

# UWTSD

WISA



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

Engineering Technical Report

Workshop and Practice ACHA4011

Odin Robinson

2306128

14/11/24

## Contents

|       |                                             |                                     |
|-------|---------------------------------------------|-------------------------------------|
| 1     | Introduction .....                          | 1                                   |
| 2     | Health & Safety with Risk Assessments ..... | 2                                   |
| 3     | Engineers' role in society .....            | 3                                   |
| 4     | Problem solving.....                        | 4                                   |
| 5     | Team Structure .....                        | 5                                   |
| 5.1   | Team activity.....                          | <b>Error! Bookmark not defined.</b> |
| 5.2   | Alternative team structure .....            | 6                                   |
| 5.2.1 | Functional based team structure .....       | 6                                   |
| 5.2.2 | Hierarchical .....                          | 7                                   |
| 6     | Personal Development Plan .....             | 8                                   |
| 7     | Conclusion.....                             | 9                                   |
| 8     | References.....                             | 10                                  |

## 1 Introduction

This paper will cover variety of topics including, health and safety briefing from a standard workshop task, this covers how the activity is carried out and safety precautions that need to be considered.

Moreover, the role of an engineer in society is very important, so having a code of conduct when being associated with an institute is imperative, with all the responsibility of an engineer they are trusted with the design and development of everything that currently exists in the modern world, so this will cover how they are expected to act as a chartered engineer.

Problem solving makes up a large proportion of an engineer's job, so this paper will cover the process taken to solve problems at different stages of the production process.

Working in a team is imperative, when it comes to product research and development it takes a team of specialists that need to work together to be as efficient as possible. Having the proper team skills will help the process move smoothly without hiccups and product defects.

Finally a personal development plan that will cover plans for the next 5-10 years.

## 2 Health & Safety with Risk Assessments

Table 1 Risk assessment matrix

| Likelihood | Impact | 1                      | 2                             | 3                        | 4                                      | 5                                        |
|------------|--------|------------------------|-------------------------------|--------------------------|----------------------------------------|------------------------------------------|
| 5          |        | Cuts off sharp objects |                               | Oil spill (slip hazard)  |                                        |                                          |
| 4          |        |                        | People walking past work area | Parts falling onto floor |                                        |                                          |
| 3          |        |                        |                               |                          |                                        | Fuel still in fuel system causing a fire |
| 2          |        |                        |                               |                          | Chemical poisoning (brake cleaner etc) |                                          |
| 1          |        |                        |                               |                          |                                        | Engine falling off stand                 |

Since starting university on October 1<sup>st</sup>, we carried out an assignment for our workshop and practice sessions in which we dismantle and reassemble an engine to get measurements of the crank bearing journals. We started with removing the cylinder head as we needed access through the top of the engine, as the engine was on a stand and not positioned in a car it gave easy access to the inlet manifold, cam cover and anything else that needed to be removed to allow the cylinder head to come off. Once this has been completed, the sump and crankshaft cradle can be removed to allow access to the big end bearings, once we gained access and removed the pistons through the top of the engine, the crankshaft can be removed. Though this may seem a very reasonably safe activity there are many health and safety aspects to consider. Because the Right to repair legislation exists it's making the process a lot easier for mechanics to work on these engines as all repair manuals and specifications are readily available, this also allows us to plan out the job to make it as safe and efficient as possible. First making sure all the proper PPE is used throughout, this includes safety boots, protective clothing and gloves. As there are many heavy parts and tooling around the workshop safety boots are an essential part of safety equipment, as anything should fall or be drop,

your feet are the most vulnerable and need to be protected. Protective clothing is also important, because oil, debris and other harmful substances can cause serious skin problems so wearing clothes that protect you from these things is important, and gloves or a barrier cream are essential.

## 3 Engineers' role in society

### 3.1 Code of conduct

The code of conduct for engineers is similar between institutes with slight differences. It is important that all engineers follow this to protect members of the public and engineers. When you join an institute, you are expected to follow the code of conduct and keep up to date.

