

Learning Objectives

- To learn about the impact of computer aided design and manufacture on the design and manufacturing industry.
- To further advance CAD skills in 2D Design and SketchUp.

WHAT WILL YOU BE DOING THIS PROJECT?

For this project you will be learning about CAD and CAM as well as how it has changed the way we make products. You will then move on to using 2D Design and SketchUp to produce a variety of virtual designs.

Key words

Computer aided design (CAD): using computer software to draw, design and model on screen.

Computer aided manufacturing (CAM): manufacturing products designed by CAD.

Automation is the use of machines to do a task automatically, without much or any human input.

Input This is all of the materials, tools and equipment that you start off with.

Process This is what happens to the input to change it to an output.

Output The output is the result of the system – in other words, the finished product.

Manufacturing is a system

Industry involves manufacturing products. Manufacturing involves several processes that are carried out to create a finished product from some raw materials.

The process of manufacturing is a **system**. Products are made as a result of a number of different stages taking place one after the other.

These systems can be split up into three parts:

INPUT

This is all of the materials, tools and equipment that you start off with.

PROCESS

This is what happens to the input to change it to an output.

OUTPUT

The output is the result of the system – in other words, the finished product.

Advances in technology

Technology never stands still. Advances can help manufacturing processes to run more efficiently.

In recent years this has been enabled by advances in information and communications technology.

Automation of manufacturing processes

- Automation is the use of machines to do a task automatically, without much or any human input.
- Automation has been a key development in manufacturing and is present in many modern factories. It can be used to carry out as particular process or manufacture of a whole product.

Advantages (of automation)

Robots can increase the speed of production as they can work faster than humans and don't need to rest. This also means robots can be cheaper to use than human workers.

Robots can work with high accuracy as they perform the same task consistently, whereas humans can make mistakes (which have costs, e.g. time and materials). Robots can therefore increase the quality of manufactured products and reduce costs.

Robots can be used in dangerous situations where it would be unsafe for humans.

Example of automation

In the car industry robots are used to do certain processes like welding parts together and stamping out metal body panels.

These robots are programmed by humans but then run automatically. Humans are only needed to monitor the robots and repair them if they break down.

Disadvantages

Robots can replace human workers so there are fewer jobs for people to do.

Robots can be very expensive to buy.

Robots can't carry out tasks that require human judgement.



CAD/CAM

CAD and Cam are a really important part of designing products and manufacturing them. They're used in lots of different industries from food packing to component manufacture.

CAD stands for **computer aided design**

- It involves designing products on a computer rather than using a pencil or paper.
- CAD software packages allow you to make 2D or 3D designs. Examples of CAD software include 2D design, Solidworks and SketchUp.



CAM stands for **computer aided manufacture**.

It's the process of manufacturing products with the help of computers.

CAD software works out the coordinates of each point on the drawing (called **x,y,z coordinates**).

- **X = left/right**
- **Y = forwards/backwards**
- **Z = up/down**

The point where x, y and z meet is (0,0,0) known as the datum.

CAM machines are computer numerically controlled (**CNC**). They can follow x,y,z coordinates and move the tools to cut out or build up your design.

Advantages of CAD

It helps designers model and change their designs quickly.

It's easy to experiment with alternative colours and forms.

You can often spot problems before making anything.

Less space needed for making prototypes.

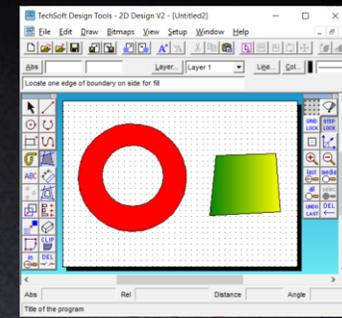


2D Design

Learning the basics

In order to further progress your 2D Design skills, you will be following the tutorials in this PowerPoint presentation to complete a variety of set tasks.

TechSoft created 2D Design for users who require sophisticated drawing and design features, but don't want to spend a lifetime learning to use them. Although designed with professional capability, its ease of use means that 2D Design is the CAD standard for the vast majority of UK secondary schools. Whether you need to produce traditional engineering drawings, colourful 'free-form' designs for embroidery, or smart graphical presentation sheets, 2D Design V2 has been carefully developed to give you all the tools you need – and all in one place.



Orthographic Projection

An orthographic projection shows **2D views of a 3D object**.

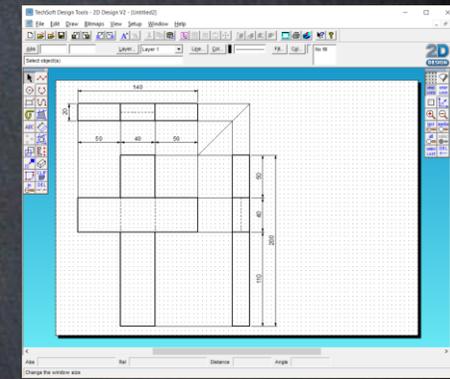
They are **widely used in industry** to help the manufacturer understand the design.

They show a 3D object as a set of 2D drawings viewed from different angles:

- **a front view**,
- **a plan view** (as seen from above)
- **an end view** (as seen from the side).

Each 2D view is drawn accurately to scale.

The dimensions are always given in millimetres.



Isometric Projection

Isometric projection is a method for visually representing three-dimensional objects in two dimensions in technical and engineering drawings. It is an axonometric projection in which the three coordinate axes appear equally foreshortened and the angle between any two of them is 120 degrees.

