

FRC SIMULATED ROBOT DRIVING PRACTICE USING AUTODESK BXD SYNTHESIS V4.0

SEPTEMBER 2017

ABOUT

The better an FRC team's driving is, the better they will be able to maximize the performance of their robot on the field. It takes a significant investment of time for a person to develop robot driving skills, and the actual amount of time a driver has with the robot is often much less than would be ideal.

Simulations are not perfect. The real robot in the real world will absolutely behave differently than a simulated robot on a computer screen. That said, a simulation does offer a major advantage: unlimited practice time.

The latest version of Autodesk's "BXD Synthesis" (v4.0), which runs on Windows only unfortunately, seems quite good for simulated FRC driving practice. Various kinds of simulated robots are available, and simulated FRC fields back to 2010 can be loaded within the environment. Also, a wide range of controllers can be set up in different configurations, including flight stick controllers like the Logitech Extreme 3D Pro and PC-compatible game controllers like the Xbox One controller.

This document provides instructions for how to install and use BXD Synthesis for driving practice. It does not cover every feature of the application, and the approach described may not be the best approach for you in the long run, but it should get you started. Good luck driving & have fun!

STEP 1:
INSTALL BXD
SYNTHESIS

Go

to <http://bxd.autodesk.com/>

Click

“Download It Here!”

Follow

Installation Instructions

STEP 2: RUN THE BXD SYNTHESIS APPLICATION

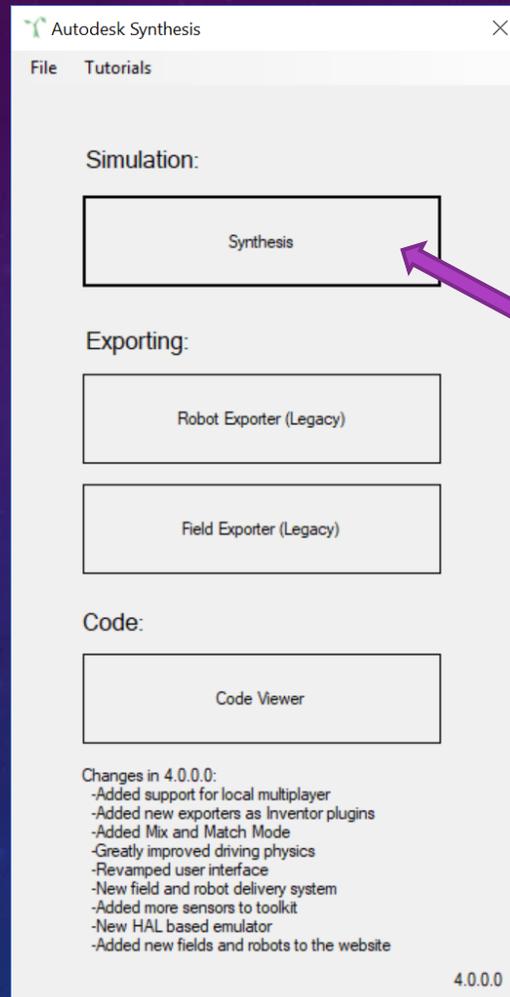
Click

the Desktop or Toolbar shortcut to
Synthesis

Or
Search

for Synthesis using the menu or search
function near bottom left in Windows,
and start up that way

STEP 3: START THE SIMULATION APPLICATION



CLICK HERE

STEP 3
(CONTINUED)

YOU WILL
ARRIVE HERE



STEP 4:
PLUG IN A
CONTROLLER

Tested
So Far

Xbox One Controller (with USB cord)

Xbox 365 Controller for PC

Logitech Extreme 3D Pro Flight Stick

Playstation-style Saitek P990 handheld controller

STEP 5: SELECT CONTROLLER OPTIONS – XBOX CONTROLLER

(SKIP FORWARD IN
THESE INSTRUCTIONS IF
YOU HAVE A FLIGHT
STICK OR NON-XBOX
GAME CONTROLLER)

Click

“Options” at top of screen

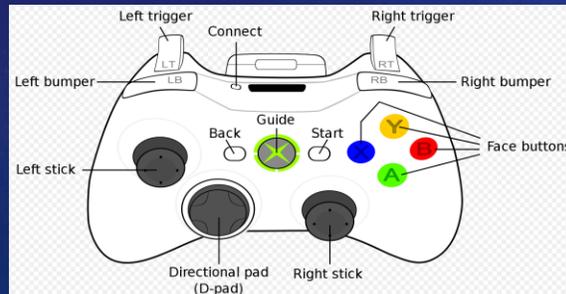
Decide

Option 1: Defaults. The default settings are the most common Xbox controller configuration used by FRC teams, sometimes called “Modified Arcade Drive”. The left joystick controls forward / backward and the right joystick controls left / right steering. This is a good place to start, but be sure to try option 2 as well for comparison.

