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University of Wales Trinity Saint David
Wales Institute of Science and Art



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

Role of an Engineer

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Workshop and practice (core)

Motorsport Engineering (BEng)

ACHA4011

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Introduction

The report will cover different aspects of what make an engineer, the report will cover personal experiences with some of the heading titles combined with industry standards. There will be comparisons made from personal to industry standards and how they could improve.

Health and safety

Health and safety regulations are appropriate for keeping people safe and to reduce the chances of injury. When in the University workshops, the PPE varies from room to room to ensure the individual is protected. Throughout the whole workshop protective footwear is required and no food or drink can be taken in.

The Rolling Road Dynamometer room is an area of the workshop that poses a potential high degree of danger to nearby operators. When in use, barriers are used to keep a safe distance from moving components, also ear protection is required. There is legislation regarding health and safety that are required to be followed by law to keep people safe. The Health and Safety Executive (HSE) are responsible for regulation for British workplaces, protecting workers and employers. The HSE guidance on how to reduce risk and advise to minimise it, for example the dynamometer room is a very noisy area that has race cars and big fans working, producing a lot of noise in a confined space. The HSE want to limit prolonged daily exposure to noise that are over 85 dB to prevent hearing damage or loss, students must wear hearing protection when the dyno is in operation to mitigate the chances of hearing damage (Health and Safety Executive, 2023).

*First priority: protect the personnel
Second priority: protect the facility
Third priority: protect the unit under test*

Figure 1-priority list (Anthony J. Martyr, 2021)



Figure 2-Dyno Test in Workshop

when producing a risk assessment for any part of the workshop there is a priority list of which should be followed as shown in Figure 1. A risk assessment will be produced on all the potential outcomes of either use of equipment or chemicals and weigh up the severity to the chance of it occurring. This information can then be used to see if there is any way of reducing the chance or severity when in use. An example of this would be the rolling road testing the MCR 2000 car.

Figure 3 shows a potential risk in the dyno room. The graph shows areas that could go wrong giving a general overview of how a risk assessment works. Figure 4 shows an example of how the risk assessment is laid out, when trying to establish what is a priority area of focus with high degree of danger. It will be shown in the red area of the matrix making it clear to the users that that activity presents a high level of risk and actions can then be taken to mitigate the potential of harm.

The green areas show unlikely and low risk tasks that still need to be considered but are not life threatening, the aim of the risk assessment is to highlight the most severe risk and to help appropriately deal with the danger.

Risk Assessment Matrix for Dyno Operations				
Risk Event	Likelihood	Severity	Risk Level	Action Required
Machinery malfunction	High	High	High	Immediate action, shutdown, maintenance
Operator error	Medium	High	High	Training, supervision, procedural improvements
Electrical failure	Medium	High	High	Emergency protocols, backup systems
Fire hazard	Low	High	Medium	Fire suppression systems, regular inspections
Personal injury	Medium	High	High	Safety equipment, training, standard operating procedures
Exposure to harmful emissions	Low	Medium	Low	Proper ventilation, personal protective equipment
Noise-related health issues	Medium	Medium	Medium	Ear protection, noise reduction measures
Environmental impact	Low	Medium	Low	Waste management, eco-friendly practices
Data loss or corruption	Medium	Low	Low	Regular backups, data protection measures

Figure 3-Risk Assessment for Dyno Testing (Chat GPT 3.5, 2023)

		Severity →				
		Negligible	Minor	Moderate	Significant	Severe
Likelihood ↑	Very Likely	Low Med	Medium	Med Hi	High	High
	Likely	Low	Low Med	Medium	Med Hi	High
	Possible	Low	Low Med	Medium	Med Hi	Med Hi
	Unlikely	Low	Low Med	Low Med	Medium	Med Hi
	Very Unlikely	Low	Low	Low Med	Medium	Medium

Risk Matrix Example Likelihood X Severity = Risk Level

Figure 4-risk assessment matrix example (RiskPal, 2023)

Engineers Role in Society

Engineers have significant responsibility when designing products for public and have a duty to make the item as safe as possible to reduce risk to the user and surrounding area. Engineers are governed by councils that highlight safety procedures and ways that engineers should conduct themselves.

Engineering council is one branch that is based in the UK that ensures that the UK are maintaining standards that are competitive to the rest of the world.

