Project Aquaticus: General Orientation

At this point you should have gone over and signed the consent form.

Orientation General Safety:

For reference we include the safety rules and regulations of the Pavilion that apply to our experiments:

Safety:

1. Each person using MIT boats must be able to swim at least 91.44 meters (100 yards)
2. Each person in MIT boats must always wear a life jacket when on the water
3. Never leave your boat after leaving the dock. If you capsize, stay with the boat until you are rescued or you right yourself.
4. All boats must return to the Pavilion immediately upon any of the following:
   1. Sunset
   2. The burgee (the red triangular flag) is lowered
   3. The dock lights are turned on
   4. Thunder is heard or lightning is seen
5. Smoking is not permitted in any MITNA facilities
6. Alcohol is never allowed in the boats.

Sailing Area and Rules:

1. Do not crash. Avoid collisions
   1. Stay away from crew shells, canoes, kayaks and other rowed boats
   2. Stay away from very large boats which cannot easily steer away from you
2. Land only at the MIT Sailing Pavilion dock

Swimming Requirement:

Anyone who wishes to use the boats at the MIT Sailing Pavilion must agree to the following:

I am 21 years of age or older and can swim 91.44 meters (100 yards) and tread water for 10 minutes without help. Sailing Pavilion staff may require you to present proof-of-age before issuing your sailing card.

Or

I have taken and passed the MIT “Boating Test”. You are required to bring proof of the test prior to obtaining your sailing card.

Further, I will always wear a personal flotation device when aboard an MIT boat.

The MIT Sailing pavilion requires that card holders under the age of 21 must take the Small Boat Swim Test at the “Z” Center Pool. This test consists of jumping into the pool and swimming 91.44 meters (100 yards) (4 lengths in the pool) continuously and treading water for 10 minutes.

On-water orientation:

Operating area:

The operating area for all vehicles is within the buoys and this dock.

Safety Boat:

A safety boat will be quickly accessible and respond to you at any moment. Waving your hands is a general distress call.

Shore Side Operator:

There will be a shoreside operator that has the ability to see your vehicle’s location and that of the other vehicles on the water. The shoreside operator will have the ability to stop the autonomous vehicles with the press of a button. During the communication orientation we will describe how you will be able to communicate with the shoreside operator.

Quick Aquaticus Capture the Flag Orientation:

Just a quick reminder that we are playing capture the flag on the water with human and robot teammates. The goal of the game is capture more flags than the opposing team. In order to capture a flag, you go to your opposing teams area and execute a flag grab command (we will cover exactly how in just a sec). Once you have the flag, you will then return it to your home flag. In order to defend your flag, you can tag an opposing player when they are on your side of the field and vice versa. A tag makes a player useless until they untag themselves by returning to their home flag. If someone has a flag and they are tagged then the flag gets returned to its home. Going out of bounds also results in being tagged.

Quick Radio Orientation:

In order to speak to everyone that is part of this experiment, we use these Blue Radios that are on the FSR 4 frequency. Using the radio if simple. Press the black button (PTT) and hold it down while speaking. Then, release the button to hear someone’s response. It is single duplex – meaning only one person at a time. We go by a simple radio protocol for ease of communication. We start with who our target recipient is such as the Shoreside operatores called “PavLab” followed by our own identifier such as “Blue One.” Let’s do a radio check to try out the process and make sure your volume is set properly.

“Pavlab, this is Blue One. Radio Check”

“Blue One, this is Pavlab, I hear you 5 by 5, over”

Great – at any point you can use the radio to reach anyone in the experiment.

The human-operated Mokai vehicle orientation:

Lifejackets:

You have declared, per MIT Sailing Pavilion regulations, that you are capable of swimming 100 meters and treading water for 10 minutes. Please confirm this verbally. Please put on this lifejacket – YOU ARE TO WEAR THIS LIFEJACKET AT ALL TIMES. The lifejacket has a whistle attached, just in case other communication devices do not work.

Description of Mokai:

This is a motorized kayak called a Mokai.

There is standard safety gear already in the Mokai. To your left is a fire extinguisher. To operate it – pull the pin, point the nozzle at the flames, and press the lever. There are paddles inside the cockpit area. These paddles are used when the Mokai runs out of fuel or you need to nudge away from something. On your right is a horn. If for some reason you must contact us or another vessel that does not have radio contact you can use the horn.

The Mokai is a stable platform. However, if you do fall in, please stay by your vessel as our safety boat will immediately come to your assistance. If the Mokai has flipped over – DO NOT ATTEMPT TO CORRECT IT. You are to ensure your own safety by staying clear of the Mokai and allow the safety boat to correct any issues.

Getting in and out:

Prior to getting into and out of the Mokai ensure that it is tied up to the dock. Stability getting into and out of the Mokai is aided by placing your hands on either side of the cockpit. Either both legs in or both legs out – DO NOT HAVE ONE FOOT ON THE DOCK AND ONE FOOT ON THE BOAT. Please get into the Mokai.