Option 2: Triggers. Go to Next Page

STEP 5: SELECT CONTROLLER OPTIONS – XBOX CONTROLLER

(SKIP FORWARD IN
THESE INSTRUCTIONS IF
YOU HAVE A FLIGHT
STICK OR NON-XBOX
GAME CONTROLLER)



Decide
(continued)

Option 2: Triggers. Use the left and right triggers for Forward / Backward control instead of the left joystick.

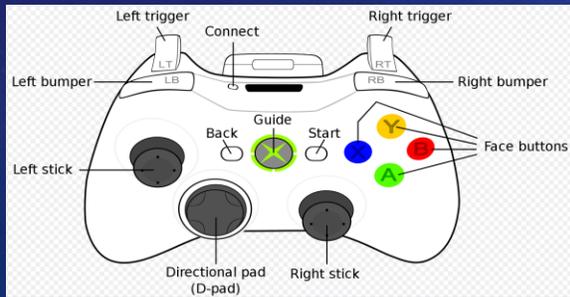
Setup Instructions:

1. On the Options-Input screen, click the box to the right of the “Up” box as indicated below.
2. Press the left trigger on the controller



STEP 5: SELECT CONTROLLER OPTIONS – XBOX CONTROLLER

(SKIP FORWARD IN
THESE INSTRUCTIONS IF
YOU HAVE A FLIGHT
STICK OR NON-XBOX
GAME CONTROLLER)



Decide
(continued)

Option 2: Triggers. Use the left and right triggers for Forward / Backward control instead of the left joystick.

Setup Instructions (continued):

3. Click the box to the right of the “Down” box as indicated below.

4. Press the right trigger on the controller

The screenshot shows the 'Options' menu with the 'Input' tab selected. The 'TANK DRIVE' section has 'ARCANE' selected and 'TANK' unselected. The 'MEASUREMENTS' section has 'IMPERIAL' selected and 'METRIC' unselected. A pink arrow points to the 'Down' button in the 'TANK DRIVE' section, which is currently assigned to 'Joystick 1 Axis 3 (-)'. The 'Reset Defaults' button is visible at the bottom left, and a 'Please save your changes.' message is at the bottom center.

Player	Control	Input	Measurement
P1	1: Forward	Up	Joystick 1 Axis 3 (+)
P1	1: Backward	Down	Joystick 1 Axis 3 (-)
P2	1: Left	Left	Joystick 1 Axis 4 (-)
P3	1: Right	Right	Joystick 1 Axis 4 (+)
P4	1: PWM 2 Positive	1	Joystick 1 Axis 3 (+)
P4	1: PWM 2 Negative	2	Joystick 1 Axis 3 (-)
P5	1: PWM 3 Positive	3	Joystick 1 Axis 5 (+)
P5	1: PWM 3 Negative	4	Joystick 1 Axis 5 (-)
P6	1: PWM 4 Positive	5	Joystick 1 Axis 6 (+)

STEP 5: SELECT CONTROLLER OPTIONS – XBOX CONTROLLER

(SKIP FORWARD IN
THESE INSTRUCTIONS IF
YOU HAVE A FLIGHT
STICK OR NON-XBOX
GAME CONTROLLER)

Decide
(continued)

Option 2: Triggers. Use the left and right triggers for Forward / Backward control instead of the left joystick.

Setup Instructions (continued):

5. The original default mappings of the triggers need to be removed. Click the box to the right of “1” and then press the controller’s “A” button. Do the same for the box to the right of “2” and the “B” button.

