CAD basic introduction

**Introduction**

Welcome to team 4141 Monarch Robotics. For the past 8 years of this team’s existence, we have constantly created robots using ideas from all our members. The problem was that we had no way to truly visualize it and often ran into several issues every time. This always resulted in a rushed robot and often missing several of our matches at the beginning of our competitive season. Two years ago, several new members of the team including myself, decided to create the CAD team. CAD stands for computer aided design and was the one thing our team needed to make all our ideas happen and work together. When we first introduced the smaller sub team, we were inexperienced and we were just testing our abilities in the first year. However, by the second year, we had begun to truly work as members of the team, becoming essential to the building process. However, years of building without plans had made the team heavily reliant on simply improvising as we went along. For the new CAD team, this created several problems as we required a built-out plan that didn’t change constantly. This caused our small CAD team to quickly stress and become overworked as a result. Older members will remember this and with our new experience we have learned what we need to do to implement a plan before we start CADing. As we go along in this short introduction you’ll learn some useful tips for planning ahead in the CAD world and keeping up with the team.

**Basic mechanics**

Learning basic CAD is the first step into the team that you will need to understand. Although every member of the team will understand the lowest basics of CAD, you will have a thorough understanding that will allow you to make constructs for the entirety of the team to follow. To start out you will need an Onshape account. To start with Onshape you should take the basic tutorials. This will allow you make constructs, cut, and modify pieces in ways the team needs. After these basic tutorials and the advance ones, ask your team administrator to get you on the team reminders and groups that you will need to have access to contribute to the team. If you have any issues don’t worry about asking questions. Our more veteran members and mentors are more than willing to help you with anything you need.

**Group work**

When working on Onshape, often you will be assigned to a full group project where multiple members will be working on one project. You will be divided based on your skill and abilities. For example, there will most likely be an administration team that will manage all other teams and assemble the final build, while there may be a team dedicated to building a chassis and another that may be dedicated to building one of the many subsystems on the robot. Together they will all build a cohesive robot design that eventually the entirety of the team will end up working on. When the design is finally put together on Onshape, each team will highlight qualities that they like and others that they may ask for change.

Finally, after the design has been finished, it will be time for the entire team to view the robot and vote on any changes that need to be made or go into the prototyping stage. Although most of the other teams will be made smaller to assist the mechanical team, there will still be a skeleton team that will make changes that will be made to the Onshape design. Other than this however most of the team will now be focused on the physical parts of the robot. We will also switch some of our team over to the financial team to calculate final cost if they need the extra hands. Splitting our team up allows for more time to be put into the physical robot

**Scheduling**

We will be very constrained on time as we are required to get our final design to the rest of the team by week two latest. From the moment that the competition is announced to the moment it ends you should be busy. By the first day here should be a concept in the making and by day two there should be some ideas worked out on how some of the problems can be solved. The game manual is also a very good resource and should be consulted on every decision. By the 3rd or 4th day, a concept should have come together and the main design idea should be in the process of being CADed and by the last day of the week every single one of the groups should have a base designed at least and the frame of all the other designs. By the beginning of the second week, all designs should be in their final stages. By the end of the week, the designs should be put together and all of them should be shown to the rest of the team. With this only a skeleton team is really required at this point and the rest of the smaller sub teams can be broken up into the mechanical and financial teams. The skeleton team will keep updates to the main model, but other than that most of the work will be up to the rest of our team now

**Communication**

In the previous paragraphs on how to CAD, it makes it seem as if the CAD team is off doing their own thing while the rest of the team does something else. But the whole team is important to every single endeavor that CAD does. While we may not make a perfect model, we lay the foundation for everything. This includes mechanical who follow our designs to near perfection and build everything based on what we give them. There is also electrical who must figure out where to lay every wire, every board, and every single motor on our models. Finally, is programming who may not have much on the physical level, but need to know how many motors we will have, how many cameras will we have, and in general what is our robot supposed to do. While none of these teams may directly impact us, they still require our attention and ignoring them will lead to the past 8 years of disarray and disorganization. With CAD, our mission is to link all the teams so there is no more miscommunication, so little problems don’t happen as often and the big problems never existed in the first place. This will allow us to build great designs with few flaws and allows the rest of the team to work more easily

**Some Resources**

Besides the basic recourses that we have access to on Onshape, you also have access to a massive library of parts created by our veteran CAD members in a360 under Autodesk. This cloud based storage will allow you to access older, but usable files for future projects. This will allow you to use older more customized parts instead of having to recreate the same parts. You also will have access to our club google drive that will give you access to manuals, information, and other CAD models. Not only there are also YouTube videos that will help with tutorials and examples of functioning and tested designs. We also have mentors with years of experience that have competed in not only previous FRC events, but have also worked in professional environments. These mentors provide invaluable knowledge and experience for the team and asking questions as well as utilizing their knowledge to the best of our abilities.

**Time dedicated**

Like most clubs at Mater Dei, everything you do is dependent on the amount of time you put into it. We do have quite a bit of administration support behind us, but most of the dedication will come from you as a club member. Whether you work in the room, at home, or somewhere else, that time you put in is essential for the club to function. Without time dedicated to the team, it will quickly fall apart and anything that is left will have to be picked up by another member that will have to put more time in for a lack of dedication. There were days in years before that well over full evenings were spent working and even longer were often spent to finish things that should have been long finished. Nights like that may happen, but it’s the hope that with a more efficient CAD team, we will avoid this for the years to come.

**STANDARDS While CADing**

Some things to start off when starting with CAD. Really helps especially if you have never CADed before:

* 10/32 Screws are the main screw will be using unless said otherwise
* 8020 will be used for practice bots and testing ONLY if CADed at all
* Final builds will be made using a stronger 2x1 aluminum metal that has standard holes drilled in already
* A360 contains many old, but useful files that can be remodeled to our use
* Don’t design something entirely new unless you know that it does not exist ANYWHERE
* Although there are those with more experience on the team, remember that most things are suggestions and can be taken or left at your description

**3D Printing and Limitations**

We do have 2 3D printers; however, they do have some restrictions on them as said below:

* We do have 3D printing however, unless approved by instructor and at least 2 other members of the team (preferably those with experience) you are not allowed to print.
* Material is expensive and cannot be used lightly, especially in heavy loads. DO NOT USE CARELESSLY
* Software required by the two 3D printers is called Apex 3D printing and XYZware
* CHECK BEFORE YOU PRINT

And Remember happy CADing!