The Engineering council's guidance for sustainability engineers is expected to comply not only environmental guidance from law makers such as the UN and EU but are to push the boundaries using their skills and knowledge to help not only stop the degradation of the environment, but to actively help seek to improve it. The expectation of engineers is to have a wide range of knowledge of current affairs such as climate change and are expected to act ethically when designing products so that it's not causing harm or lasting damage. This could be from the materials used, to production processes or by the product itself such as automotive vehicles. (Engineering Council, 2023)

IMechE have a code of conduct for their members to follow. The code of conduct echo's that of the Engineering council code of conduct with members expected to take in a wide range of political, environmental, and social factors into consideration and to be beneficial to the cause. They are also asked to not only think of the current effect but the future effect of the production and requirement for such a product. (IMechE, 2021)

The code of conducts from the two council have fuelled a major shift in the automotive industry with manufactures and engineers striving to find alternative ways of powering commercial vehicles, whilst also bringing into question the ethics of these new technologies. For example, Electric vehicles being a controversial topic for how ethical and environmentally friendly they are compared to the Internal combustion engine.

Problem solving

Engineers are faced with constant problems that threaten parts from being produced on a regular basis, part of being an engineer is to solve the problem as fast and efficiently as possible. Often used in industry a flow chart helps with plotting each stage of a products development and what course of action is required by the company to rectify the issue. The use of a flow diagram can be spread across all disciplines of a business such as issues once on market, supplier issue and the creation of the product itself. Figure 5 shows a flow diagram of the structure to developing a product, industry will have extensive check lists and agreements on each stage of a process to ensure that the product is affordable, works as intended and is safe for public use.

Automotive industry have experienced issues with products whilst on market before such as Audi. a recall of various types of Audis built between 1989-1993 due to an issue with air bag sensors being faulty and setting off the airbag during normal operation. Due to the severity of the issue, cars built between this time had to be recalled to dealerships and sensors replaced. Resulting in 54,800 cars in total being recalled. (Ford Motor Co, 1998)

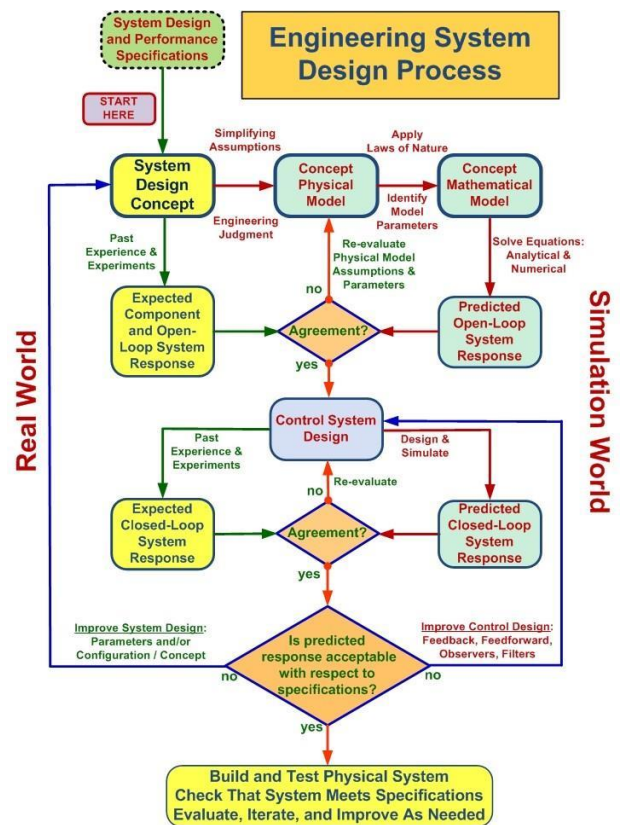


Figure 5- Engineering System Design Process Flow Diagram (Vaccaro, et al., 2016)

Team Structure

I have a lot of experience working in teams for different disciplines either work, sports, or educational challenges. I've contributed in many ways from working roles to leadership roles with the most recent and significant being on the University race team (MCR) where the importance of a structured team can have a major effect on results.

The team structure at a race day figure (6) is a critical part of having a car ready on time for the sessions, it also allows the right people to get the information they need to prepare for the next session while the rest of the team are still able to operate and complete tasks before re tasking.

