Unit 4 - Working with and Understanding Unmanned Vehicles

Overview

The overall focus for learning in this unit is to allow learners to research and understand the history and development of unmanned vehicles and to see the range of uses across all sectors. They can then explore how to make their own devices and think about the materials and processes required for success. As with all the units, what are some of the consideration of these devices, for example driverless cars and lorries.

A work activity will typically be ‘straightforward or routine’ because:

The task or context will be familiar and involve few variable aspects. The techniques used will be familiar or commonly undertaken.

Example of context – assembling and controlling a basic unmanned vehicle

Assessor's guide to interpreting the criteria

General Information

RQF general description for Level 1 qualifications

- Achievement at RQF level 1 (EQF Level 2) reflects the ability to use relevant knowledge, skills and procedures to complete routine tasks. It includes responsibility for completing tasks and procedures subject to direction or guidance.
- Use knowledge of facts, procedures and ideas to complete well-defined, routine tasks. Be aware of information relevant to the area of study or work
- Complete well-defined routine tasks. Use relevant skills and procedures. Select and use relevant information. Identify whether actions have been effective.
- Take responsibility for completing tasks and procedures subject to direction or guidance as needed

Requirements

- Standards must be confirmed by a trained Gold Level Assessor or higher.
- Assessors must at a minimum record assessment judgements as entries in the on-line mark book on the INGOTs.org certification site.
- The work in the unit is recommended in order for candidates to have covered enough depth and breadth in the topic to successfully carry out their controlled assessment and take the external exam.

- When the candidate has covered as much of ths material as necessary to complete the controlled assessment element, they may be introduced to the topic

- This unit should take an average level 1 learner 30 hours of work to complete.

Assessment Method

Understanding of these learning objectives will be demonstrated through answering questions related to key ideas and concepts in the terminal examination as well as practical application of their understanding through the controlled assessment.

Expansion of the assessment criteria

1. Understanding the range of unmanned vehicles

1.1 I can list a variety of unmanned vehicles

Learners will research and list some unmanned vehicle designs

Additional information and guidance

The most well known unmanned vehicles for most learners will be multi blade drones and many schools now use these to take aerial videos of their school for website marketing. However, there are a multitude of unmanned vehicles that are used in air, on land and in the sea. Learners can give a few examples in each category to show an understanding of a small subset of the overall range of uses. A table may make the list clearer. The full table is shown in 1.3 below.

1.2 I can list some of the uses for unmanned vehicles

Learners will list the uses of the vehicles they list

Additional information and guidance

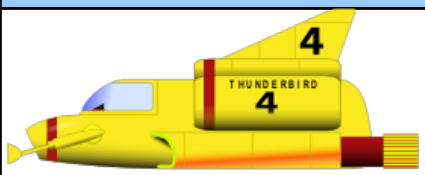
Learners can add additional columns to their table or report and add in their list of uses.

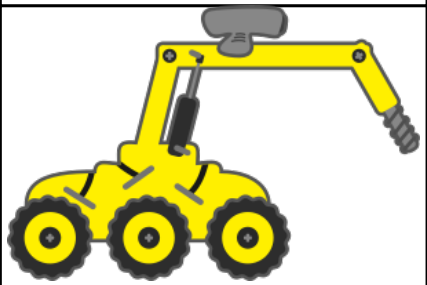
1.3 I can explain some of the uses of unmanned vehicles

Learners will explain some of the detail of the use of the vehicles

Additional information and guidance

Learners can add additional columns to their table or report and add in the more detailed explanation of uses of uses.

Device	Image	Type	Uses
Submarine		Water	Surveys
Helicopter		Air	Surveys

			Testing	
Multileg / wheel crawler		Land	Search and re	

1.4 I can explain some limitations of unmanned vehicles

Learners will explain their findings of limitations

Additional information and guidance

The most obvious limitation of any device, regardless of function, is the power supply. Most unmanned vehicles are powered by batteries. The limitation here is to make the batteries light enough, but also powerful enough to last for a long time. If they are too powerful, there is a danger of overheating and fire. There are new developments in battery technology to move away from exiting designs and chemical formulations, but they remain the main limitation.

Other limitation, as with any manufactured device, will relate to environmental factors such as heat, humidity, pressure etc.

1.5 I can explain some future uses of unmanned vehicles

Learners can explore their ideas and suggest possible uses

Additional information and guidance

What might future uses be for these devices? Some of the ideas are already being trialled, so some companies are testing whether or not they can use unmanned aircraft to do city based deliveries as they will avoid all of the road based traffic problems. Unmanned trains are already in use in many cities and buses and cars are beginning to appear. The issue for more high speed forms of unmanned vehicles is presumably the risk of human life. A relatively slow moving train or bus with passengers may not cause too much injury if it has a problem, but what about trains travelling at 300 kmh, or airplanes? Electric, unmanned trucks would go a long way towards reducing pollution, as long as their energy was sourced cleanly.

2. Testing and evaluating unmanned vehicles for particular uses

2.1 I can list materials used in unmanned vehicles

Learners will list some of the materials used in vehicles

(function(i,s,o,g,r,a,m){i['GoogleAnalyticsObject']=r;i[r]=i[r]||function(){ (i[r].q=i[r].q||[]).push(arguments)},i[r].l=1*new Date();a=s.createElement(o), m=s.getElementsByTagName(o)[0];a.async=1;a.src=g;m.parentNode.insertBefore(a,m) })(window,document,'script','//www.google-analytics.com/analytics.js','ga'); ga('create', 'UA-46896377-2', 'auto'); ga('send', 'pageview');

Additional information and guidance

The list of materials will include plastic, wood, perspex, various metal alloys, silicon, rubber etc. learners can list these in a table and add some commentary if it makes it easier to make sense of them all.