#### 3.1.1 IMechE

1. The IMechE code of conduct states that being honest is a crucial part of being an engineer, this is especially important in the automotive industry as people rely on cars to be safe and carry their families and doesn't help colleagues as when working on a project there as would cause delays further down the line or product defects.
2. Having respect for others, whether that's colleagues or customers, and being unbiased should be a top priority. This is important in the automotive industry; customer needs should be considered.
3. Promoting sustainability in these pressing times must be a top priority to preserve the planet, so any unethical practises that could impact the planet need to be eliminated. With the automotive industry waste can be reduced by recycling old cars or parting them out or using recycled metal.
4. Keeping information and professional skills up to date is important, this means that all work carried out and information provide is as accurate as possible. An engineer should also be honest about professional limitations such that any work can be completed without guessing or pushing into areas that require extra training or skills.

#### 3.1.2 How does IMechE compare to IEEE

The IEEE (Institute of Electrical and Electronics Engineers) is a comparable institute to the IMechE. They have the same principals of respect, sustainability. And have been around for 140 years.

*(Code of Conduct explained - IMechE, no date; IEEE - History of IEEE, no date)*

## 4 Problem solving

Development issues- when an issue is found during development, consider going back to brainstorm new ideas to fix the problem before choosing to carry on with development. Based on results review the data and make changes to the design as needed before moving onto a prototype to test in a real-world application. Take more data from carrying out tests to evaluate the changes made and they perform as expected.

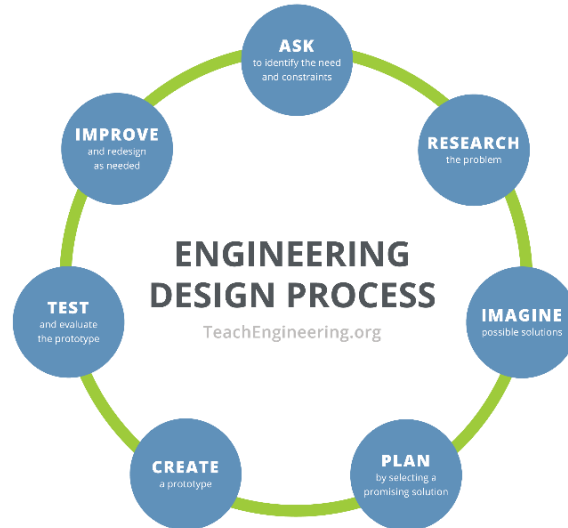


Figure 1 design process

What to do when there is a problem with a product already on the market- this is very similar to finding issues during development, the problem should be identified, once the problem has been found, research, plan and test a design that will solve the issue. The main difference being units may have to be recalled fixing the issue. For example, a new car is released on the market, there's an issue with self-locking causing people to be locked out of their car, engineers need to identify the issue, come up with a simple solution to repair the issue, and all vehicles affected need to be recalled and the problem rectified before being returned to the customer.

Issues with supply chain vendors- to begin with you should make sure to utilise a reliable vendor, staying in constant communication with the vendor is also important so any implications or delays can be identified immediately. A few ways problems can be averted or avoided.

- An easy way to avoid issues with the production process is to have multiple vendors so that if one should fail the project doesn't come to a complete stop.
- Utilising digital tools to grasp how their production process works and identify issues before production starts can also help.
- Keeping track of analytics can help foresee any growing issues before they become problematic.

