

Hello Programming Team,

Here are some resources you should make yourself familiar with to help you become effective at programming the robots as quickly as possible. As we've discussed at our meetings, you need to learn and know several programming tools.

I will describe both informational resources, as well as tools you can install on a Windows PC/laptop, if you have one and would like to use it. Feel free to bring your laptop to meetings; I encourage it. It is not required, but if you have this luxury you will appreciate it. It does not have to be powerful, use what you have. It'll work best if you download things at home rather than at the meetings. You will still learn a lot even if you don't have your own laptop.

Know your programming language.

For now, we will focus on the language currently being used in the Recycle Rush robot, and which will also be used during our current season. That is C++. A good online web site for being introduced to this is <http://www.cplusplus.com/>. There are many others too. At a minimum, you should learn the following:

- **The C++ language**--Learn from these pages in the order provided <http://www.cplusplus.com/doc/tutorial/>. You can practice these using the Visual Studio compiler described below too.

Know your Integrated Development Environment (IDE) and compiler.

I will tell you of two compilers:

The first you can use to learn using your own laptop is Visual Studio 2015, which is downloadable for free, and you can run the programs it compiles on your same Windows PC/laptop. It is Visual Studio, which is a terrific IDE/compiler. But it is not actually used for anything in FIRST Robotics, so use it for learning the C++ language.

- **Visual Studio Community 2015** is free at (<https://www.visualstudio.com/downloads/download-visual-studio-vs>)

Click on the Download Community Free button. You will need admin privileges for the following steps. Launch the installer that is downloaded, then change from Typical Install to Custom Install. Click Next. Expand Programming Languages, check Visual C++. Click Install. It will take a long time to download more components and simultaneously install them (my older i5 desktop took 2 hours). You can walk away. When it's done, it may prompt you to restart windows- do so. The rest of this setup will likely take you an hour or more. Launch Visual Studio Community 2015 from the start button. (You may want to right click on it and pin it to your taskbar.) Once launched, you can click on "Not now, maybe later" at the sign in prompt. Click on Start Visual Studio button. Takes a long while to prepare for first use. Once ready, click on New Project. Under Templates > Visual C++ > Windows, click on Win32 to highlight it. Click on Win32 Console Application. You will see an empty main routine, with a

simple return statement. Click on OK. Click on menu item Build > Build Solution, then see in Output window Build 1 Succeeded, 0 failed. See the main() routine, add a line of code before the 'return 0;' statement:

```
printf("Hello World\n");
```

Click on menu item Build > Build Solution, then see in Output window Build 1 Succeeded, 0 failed. Right Click on the Return statement, then select menu item Breakpoint > Insert Breakpoint. See the red dot. Click on Debug > Start Without Debugging. You should see a cmd.exe window, see the Hello World text, and Press any key to continue. Hit Enter key. Congratulations, everything is working. Click File > Close Solution. Explore further on your own, and/or see you at the meetings!

The second IDE/compiler is also free and is the one we need for FIRST Robotics. But we'll be setting it up to cross compile to the RoboRIO computer, which you'll have limited access to only while at the team meetings. You will not run the programs on your laptop. Still, it is imperative you download and install it to learn how to use it. Doing so will provide you independence from the team's lone developer laptop so you can develop your own programs at your convenience and will have the convenience to load the robot from your own laptop. Knowing and using this Eclipse/C++ setup is required to be a robotics programmer. This is the Eclipse IDE with C++ and is configured with the WPI plugins, etc.

- **Eclipse IDE for C/C++ Developers** is free at (<http://www.eclipse.org/downloads/packages/eclipse-ide-cc-developers/mars1>)

Download either 32-bit or 64-bit version as is appropriate for your Windows PC.

Not all the robotics tools are available for non-Windows operating systems, so we will focus on using Windows.

Once you have downloaded these to your computer, we will work to get them installed at the team meetings. If you are brave, you can try to do it yourself (refer to this link <http://wpilib.screenstepslive.com/s/4485/m/13810>). This will be challenging because this documentation can be confusing. If you are serious about trying on your own, first read through the Setting up the Development Environment procedures. Then, if you understand what to do, email me for a code you will need in one of the steps. The steps are also in a file you can download <http://wpilib.screenstepslive.com/s/4485/m/13810/pdf>. Read the first half of the document.

Know your robotics C++ library.

See <http://wpilib.screenstepslive.com/s/4485/m/13810/pdf> and read the second half of the document. It shows you the software components that your C++ code will invoke to read and control the robotics electronics hardware. You usually instantiate a class object per real world electronics hardware component on the robot. This becomes your software interface to that piece of electronics hardware. An important concept to grasp is that the "port" numbers you choose in the C++ class constructors will map to 'pins' on the RoboRIO, as well as to addressable ports ('pins') on other hardware components such as the Pneumatic Control Module.

Know your robotics hardware that will be controlled via the Robotics C++ library

See <http://wpilib.screenstepslive.com/s/4485/m/24166/pdf>

This reading is a great start to get oriented to know the FIRST robots electronics hardware available. It looks formidable, but do not be discouraged. You will understand it all. We will help you. Read as much as you can, so you will be best prepared to make the most of our meetings. Knowing the hardware makes the software libraries make sense, and you'll know what you can and need to do. You'll be amazed how much you've learned, what you can do, and how much fun it will become!

Know your Team 263 Aftershock Robot C++ Source Code

Go to the Team's GitHub project by going to https://github.com/FRCTeam263/FRC_2015_2016. You can browse source files right from here. You can also bring the files into your PC/laptop by clicking on "Download ZIP". (Eventually you will prefer to use "Clone In Desktop" button, but it is more involved than I want to write up now.) Expand the zip file, then you'll be able to open the projects there in using Eclipse.

Look at the Documents folder. This is where the software team will keep helpful documents the team writes.

There are three C++ projects you will want to study at this time that are for the three robots we have in service.

- 6 Wheel Drive Code
- AtlasPivot
- ShirtShooter

Start by looking at the Robot.cpp in each of them, then explore the other .cpp and .h files. If you don't have Eclipse installed yet, use your favorite text editor, or use WordPad.

The other projects may be studied as well.

At the team meetings you will see how to start a new robot project, and add software components to experiment with and learn to be independent.

Know to take care of your tools

Your laptop, the team's laptop, the electronic modules, the robot, and everything else is very expensive. We cannot easily fund to replace them. Even with the money to do so, it takes time to replace, and there can be long delays due to availability from vendors. So, it is important that you always are mindful to protect these assets. Do not allow them to be next to dangerous activities, or precariously balanced somewhere they can fall and break. Laptops are especially vulnerable when not treated with respect. Protect these tools, and they will be fine for a long time. Being flippant will make you sorry. We have suffered loss of laptops due to negligence, and they have not been replaced due to their expensive nature.

Additional Ventures

An extra-curricular programming experience that is relevant and would help you build your intuitive understanding of real time embedded programming is learning about the Arduino hardware and programming platform. This is not a requirement for FIRST Robotics, but I believe would help you to really “get it.” Some team members have been exploring this, and are trying to apply it as a subsystem on our robot to control lighting effects. For more information, see <https://www.arduino.cc/> and http://www.amazon.com/gp/product/0071784225?keywords=arduino&qid=1445657800&ref=sr_1_1&s=books&sr=1-1. There are relatively cheap kits available on Amazon if you really get into it, and want to become a Maker.

I’m looking forward to seeing you at Robotics!!!

Mr. Tripi