2.2 I can explain the choice of materials used in unmanned vehicles

Learners will explain some of the reasons for these materials being used

Additional information and guidance

Most unmanned vehicles, especially the commercial ones that learners are likely to investigate, need to be strong but light. For example, a small flying drone needs to be light so as to not run the batteries out quickly. The ideal materials for this sort of application will be some kind of plastic. Plastics can be expensive to produce, though 3D printers are making these less costly. Other materials could be materials such as balsa wood, which is relatively strong and very light, but also environmentally friendly as it will decay if lost.

For land based vehicles, there will be a need for some kind of tyres of tracks which could be rubber or steel links.

Underwater vehicles will be subject to a lot of pressure so the plastics will need to be thicker. Perhaps weight is not such as issue as the pressure under water is extreme. Some forms of rubberised material or silicon might be used to prevent leaking

2.3 I can test the basic functions of an unmanned vehicle

Learners will demonstrate some testing skills

Additional information and guidance

Depending on what kind of vehicles the centre has access too, learners can show that they can control the vehicles in therefore understand some of their usage. It may be necessary for the learners to work in groups with the assessor, as long as they can see the functionality in action.

2.4 I can explain the limitations of unmanned vehicles I have found

Learners will explain what the vehicles can’t do

Additional information and guidance

Unmanned vehicles are usually designed for very specific purposes and don’t always work well outside of these boundaries. For example, small airborne drones will not be very effective in strong winds as they will be too light to buffer against the forces of the wind. As discussed in other areas of this qualification, the battery life of these vehicles is a major limitation as they will have a specific time range which will then determine what they can be used for. A submarine based drone can probably only dive to a specific depth because of the pressure involved and the battery life. This then limits what can be achieved. There are also legal constraints that learners need to be aware of.

2.5 I can explain the impact of unmanned vehicles on general manufacturing practices

Learners will explain some of the link between manufacturing and technology

Additional information and guidance

The modern development of devices such as 3D printers and the miniaturization of components has had a huge impact on the growth of unmanned vehicles. Most toy shops now have small and powerful flying vehicles with high quality cameras that can allow anyone to make videos of their

garden or local allotment, for example, to get a clear idea of their surroundings. The demand for these devices and the lowering cost means that more development is going into the development of equipment to make these devices easier and more cheaply. This also, perhaps, means more small scale companies emerging that can quickly develop designs and distribute them. It could mean a move away from large scale companies and factories towards more artisan design and manufacturing industries.

3. Exploring the use of unmanned vehicles and their future uses

3.1 I can comment on the need for unmanned vehicles

Learners will offer their opinions on the value of unmanned vehicles

Additional information and guidance

Beyond the obvious fun of having a small unmanned vehicle flying about in your house or garden, is there anything more to them? In their research and understanding of these devices, have the learners gained a sense of their importance for the wider world? Can they give examples they have come across where they think that unmanned vehicles are really important for the future of themselves or others? Can the learners give a clear example of what they feel is a use for unmanned vehicles which is absolutely essential?

3.2 I can explain the issues surrounding unmanned vehicles

Learners will explain any issues they have come across in their investigations

Additional information and guidance

All manufactured devices have advantages and disadvantages. The current news makes it quite clear that the incredible convenience of the modern world as a result of the development of plastics is also a potential threat to our very existence as they continue to leach into the seas in high volume. What, if any, are the issues around unmanned vehicles. The following are some points for investigation:

- Privacy
- Interference - i.e. with commercial flights
- Pollution
- Over reliance

The privacy concerns are becoming more widespread as unmanned aircraft are used to spy on other people. Interference with commercial flights is increasing as the volume and number of unmanned vehicles increases. Vehicles that crash into the sea or other places where they can not be recovered will cause pollution and other issues. If we rely too much on them and don’t develop other ways of doing things, they may cause issues.

3.3 I can list the benefits of unmanned vehicles

Learners will list some benefits they have discovered

Additional information and guidance

There should be endless stories in the news about the great things that can be achieved with unmanned vehicles. Some of them are ongoing and almost forgotten about, such as the rovers on Mars that are sending back data to earth for scientists. If unmanned vehicles are used to deliver packages in cities and this means no more petrol and diesel based vehicles doing these jobs, then cities will be far more pleasant places to live and work. Using drones to fly body organs between hospitals quickly to avoid traffic jams will mean more lives are saved and the small land based vehicles that can scurry through wrecked buildings will also save more lives.

What other uses have learners discovered/

3.4 I can comment on the limitations and dangers of unmanned vehicles

Learners will explain some of the potential problems with unmanned vehicles

Additional information and guidance

Learners will have explained some dangers, in terms of the way unmanned vehicles are used, in 3.2 above. In this criterion, they will comment on their views of these issues. Many things in life are a compromise between good and potential bad. We all need a motorcar to get around, but the fact remains that 2-3,000 people a year die as a result of cars each year in the UK. Is this enough reason not to use cars? What are some of the dangers associated with unmanned vehicles and what judgements should be consider about these facts? The popularity and relative low cost of unmanned vehicles means that they are somewhat disposable. Why pay to get one fixed when it is cheap enough to buy a new one. This results in more of them ending up in landfill sites. How much of the material can or should be recycled? Recycled materials are more expensive, so should people pay more money to protect the environment?

3.5 I can present my thoughts on the future of unmanned vehicles

Learners will reflect on what they think the future f these devices might be

Additional information and guidance

Learners will understand enough about unmanned vehicles and have researched various areas to be able to make some simple predictions. What impact will unmanned vehicles have on their own lives in the next 5 to 10 years? Will they be a force for good or cause more problems than they solve? Will they be involved in unmanned vehicles professionally, if so, in what capacity?