	BACKSPACE: Sets controls to none	TANK DRIVE ARCANE <input checked="" type="checkbox"/> TANK	MEASUREMENTS IMPERIAL <input checked="" type="checkbox"/> METRIC
P1	1: Forward	Up	Joystick 1 Axis 3 (+)
P2	1: Backward	Down	Joystick 1 Axis 3 (-)
P3	1: Left	Left	Joystick 1 Axis 4 (-)
P4	1: Right	Right	Joystick 1 Axis 4 (+)
P5	1: PWM 2 Positive	1	Joystick 1 Button 1
P6	1: PWM 2 Negative	2	Joystick 1 Button 2
	1: PWM 3 Positive	3	Joystick 1 Axis 5 (+)
	1: PWM 3 Negative	4	Joystick 1 Axis 5 (-)
	1: PWM 4 Positive	5	Joystick 1 Axis 6 (+)

Reset Defaults Please save your changes. Save

STEP 5: SELECT CONTROLLER OPTIONS – FLIGHT STICK

(SKIP FORWARD IN
THESE INSTRUCTIONS IF
YOU HAVE A GAME
CONTROLLER THAT IS
NEITHER XBOX NOR
FLIGHT STICK)

Click

“Options” at top of screen

Decide

The default settings will not work with a flight stick – try one or both of the options below.

Option 1: Arcade Drive – stick only

→Go to next page for instructions

Option 2: Modified Arcade Drive using throttle

→Skip forward a few pages

STEP 5: SELECT CONTROLLER OPTIONS – FLIGHT STICK

(SKIP FORWARD IN
THESE INSTRUCTIONS IF
YOU HAVE A GAME
CONTROLLER THAT IS
NEITHER XBOX NOR
FLIGHT STICK)

Decide
(continued)

Option 1: Arcade Drive – stick only

Setup Instructions:

1. While on the Options-Input screen, push and hold the joystick all the way up/forward
2. Click the box to the right of the “Up” box as shown below
3. Repeat the above to set up the Down/Backward, Left, and Right directions



STEP 5: SELECT CONTROLLER OPTIONS – FLIGHT STICK

(SKIP FORWARD IN
THESE INSTRUCTIONS IF
YOU HAVE A GAME
CONTROLLER THAT IS
NEITHER XBOX NOR
FLIGHT STICK)



Decide
(continued)

Option 2: Modified Arcade Drive using throttle

Setup Instructions:

1. While on the Options-Input screen, push the throttle all the way up/forward
2. Click the box to the right of the “Up” box as shown below
3. Similarly push the throttle all the way down, and click the box to the right of the “Down” box



STEP 5: SELECT CONTROLLER OPTIONS – FLIGHT STICK

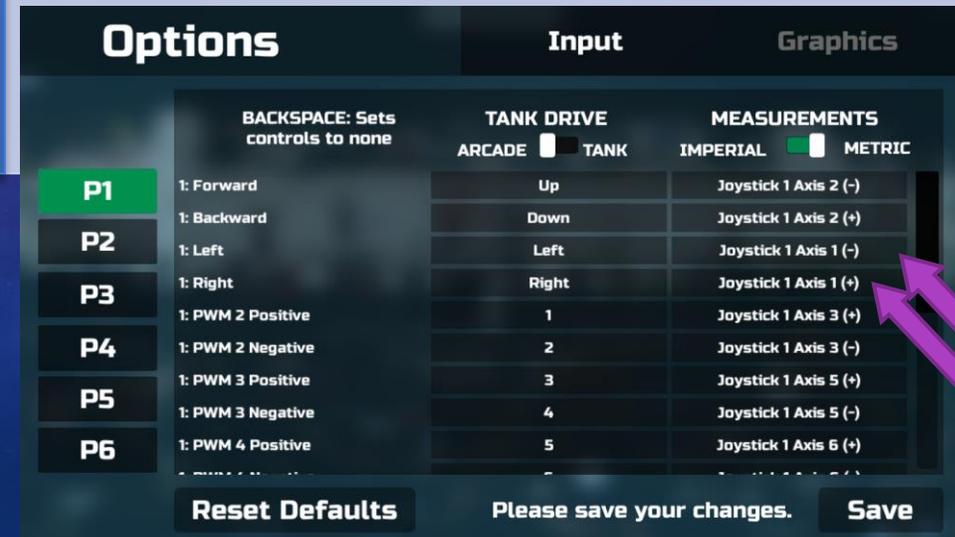
(SKIP FORWARD IN
THESE INSTRUCTIONS IF
YOU HAVE A GAME
CONTROLLER THAT IS
NEITHER XBOX NOR
FLIGHT STICK)

Decide
(continued)