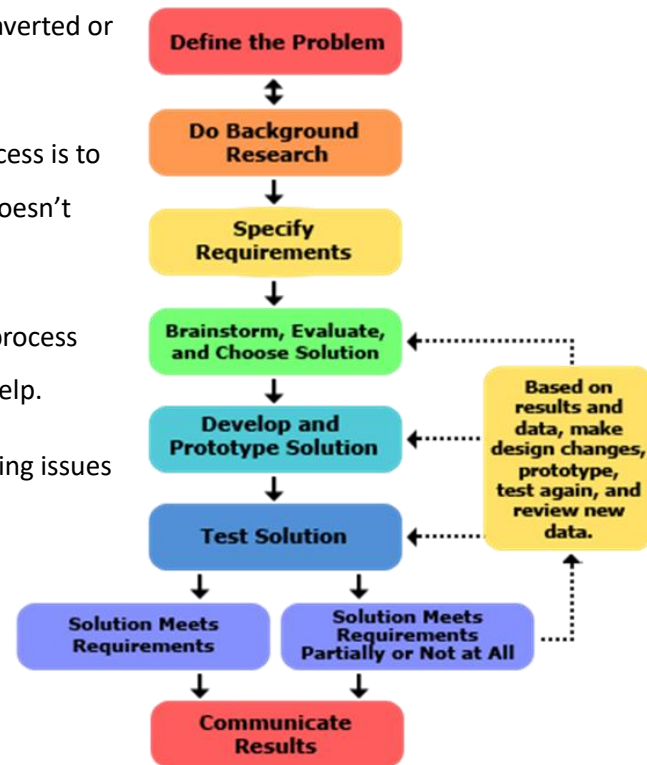


Figure 2 what to do when finding a fault from- science buddies

(Engineering Design Process, no date; Solving Everyday Problems Using the Engineering Design Cycle

- Activity - TeachEngineering, no date; Ball et al., 1997)

## 5 Team Structure

### 5.1 Teamwork experience

In a garage that I work at, there is a simple yet effective team structure, where it is formed of a hierarchical system. The Director (who owns the company) acts as both a working manager and controlling all business matters, below him there's a workshop manager, who is responsible for booking in cars, ordering parts, etc, who is also a working manager, both the workshop manager and the director are supported by an administrator who deals with customers when it comes to finance and booking MOT's. Then you have the mechanics, their responsibility is to carry out work on customer cars, attend to customer enquiries, etc. Overall, this system is a very solid team structure, working well in both terms of efficiency (with two managers present) and team spirit, which is a very important part of the workplace.

Though this team structure works well there are a few areas that could be improved, for example, though there are two working managers there may not always be someone to report a problem too, because they can easily be taken off to sort out a problem somewhere else or be occupied with a job

that they can't leave, leaving the individual or team members to solve the situation themselves leading to an issue of responsibility being unclear.

Secondly there is not much room for career progression, this may lead to employees/team members getting lack of motivation to carry on working to their full potential.



Figure 3 Flat hierarchical

## 5.2 Alternative team structure

### 5.2.1 Functional based team structure

In a functional based team, people are assigned their role through their speciality, this would be structured in a way that fits people's skill set for example a team would consist of different groups e.g. product designers, research and development, manufacturing and admin team etc. These teams will be overseen by a line manager who oversees administrative tasks and a functional manager who manages the specific jobs that need to be done to complete projects.

