safety surrounding the use of a lathe, It also highlights engineers' ethical duty to push for sustainability, particularly in fields like motorsport that are in the public eye, team structuring within the MCR team, and problem solving strategies.

Health and Safety with Risk Assessments

The university holds practical sessions on the lathe, where students are assessed on their ability to use different skills and methods to successfully replicate a component accurately. This task comes with many risks due to the nature of the machine, with fast spinning components, sharp edges and crush zones. Consequently, there is a large risk assessment surrounding this activity. To help minimize the risk of accidents and injuries there is several required items of ppe to be worn at all times. This is comprised of, safety goggles, safety boots and overalls that cover your arms and legs to protect against flying hot metal swarf. Jewellery that can get caught must be removed and any long hair tied back.

Likelihood	Potential consequences				
	Minor cuts and discomfort, medical attention not needed.	Injuries requiring some medical attention, short term impairment.	Injuries resulting in a hospital visit.	Injury resulting in permanent impairment	Fatality
	Not significant	Minor	Moderate	Major	Severe
	Almost certain	Burns from hot metal			
	Likely	Cutting skin on sharp edges		Hot metal swarf in eyes	
	Possible	Catching skin on rotating parts	Crushing fingers in moving components		
Unlikely		Falling onto moving equipment	Entanglement with rotating parts		Getting trapped in machinery
Rare		Electrical shock		Piece flying out machine and striking user	Dismemberment

Figure 1.1: is a self-made risk assessment matrix, filled with potential risks surrounding the use of a Lathe (Dunstan, 2024).

Using this risk assessment matrix it is evidently clear that the use of a lathe is a high risk activity. The university helps mitigate these risks by holding these classes in small groups of 2-4 students. With 2 lecturers in the room, whilst the machines are in use, the risk of an accident is lower.

The lathes are set up a safe distance apart and are fitted with multiple clear shields to protect users and others from material flying off. The HSE states that manually operated lathes must have a fixed guard at the rear of the machine, a chuck guard, and a splashguard for swarf (Health and Safety, 2010). Where the user stands there is a thick nonslip rubber mat to reduce the chances of a slip, trip or fall. Regulation 16.1 of the safe use of work equipment states that work equipment must be fitted with at least one readily available kill switch that brings the machine to a complete stop (Health and Safety Executive, 2014). To comply with this regulation the machines are fitted with multiple kill switches for use in the event of an emergency, these can be found as a large pedal to stamp on if you or others get caught, a kill switch on the machine, and one on the wall. To correctly secure the metal piece into the lathe there is a 'chuck' where it has to be correctly aligned using the centraliser that can be slid in and out of the way, once centralised you fasten it down with a 'chuck tool', in 3 separate clamps.



Figure 1.2 shows the setup of a lathe within the universities machine shop (Dunstan, 2024)



Figure 1.3 shows the control panel of the lathe, fitted with an emergency stop (Dunstan, 2024)



Figure 1.4 shows the main elements of the lathe as well as the bin to catch the swarf (Dunstan, 2024)



Figure 1.5 shows the centralisation tool as well as the lockable power switch and health and safety guidelines poster (Dunstan, 2024)

Table 1.1 shows an example risk assessment surrounding the use of a lathe (Dunstan, 2024), (Disney, No Date).

Task	Hazard	Controls
Pre-operational checks	Poor condition / damage of guards or chuck.	Create a logbook where all inconsistencies are noted on every pre-use check. Machines must not be used until damage is repaired.
Operation of lathe	Entanglements	All moving parts must have sufficient guards.
	Risk:	Users must be educated on the correct operation to minimize close contact with moving parts as well as the location of kill switches.
	• Cuts	No loose fitting clothes
	• Bruising	Long hair to be tied back as well as all jewelry removed.
	• Abrasion	
	• Amputation	
	• Breaking of bones	
	Waste materials	Safety goggles with side shields must be worn. Swarf is sharp and hot so should not be handled with bare hands. No attempts to clear the swarf should be made when the machine is in motion.
	Risk:	Long sleeves should be worn to reduce the risk of burns in the event of hot swarf flying off.
	• Damage to eyes	
	• Burns	
	• Cuts	
	• Bruising	
	Slips, Trips and falls	A nonslip mat should be placed in front of the machine to reduce slipping over. The mat should be rubber and have spaces in it for the waste swarf debris to fall through.
	Risks:	
	• Falling onto moving components	
	• Bruising	
	• Cuts	
Setup of lathe	Electrocution	Ensure all power cables are correctly isolated from any moving components
	Lack of visibility	
	Risk:	High-intensity LED lights should be fitted to overcome the flickering of fluorescent lights, which causes the workpiece to appear stationary at certain speeds.
	• Contact with lathe	
	• Trips	