Option 2: Modified Arcade Drive using throttle

Setup Instructions:

4. Push and hold the joystick all the way to the left
5. Click the box to the right of the “Left” box as shown below
6. Repeat the above to set up the Right direction

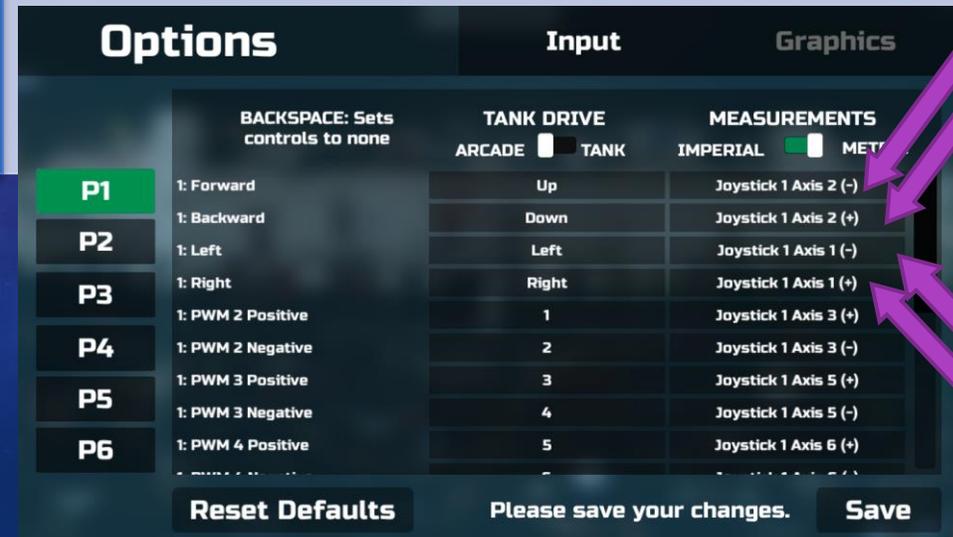


STEP 5: SELECT CONTROLLER OPTIONS – OTHER CONTROLLER

Decide
(continued)

Since there are many types of controllers, specific instructions covering them all cannot be provided. The default settings worked fine with a Playstation-like Saitek controller for Modified Arcade Drive.

If that doesn't work or if you wish to experiment, then similar Up, Down, Left, and Right mapping actions to those described for Xbox controller and flight stick will be needed.



STEP 6: SELECT GRAPHICS SETTINGS

Click

“Options” at top of screen, then “Graphics”

Decide

I picked Full Screen and Medium, but you may wish (or need) to use other settings depending on your computer.

STEP 6: SELECT ROBOT AND FIELD

Click

“Select” at top of screen, then click on “Main Simulator”. (Feel free to try Mix and Match as well later.)

Decide

I recommend starting with Field = “2013 Ultimate Ascent” and Robot = “Sample Robot” because both are fairly simple, fast to load, etc.

After you have done some driving practice, then you can try some other fields, including “2017 Steamworks”. And you can try some other robots to see how they behave differently.

STEP 7: START SIMULATION & SELECT VIEW -- FREEROAM

Click

Once you pick your field and robot, click “START!”. Then pick a View option (see below).