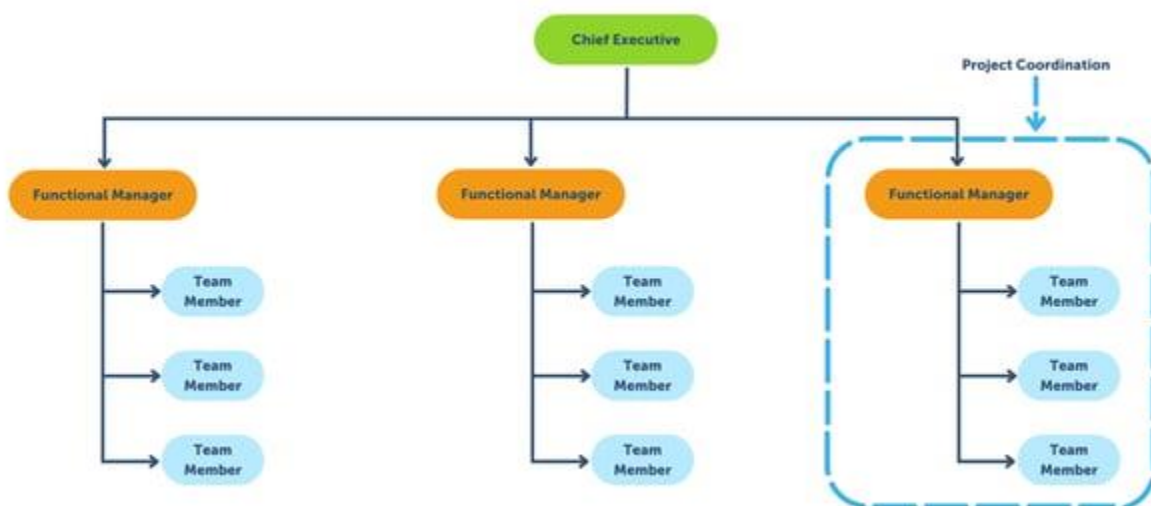


Figure 4 Functional based team structure from workamajig

### 5.2.2 Hierarchical Tall (pyramid)

A hierarchical team as it sounds, consisting of a pyramid type arrangement, where a chain of command is in place, mostly used in big corporations it can be effective to overlook a large team. It will consist of a director, line managers, functional managers and employees.

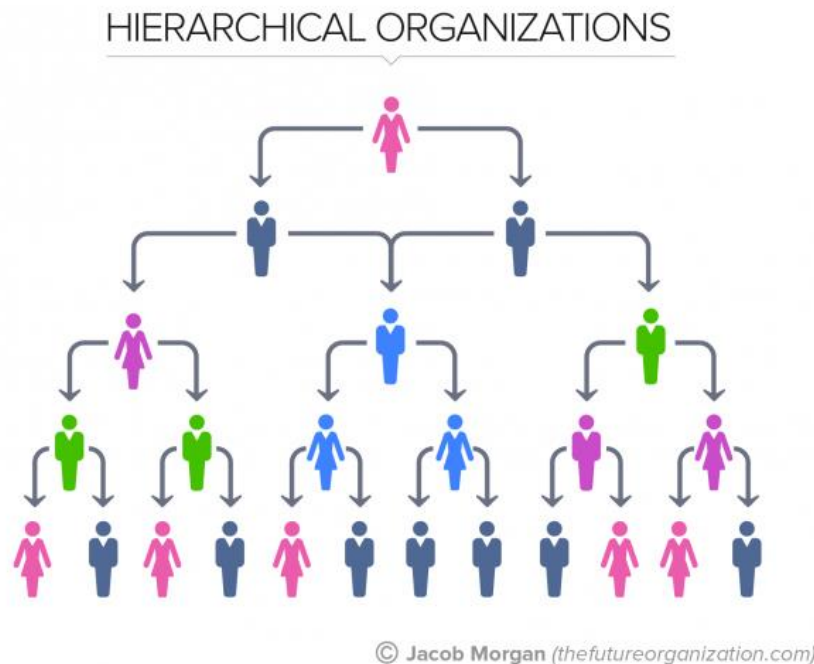


Figure 5 hierarchical based team

### 5.2.3 Product focused

Ideal for companies that want to focus their efforts on designing and developing new products, teams are constructed with supporting departments like sales, customer service, marketing etc. the rest of the team would involve engineers and designers to deliver a product on target deadlines.

They are usually managed by a single product manager who will oversee job allocation.

*(The 7 Challenges of Flattened Management Hierarchies | Primeast, no date; Tall and flat organisations - Structures - Higher Business management Revision - BBC Bitesize, no date; Project Team Structure: How To Build An A-Team, no date)*

## 6 Personal Development Plan

- Name – Odin Robinson
- Degree – Automotive Engineering
- Previous Qualifications – BTEC Light Vehicle Maintenance and Repair level 3
- Previous Experience – 3 years part-time experience working in a Garage

