

## Steps in the Design and Building Process

These are the basic steps you should go through when building some type of prop or device. How much time you spend on each step depends on the type and complexity of the device or prop you are building. If it is something simple you may not spend much time on any step but Building. If it is something complex you may have to spend a lot of time in each step.

**Define**- Generate ideas and define what you want to build and what it needs to accomplish.

- What are you trying to build?
- What do you want it to do?
- Who on the team will be using the object?
- Are you building a required element for your challenge? If so, are their specific dimensional or other requirements that you must meet.

### **Other Considerations in the Define Step**

- Will it fit through a 30" door? The Rules of the Road require this. If not, think of how you are going to overcome that limitation. If your prop will not get through a door into the performance area then you can't use it.
- How are you going to transport the object you are building to the tournament? You may need to talk to your team manager about this. If your team manager has a trailer that is 5' wide by 8' long and 5' high and you build a backdrop (for instance) that is 10' long then you will have trouble transporting it to the tournament. It is not interference for the Team Manager to tell you that they will not rent another trailer to move props.
- How many people have to move the object? Is it heavy? Does it need wheels? Is there a chance you are presenting in a gym where you will have to make sure you don't damage a wood floor?
- Do you have to be able to break it down for transportation or to move it through the building to the presentation site?
- You may have designed it to accomplish a certain task but what other things MIGHT you want to accomplish with the device or object if you have time to work on it further.

**Think Outside the Box!** - How would you build this if technical skill and budget were not an issue.

Think about how you would solve this challenge if you did not have the constraints of a challenge budget or lack of knowledge for the optimum solution. Then break that idea down into smaller pieces. Decide what parts of your design you can use as is and then start generating ideas on how you might implement those wild and crazy ideas that you came up with. Can you use recycled materials or repurpose things in order to achieve the maximum effects?

**Design** - Using the ideas and criteria you developed in the DEFINE step, produce a drawing of what you want to build.

**Producing a drawing**

You should put your design down on paper before you ever start building. Use grid paper or at least include dimensions of all components. You may need to draw several views of your object - for instance a top view and a side view.

**Other design considerations**

- Lumber dimensions for most of the lumber you purchase at a home improvement center are nominal dimensions. What this means is "it ain't what it says. When you purchase a 2x4 at a home improvement center it is not 2" x 4". It is actually 1-1/2" x 3-1/2" It is important to keep this in mind. Dimensions for plywood are typically correct so that a 4' x 8' piece of plywood is actually 4' x 8' and the thickness is listed where you purchased it.
- If you are building a large object you need to think about your design requirements. If the object is large and must be disassembled you must think carefully about how the object goes together so you can break it down into modular pieces.

**Model** - When appropriate build a small scale of what you are trying to build.

- If you are working on a technical challenge you should also develop a drawing of the challenge site to get a good understanding of the layout.
- Before starting any major project it is best to build a model. In some cases a simple model out of paper or cardboard will suffice. In other situations you may want to build a small model out of wood. Balsa wood is a good medium for creating a model.

**Build** - Start constructing your device.

- Before you begin to build make sure that you have all the supplies that you need. There is nothing more frustrating than getting into a project and then finding you cannot complete it because you don't have something on hand.
  - Do you have all the wood that you need?
  - Do you have the correct fasteners? Bolts and Nuts? Screws in the right sizes?
  - Do you have the tools that you need? Correct drill bit sizes? Saw Blades?
- When you start to build, consult your drawings frequently. "Measure Twice, Cut Once."
- Don't rush. Take the time to do things right. "That's Close Enough" should NEVER be your attitude, particularly with a complicated technical device.
- Make sure you have a clean work area and plenty of room to work.
- Stop work if you start to get tired. If you get tired you make mistakes that can ruin what you have done at best or will hurt you at worst.

### **Refine - Redefine - Redesign**

- When you have the first version of your device built, test it out and see how it works.
- Hopefully it only needs some little adjustments for it to work perfectly and you can just REFINE your design.
- More than likely you may find that your device just doesn't work the way that you want it to. At this point you may need to move back up the top of this list and REDEFINE your object or device and what it is trying to accomplish. Then you REDESIGN your device using the experience you gained when you built it the first time.