Decide

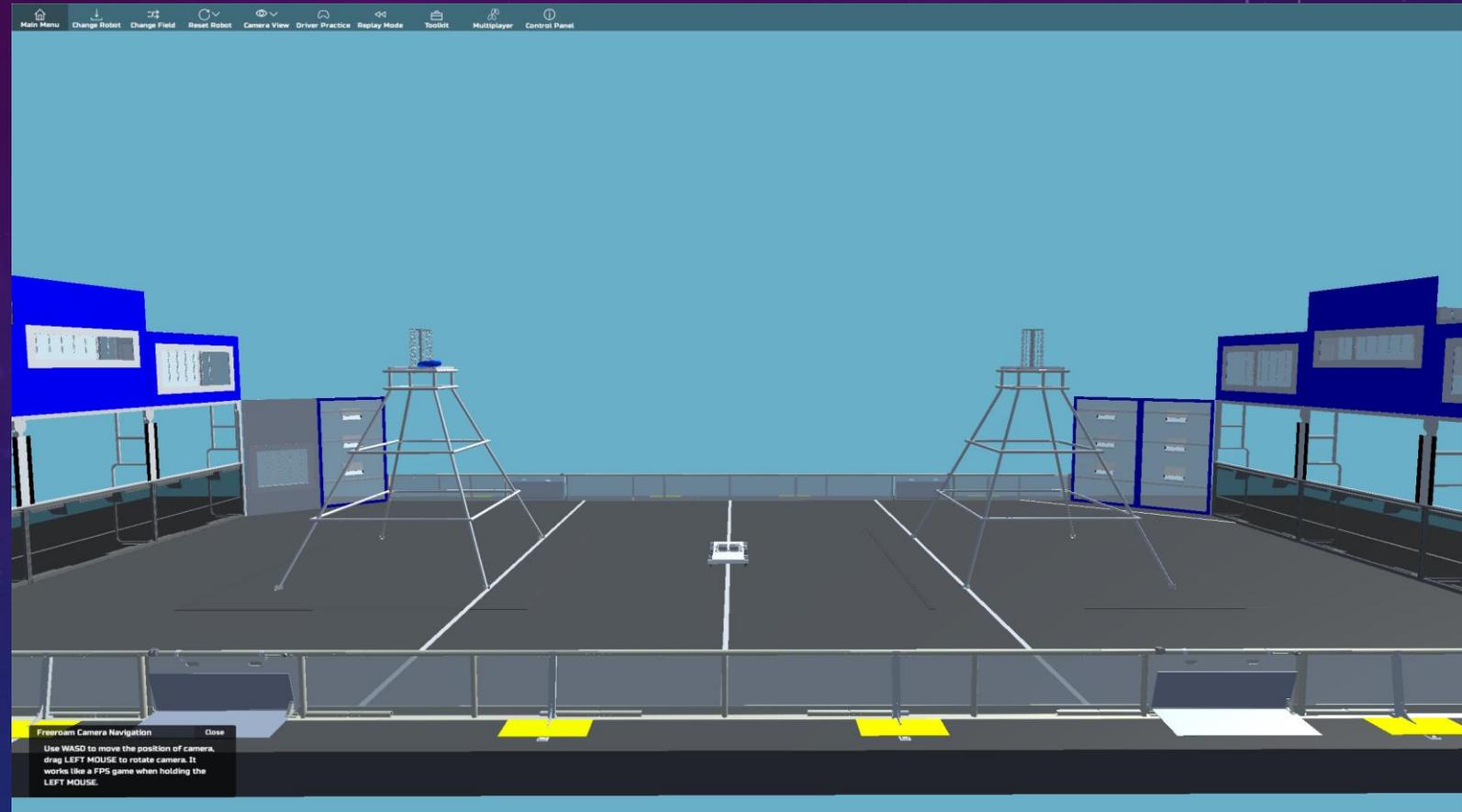
The default camera view is easy to use but unrealistic. It simulates a camera following behind the robot as it moves, like a video game. You can start with it if you like, but I recommend switching over to one of the following two more realistic views:

Freeroam: You pick a fixed position for the camera. I like a side audience view for beginner driver practice. Set that up as follows:

1. Click “Camera View” at top, and choose Freeroam
2. Hold down your left mouse button and move the mouse to the right until the camera is facing the long side of the field (it’s a 90-degree shift)
3. Press the “S” key on your computer keyboard to back the camera up so you can see the whole field. See next page for what it should look like.

Driver Station view: Move forward two pages

STEP 7:
START
SIMULATION
& SELECT
VIEW --
FREEROAM



STEP 7:
START
SIMULATION
& SELECT
VIEW --
DRIVER
STATION

Click

Once you pick your field and robot, click “START!”. Then pick a View option (see below).

