CAM Systems

Computer aided manufacturing (CAM) is now a central element in many production systems. CAM machines enable a wide range of processes to be carried out automatically in both 2 and 3 dimensional formats:

Cutting, milling, turning, routing, engraving, heat cutting and even printing in solid materials.

Most modern day CAM processes use data from either 2 or 3 dimensional CAD drawings which are converted into machining paths [called G&M codes] by the CAM software.

Normally 3D CAM software will generate a 3D model of the machine process so that it can be checked for faults prior to machining the material. It also allows the machinist to prepare a billet of material that exactly matches the machining envelope for the part so as to keep waste to a minimum.

In 2D CAM processes for cutting profiles or pocketing shapes into a material an offset allowance will be added drawings to take account of the radius of the cutter(s) being used. The offset lines will become the actual cutting profiles which the machine will follow the centre of the cutter.

Where multiple parts or batches are to be cut from a billet the production engineer must reduce material waste by careful positioning of the components.

Typically, most CAM production will follow a process similar to this:

1. *A CAD drawing or 3D models generated.*
2. *Necessary offset paths/colour coding for different cuts etc are added to 2D drawings.*
3. *3D models are exported as stereo-lithography **[stl]** files.*
4. *The data is converted into G&M machine codes which are actual paths that the machine cutter will follow either in 2 or 3D space. Cutter diameters, materials [speed/feeds], depths for cutting will need entering at this point for the correct G&M codes to be set.*
5. *At this point a virtual machining preview will be run on the computer to test the setup.*
6. *A billet of the correct size is fixed into the machine and set-ups are made regarding tooling [diameters and depth settings], actual material depth and sometimes feed and speed settings.*
7. *The machine is set to run with necessary guarding in place.*
8. *The finished piece is removed and cleaned ready for further processing or finishing.*

Advantages:	*Disadvantages:*
• *Manufacture is accurate and can be repeated consistently with large runs or batches.* • *Manufacture is less labour intensive and will save on employment costs in the long run.* • *Manufacture can take place with minimum supervision and can be done*	• *Initial investment and start-up costs are very high.* • *Machine maintenance is often costly.* • *Need highly trained operatives and technicians to ensure correct tooling and setup procedures are followed.* • *May contribute to loss of a workforce*

during unsocial work hours. • *Machines can work continuously and with small margins of error.* • *Can release staff from mundane types of work to be used in more demanding / interesting parts of product manufacture.* • *Prototype models can be made very quickly for detailed inspection prior to finalising designs for manufacture.* • *Machining routines and outcomes can be evaluated with virtual machining on screen.*	*with high level manual skill.*