| Long Term Goals (5 to 10 years)                                                                                                                                                                                                                   |                                                           |                                                  |                                                         |                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|--------------------------------------------------|---------------------------------------------------------|----------------|
| I want to have started a journey in which I can research and/or test different fuel options that can be implemented in the current infrastructure and allow ICE vehicles to remain on the road to help reduce emissions to tackle climate change. |                                                           |                                                  |                                                         |                |
| Short Term Goals (0 to 5 years)                                                                                                                                                                                                                   |                                                           |                                                  |                                                         |                |
| In the next 5 years I want to have achieved a Bachelours degree and have applied for a master's degree or PhD. I also have a personal goal to achieve a sub 12.5 second ¼ mile at Santa Pod Raceway.                                              |                                                           |                                                  |                                                         |                |
| Goal                                                                                                                                                                                                                                              | Objective                                                 | Resources Required                               | Measurement                                             | Target Date    |
| Master's or PhD                                                                                                                                                                                                                                   | To learn, understand and research alternative fuels       | University                                       | Certificate for achieving a Beng                        | September 2027 |
| Master's or PhD                                                                                                                                                                                                                                   | To learn and research about alternative fuels             | Computer to apply                                | Accepted onto course                                    | September 2026 |
| Research and find the best car for a fast ¼                                                                                                                                                                                                       | Own a fast enough car to achieve a sub-12.5s quarter mile | Internet, general knowledge of cars and dyno     | 0–60 mph time and dyno test to confirm initial power    | September 2027 |
| Modify the car to get as much as possible on a budget                                                                                                                                                                                             | To improve on the original power figure                   | Workshop, tools and specialists to remap the car | Dyno run to measure the power and compare against stock | September 2028 |
| take the car to a dragstrip to see what ¼ mile time is achieved and adjust accordingly                                                                                                                                                            | To achieve sub-12.5s quarter mile                         | Drag strip and team                              | Speed and time at the end of the quarter mile           | September 2028 |

## 7 Conclusion

This report covered the importance of the code of conduct for engineers, the importance of the planet, people's personal privacy. How being honest and keeping within your abilities is important. Furthermore, health and safety are crucial and being provided with all necessary equipment must be a top priority for an employer and dangers such as slipping, chemicals and heavy parts falling can cause serious injury.

Understanding the problem-solving process is something that is important, where it is used daily in the engineering community, starting from the basics like, brainstorming ideas, coming with a new design that solves the previous issue without creating a new one.

Structuring a team can be done many ways, whether its either having a hierarchical system which works better for larger teams or a product focused team which is better for company or organisations that need to produce a product, how a team is structured can have a massive impact on how a company works.

## 8 References

Ball, L.J. *et al.* (1997) 'Problem-solving Strategies and Expertise in Engineering Design', *Thinking & Reasoning*, 3(4), pp. 247–270. Available at: <https://doi.org/10.1080/135467897394284>.

*Code of Conduct explained - IMechE* (no date). Available at: <https://www.imeche.org/about-us/imeche-governance/governance-and-finance-reviews/code-of-conduct-explained> (Accessed: 28 November 2024).

*Engineering Design Process* (no date). Available at: <https://www.sciencebuddies.org/science-fair-projects/engineering-design-process/engineering-design-process-steps> (Accessed: 28 November 2024).

*IEEE - History of IEEE* (no date). Available at: <https://www.ieee.org/about/ieee-history.html> (Accessed: 29 November 2024).

*Project Team Structure: How To Build An A-Team* (no date). Available at: <https://www.float.com/resources/structure-and-manage-project-team#3-steps-to-assembling-a-project-team> (Accessed: 25 November 2024).

*Solving Everyday Problems Using the Engineering Design Cycle - Activity - TeachEngineering* (no date). Available at: <https://www.teachengineering.org/activities/view/usu-1961-everyday-problems-introduction-engineering-design> (Accessed: 20 November 2024).

*Tall and flat organisations - Structures - Higher Business management Revision - BBC Bitesize* (no date). Available at: <https://www.bbc.co.uk/bitesize/guides/z48y92p/revision/1> (Accessed: 27 November 2024).

*The 7 Challenges of Flattened Management Hierarchies | Primeast* (no date). Available at: <https://primeast.com/insights/the-7-challenges-of-flattened-management-hierarchies/> (Accessed: 27 November 2024).

Honourable mention- Kerry Tudor