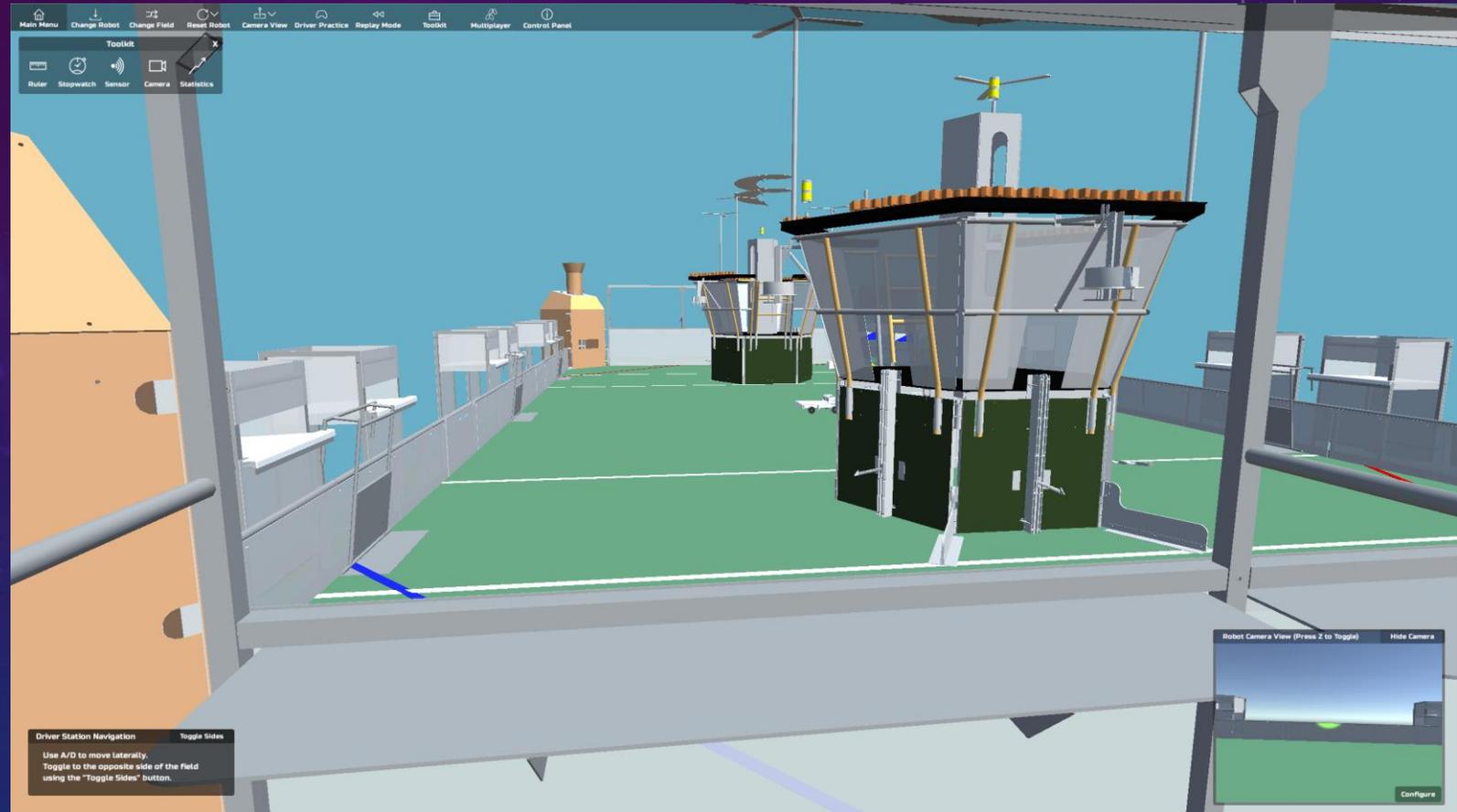
Decide

Second realistic view option

Driver Station: Camera position is closest to game-like. You can adjust the view to simulate any of the 6 driver station positions on the field. Here’s how to set it up.

1. Click “Camera View” at top, and choose “Driver Station”
2. Use on-screen instructions at bottom left to select which driver station view is simulated.
3. With a game like Steamworks that has poor sight lines, you’ll want to also turn on the robot camera.
 - Click “Toolkit”, then “Camera” using the menus at the top of the screen.
 - For some reason, the default camera direction is sideways (at least on the Sample Robot), so you’ll need to fix that. Click “Show Camera” in the camera view, then “Configure” in the camera view at bottom right.
 - Click “Show/Edit Camera Angle” in the Camera Config panel at bottom left.
 - Press the “D” keyboard key to rotate the camera until it is facing forward (yes, this is a pain). If you go too far, press “A” to rotate back the other direction.
 - The camera view is actually good once you get it set up... unrealistically good. In real life, latency and frame rates are often quite poor. So I recommend only using the camera view when you don’t have a direct sight line.

STEP 7:
START
SIMULATION
& SELECT
VIEW --
DRIVER
STATION



FINAL STEP: PRACTICE AND HAVE FUN!