How Can You Complete Your Project Successfully?

During the design process…

- Study existing solutions, resembling solutions and not so obviously resembling solutions. Search technical literature, catalogs, patent databases and the WWW.

- Design your parts with the ease of manufacturing in mind. Remember that you will be the one that will machine the parts later on.

- Choose lengths and angles at rounded values (in many cases these are standardized). Avoid unnecessary conical surfaces, angles that are not 90° and large rounded corners.

- Design your parts (and whole assemblies) having as many symmetries as possible. These will reduce the chance of assembling errors and allow for interchangeability.

- Use stock at its ready available dimensions. Avoid removing material over wide areas by milling or grinding.

- Order stock at the size you need or slightly larger dimensions. Check with suppliers about their cutting precision and let them know your requirements.

- Remember that structural steel, particularly medium and large size I-beams and C-channels may come with notable manufacturing errors (warping, bents, thickness variations etc.). Check with the supplier and be prepared for schedule delays to account for such imperfections.

In the machine shop…

- Obey the machine shop safety rules and maintain good relations with the shop personnel.

- Start your machine work with the simplest, less precise parts so that you can gradually gain experience as the work for the project progresses.

- Don’t come to the machine shop without knowing what you will do that day.

- Always have a drawing of the part you are working on available with you.

- Do not hesitate to ask the machine shop personnel about a tool selection, correctness of a setup or appropriate manufacturing process for the part you plan to work on. Show them your drawings and ask for their opinion. A part can be manufactured in many different ways, but some processes are less time consuming than others.

- Do not weld metals unless you are really proficient. Rather ask the shop personnel for help.

- Verify your setup carefully before you start any machine work. Imprecision that will affect the correct assembling and functioning of your part are rarely visible with the naked eye.

- Check the perpendicularity of the milling-machine spindle relative to the table. Similarly, check the band-saw vise to have its jaws perpendicular to the band surface. A previous user might have changed these settings.

- Inform the shop manager if you notice a machine that is improperly adjusted or if it is not working correctly.

- A close metal-saw cut can save you long milling hours. You can do a trial cut on a piece of scrap metal, or reduce the excess of material for the next part once you have got a feeling about how precise the respective saw can cut. Remember, such precision is a function of many parameters (feed and speed, stock size and material, band's condition) and can change from one day to the other.

- Never fully trust your measurements. If possible, ask a colleague to redo them or use different measuring tools and compare the results. For example, you can easily miss the integer inches when using the caliper. Measure the same dimension with a ruler or tape measure and check the values for closeness.

- In order to accurately position a hole when using a drill-press or hand-drill you must punch its center first. Always drill large diameter holes in stages, starting with a small diameter drill. This will add precision and reduce the chances to break the drill, damage your part and injure yourself.

- As you progress with your machining, check the rigidity of the setup and the condition of the cutter.

- Having the layout marked on the stock is always helpful and can reduce the number of intermediate measurements you have to take.

- If you removed material beyond the specified dimensions, be prepared to start all over again. Sometimes it is possible to save the wrong part by making changes to the design, adding washers, spacers, or build up material back in place by welding. Always inform your colleagues about such modifications and ask for a second opinion. Think twice before altering an already machined part in order to salvage a wrong part that assembles with.

- Clean your own mess before leaving the machine shop (not only the milling machine and the lathe area, but the welding table, bad-saw and drill press too).

- And remember: compleating a project always takes longer than initially anticipated!

For your presentations…

- Find out how many people will attend your presentation and learn about their backgrounds.

- Always have an introductory section presenting the project and its requirements.

- Never assume that the audience knows details about your work.

- Arrange in advance for presentation equipment and have it tested before the presentation begins.