Engineers Role in Society

Engineers have a large impact on the way society runs. Because of this engineers are held to a high level of standard. Organisations issue codes of conduct that outline the requirements of upholding this standard. These codes of conduct hold society's best interests in mind. In the IMechE's code of conduct, it states that all of its engineers must "balance the needs of the present with the needs of future generations" (IMECHE, No Date). The IMechE also states that engineers should never knowingly exploit natural resources, this clause is very relevant in terms of motorsport, due to the high quantities of fossil fuels used. There is currently a very large push in the development of sustainable and alternate fuels to help drastically reduce motorsports impacts on the environment. Engineers should consider different options when it comes to the production of designs, such as using recycled resources. Manufacturers should push the use of renewable energy sources in all facilities to help lower the overall carbon footprint. Formula 1 has set out a plan to be carbon neutral by 2030. A large chunk of the carbon footprint is created in the factories (L, 2024). To help reduce this an engineer should be mindful of the environment when it comes to the making and application of every component.

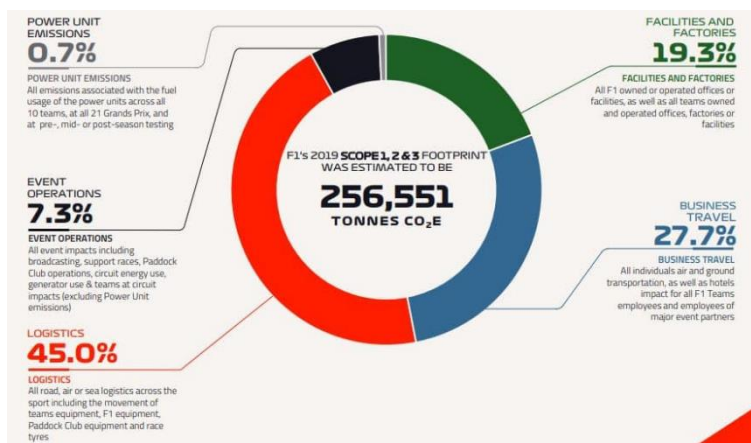


Figure 2.1 shows the distribution of carbon output from Formula 1 as a whole (L, 2024).

Engineers need to be mindful of their action's impact on future generations. This includes everything from energy consumption to use of raw materials and waste disposal. The long term benefits of manufacturing firms adopting sustainable practices are drastic. To meet the demand for eco friendly solutions engineers can creating products out of waste materials. Ethical practices in engineering are essential, these ensure that there is transparency and adequate health regulations in effect and engineering compliance (Motion Drives & Controls, 2024).

Problem Solving

Engineers will come across many different issues with the designs they make all throughout the production process. When a problem arises during the development stage it is essential that it is rectified as quickly as possible to reduce any potential delays in getting the product out. To tackle the issue the first step is to accurately determine what is the point of failure, in some cases this is easier than others, issues can range from something simple such as the component not fitting, all the way to there being issues with the material used in the product. The first thing an engineer should do once the cause of the issue has been discovered is to research the problem. This could be looking at how other engineers reacted to similar issues, how similar parts are designed, and going to engineers in different fields to gain another perspective. Once some new designs have been made up it's time to evaluate each different solution to determine which design should be taken to the next stage. A couple of ways of doing this are; creating a decision matrix, completing a cost benefit analysis, Risk assessment, and a swot analysis (Rogers, 2024). The next stage of development is to design and create a prototype, this component is to be used in the way intended for the final product to test if there are any issues with the new design. If issues do arise then the cycle starts again. If no problems arise then the new version is ready to be integrated back into the market.

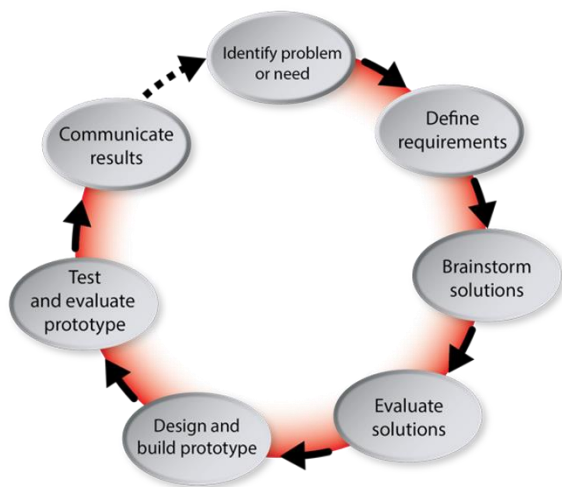


Figure 3.1 is a flow diagram showing the product development cycle (Rogers, 2024)

Team Structure



Figure 4.1 Shows the entirety of the 2024 season team (Miller, 2024)

In 2024 I became a member of the MCR Sports 2000 team. In the beginning, there was one key team leader who took control of everything surrounding the team, however, due to old students moving on, a new leadership structure has taken place. This new leadership structure comprises of 5 members. One overall team leader, one leader for each car, and then 2 further members in charge of workshop and admin work respectively. These 5 members have equal power when it comes to decision making. This new layout was a very big difference in comparison to the singular authoritative figure in the original structure.