Ignition and E-stop:

The red lanyard is our emergency kill switch. In any event that you feel uncomfortable and wish to stop the vehicle - pull on the lanyard like so and the motor will stop. The toggle switch is the ignition switch. It must be turned to ON so that we can press the green starter button like so. When you want to stop the Mokai simply flip the toggle switch to OFF and it will kill the motor, like so. Please put the toggle to ON and press the green starter button. Again, in the event you wish to stop the vehicle immediately or you are jostled from the Mokai the emergency stop lanyard will trigger the emergency stop like so (researcher will tug on the lanyard).

Joystick control:

This black joystick is what gives the Mokai direction and speed via the jet drive. The jet drive does not have an exposed propeller. Once the vehicle is turned on, it will have a slow but constant forward thrust, so please when landing slow down and attempt to bump the dock gently with the side of the vehicle. If you wish to go full speed forward press the joystick forward on the joystick like so. If you wish to turn, angle the joystick.

If there are waves, typically created by other vessels or your own, they are best handled head on. Let’s have a warm up in which you visit a buoy and finish up by returning to this point on the dock. Have any questions? Great! Go ahead and visit the buoy.

Button Box Orientation:

Along the left gunwale is the button box. It has several functions. The first is labelled “Robo” which allows you to speak commands to your autonomous teammate. The second is labelled “Team” so that you can speak to your human teammates (and is overheard by PavLab). The third and fourth buttons are “Grab” and “Tag” which we will cover shortly. We use this button box for all interaction with our teammates and the capture the flag game.

The “Tag” and “Grab” buttons attempt to tag an opponent or grab the flag. This of course only works if you are on your side of the field and have an opponent within 10 feet. The flag grab only works if the flag is in your opponent’s zone and you are not tagged.

Quick on-water Aquaticus Game Mechanics:

Let’s practice some of the game mechanics. When you hear events happen in your headset for the game, please echo them to us over Radio/VOIP. First, you are tagged because you are out of bounds. Let’s get you untagged by having you drive to your home flag. When you are untagged, you should hear your id such as “Blue One, has been untagged.” Once you are untagged, please proceed to the flag and grab it. When you are within the flag grab area you will hear an audible ding-ding. At that point you can press the “Grab” button. When you have the flag, the system will say “Blue One, has the red flag.” On your way out of the zone you should hear a buzzer. Please echo all of these events into the Radio/VOIP so we can make sure your system is working. Once you successfully have the flag, score or capture the flag by taking it to your home flag. Once you have crossed your flag zone, you should hear “red flag returned, the blue team has scored.” Again, please echo the events you hear so we can make sure your audio works. Feel free to also ask us questions if you need reminders.

Orientation of the Autonomous Robot Safety Features:

This is your autonomous robot teammate. It is a Clearpath Robotics Heron M300. It has been designed to be man portable and easy to work with. In general, please try to not get closer then 3 meters. If you feel that avoiding a collision will endanger your safety – colliding is preferred. The M300 has a rubber rub rail around its pontoons so bumping them is OK. They can also be easily redirected so if you feel you need to push them please do so. There are many safety measures in place including autonomous collision avoidance, an ‘All Stop’ button from the shore side, and a remote control for a person to take over and stop the M300 if necessary. If you believe the only course of action is to completely shut down the M300 then feel free to press its emergency stop (E-stop) button as an emergency measure to turn it off completely.

Getting Tagged:

Ok great, you now know how to get untagged, grab a flag, and score. Now let’s have you interact with an opponent’s vessel. Please go get untagged at your home flag and proceed to the opponent M300. Within 10 meters it will tag you. You should hear, “Blue One has been tagged” Once tagged, proceed to get untagged at your home flag and come back to the dock.

Speech Recognition With Autonomous Teammate:

Now, let’s discuss how you can issue commands to your autonomous teammate. We have created a short cheat sheet that you can use while on the water as a quick reminder. In order to address you teammate we use the same protocol by starting with the target recipient – the autonomous robots are typically roles 3 and 4 on a team. If you are on red team, then you would press and hold the “Robo” button and wait for an audible ding and say “Red Three, Defend.” Once you are done speaking, release the “Robo” button. The system will then ask you “Did you mean, Red Three, Defend?” At this point you can confirm by saying “Yes” or abort by saying “No.” If you respond “yes” then the system will respond with “Command Sent” If you respond “No” the system will respond with command cancelled.

Let’s do a practice round here on the dock. Practice saying your teammate’s name and a command on the cheat sheet. (troubleshooting can happen here).

Let’s now calibrate speech recognition on the water. You will perform the same drill of practicing saying your robot’s name and a command on the list but now you will be driving “full speed”. If the system is having problems recognizing your speech correctly, we will troubleshoot with you.

Great! Now you can issue commands to your autonomous teammate(s)!

VOIP Orientation:

The second button is called “Team” It allows you to speak to your human teammate. When you first press the button, you should hear a ding – that is your cue to start speaking. Once you are done speaking, you may release the “Team” button.

Try speaking to “PavLab” by using the “Team” button.

Start Aquaticus Round:

Awesome! You now know all the game mechanics for playing a game of capture the flag on the water with teammates! Remember that the goal is to capture more flags than the opposing team. We do not tolerate collisions – collisions result in being pulled from the field for at least the round.

Please proceed to your home flag and wait for further instructions from “PavLab”