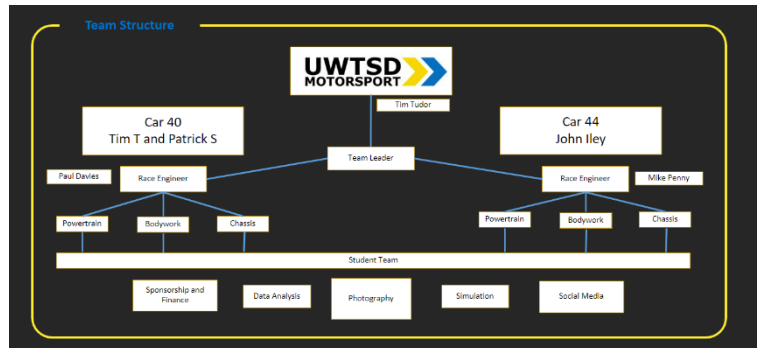


Figure 6- Current Team Structure for MCR Race team (UWTSD, 2022)

The current team structure is known as a hierarchy structure, below is listed some of the pros and cons of using such a structure.

The Pros of using this team structure:

- people who need to know the information get the info they need.
- Clear way of delegating work and setting tasks
- Always have someone to watch your back.

The Cons of using this team structure:

- communication is important otherwise key info could be missed.
- Involves a lot of different people with different ways of running things.

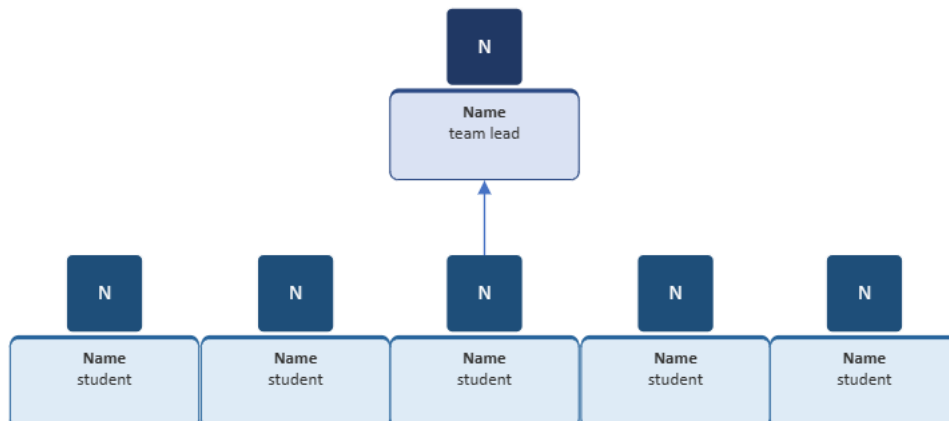


Figure 7- Flat Team Structure

An alternate way of constructing the team could be done such as the structure in figure (7). With this form of team structure the communication will improve as all parties will know the goal and hear the same information. From this the team can delegate tasks amongst each other making the workflow smoother. This kind of structure has downsides that could lead to a breakdown in work and task not being complete or people not taking responsibility for their areas.

Personal Development Plan

Name – Oliver Wilson

Degree – Motorsport Engineering

Previous Qualifications – A Level, GCSEs, Football referee, open water diving (PADI),

Previous Experience – Ten tors, DofE Bronze, 9 years of work experience in various industries consisting of construction, manufacturing and hospitality.

Long Term Goals (5 to 10 years)				
To be a member of a high-level motorsport team preferably involved with aerodynamic developments.				
Short Term Goals (0 to 5 years)				
To get a distinction in my university course and secure a job in industry.				
Goal	Objective	Resources Required	Measurement	Target Date
Distinction in my university course	To consistently hit 70% or above on every assignment	Computers and books	70% or above in each assessment	10/Jul/2026
Secure a job in industry.	To have a job to go to after graduation that will allow me to progress in my chosen field	Networking and applying to internships	Have a job that is in the right stream for my chosen career path in the 2 years after graduation	10/Jul/2028
To design and implement an improvement to the MCR.	To research design and produce a piece of body work that improves the performance of the car	CFD SolidWorks Research books Materials	Have a improvement on the car by the time I finish the course	10/Jul/2026

NOTE - Add more rows if necessary

Conclusion

In conclusion all the aspects talked about in the report is vital for an engineer to consider and act upon to ensure safe practices and to align themselves with the public interest. Risk assessments are a key part of engineering and keeping the operators safe whilst operating machines, enabling safe use, and giving confidence will allow for better performance by the operators. The role of the engineer is to act in the way described by the various engineering codes of conduct provided. Engineers should maximise their effectiveness when problem solving using flow diagrams and understanding of the potential problems when a product is released.

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