Figure 4.2 Shows the original team structure when I joined the team (Dunstan, 2024)



Figure 4.3 shows the new team leadership structure (Dunstan, 2024)

I felt that this team management structure was a positive decision. Due to the nature of motorsport, there are always issues that arise, and having a team leader for either the vehicle or the specific issue was highly beneficial. When faced with issues one member of the leadership team stood up and rectified the issue. With there being 5 members of this leadership team the workload was spread amongst them, allowing each member to spend more time on their specific areas of expertise. In the original structure, it sometimes felt that the team leader had too much going on all at once and had to be selective with what he spent his time on.

With it being a student run team, the members in leadership roles are not professional team leaders so many mistakes are made amongst them. The main issue with a larger leadership team is clashes in opinions and strategic ideas due to certain members prioritizing different things to each other in order to achieve the same outcome.

My role in the current team is to help the newer members get up to speed with what the team is about and assist them with any questions or troubles with the cars, when members of the leadership team are not available.

A different team structure that could have been appropriate for the new leadership team would be to have a hierarchy amongst the 5 leaders, as opposed to equals. This structure would reduce the amount of clashes amongst the leaders due to each individual being in control of their specific area and reporting to the head of the structure for any key decision making. One downside to this structure however would be a level of disconnect from members at the very top of the structure, due to them being distanced from the actual work on the race cars

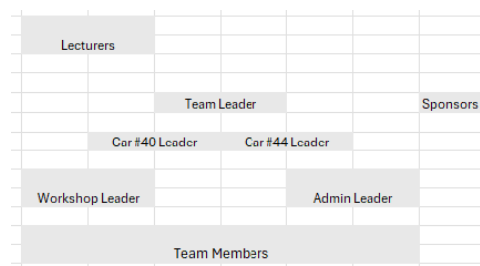


Figure 4.4 shows what i feel would be the ideal team layout (Dunstan, 2024)

Personal Development Plan

Name – Louis Dunstan

Degree – Motorsport Engineering BEng

Previous Qualifications – IMI level 2,3 Motorsport vehicle maintenance and repair (VRQ), 10 GCSE including a 7 in all sciences and maths, Level 1 Mig Welding, Level 2 Fitness Instructor, Level 3 RLSS pool Lifeguarding, Level 2 AED, Bronze Duke of Edinburgh award.

Previous Experience – 2 years at mechanical college, Work Experience at Golding Barn Garage

Long Term Goals (5 to 10 years)				
Get a mortgage on my first property Get a job in Formula 1				
Short Term Goals (0 to 5 years)				
Graduate University with a 1 st class degree Be in a Leadership role in the UWTSD MCR team Gain a job in the motorsport field Reach 100kg body weight				
Goal	Objective	Resources Required	Measurement	Target Date
Graduate Uni	Earn a first class with honours	Time management, Dedication, and great work ethic	Grade achieved	Spring 2027
Be in a leadership role in UWTSD	To be either car lead or overall team leader and gain a podium in the standings and win a race	Commitment to the team, Leadership roles, Knowledge of the team and car.	Team win in a race, overall team podium	2026 season

Gain a job in motorsport	To be hired by an established motorsport team	Graduate and gain further skills and qualifications	Whether I am hired or not	2027-2028
Buy a house	Close on a property and be	Manage my finances well and hold a successful career	Moving in or not	2030
Reach 100kg bodyweight	Get to 100kg lean mass, resulting in a 35kg overall gain from beginning my goal	To gain a further 12kg muscle mass	100kg mass	March 2025
Gain a job in F1	To be hired one of the 10 reputable teams	Immense dedication, Knowledge and understanding of my area of expertise	Whether I land the job or not	2028 onwards

Conclusion

The findings of this report highlight the variety of engineering, illustrating the technical skills required to operate a lathe as well as the health and safety aspects. An engineer's standards in relation to ethical standards in particular, highlighting Formula 1 and their efforts in reducing their carbon footprint. Problem solving is a key skill to have for engineers and working in a team with key structuring is highly beneficial.

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