Mission: Make hostel deep sea environments more accessible to scientists by using autonomous robots.

Goal 1:

What?	What approach?	When?	How many or how much	Results/outcomes
Navigation	Odometry, IMU, CNN	1 month	For 1 submersible	The submersible will be able to use Odometry, IMU, and CNN for geolocation.

Object 1:

What?	How will it happen? (Method/Strategy)	Who will do it?	How many or how much?	With what result or benefit
Odometry	Simulation location game. AMCL localization	Software Developer	Set up 3 course mappings.	The robot will be able to navigate the 3 test environments.

Object 2:

What?	How will it happen? (Method/Strategy)	Who will do it?	How many or how much?	With what result or benefit
IMU	Simulation location game.	Software Developer	Set up 3 course mappings.	The robot will be able to navigate the 3 test environments.

Object 1:

What?	How will it happen? (Method/Strategy)	Who will do it?	How many or how much?	With what result or benefit
CNN	Simulation location game.	Software Developer	Set up 3 course mappings. Robot will be trained to navigate course using CNN network.	The robot will be able to navigate the 3 test environments.

Goal 2:

What?	What approach?	When?	How many or how much	Results/outcomes
Knowledge based long-term autonomy	Algorithm	1 month	For 1 submersible	How robot would function long-term. Not programmed to handle unexpected situations.

Object 1:

What?	How will it happen? (Method/Strategy)	Who will do it?	How many or how much?	With what result or benefit
Develop Algorithm	Develop environment & tools to represent this data.	Software Developer	For 1 submersible	It will employee the first goal's map and pick waypoints to navigate it.

Goal 3:

What?	What approach?	When?	How many or how much	Results/outcomes
Behavior Control & Simulation	Create a course using Blender for object simulation and Gazebo for physics environment.	1 month	For 1 submersible and objects for 3 course simulations.	The submersible will be as close to real environment as possible with Gazebo 3D physics simulator.

Object 1:

What?	How will it happen? (Method/Strategy)	Who will do it?	How many or how much?	With what result or benefit
Develop 3D Simulation	Objects will be created in Blender and exported as urdf, xacro, and sdf format.	Design engineer	1 submersible, course terrain, water ocean, 3 grabbing objects for robot arm, and underwater docking port.	Submersible will be trained for real world environment.

Goal 4:

What?	What approach?	When?	How many or how much	Results/outcomes
Hardware Architecture	Create custom circuit board, frame, motor mounting brackets, battery tray, etc.	1 month	For 1 submersible	Submersible with components specific to fulfill the mission.

Object 1:

What are you going to do?	How will it happen? (Method/Strategy)	Who will do it?	How many or how much?	With what result or benefit
Design Pcbs	Design custom board with Arm processor. Using KiCad software and jlpcb or pcbway to print and ship board.	Design Engineer.	1 submersible	The board will be custom designed to handle the motor and controls. Also built in gpu style processing for the CNN Neural Net.

Object 2:

What are you going to do?	How will it happen? (Method/Strategy)	Who will do it?	How many or how much?	With what result or benefit
Submersible design and stl model files	Design submersible with all components. Stl files will be sent to LexCent for print and ship mold.	Design Engineer	For 1 submersible	The model will be created and ready for motors, board, and battery installation.

Goal 5:

What?	What approach?	When?	How many or how much	Results/outcomes
Robot Control	Controller with tether arm for preprogramming and testing.	1 month	For 1 submersible	The submersible will be able to be dropped in a testbed pool for real world simulation. The submersible will be as close to real environment as possible with ROS 3D physics simulator.

Object 1:

What are you going to do?	How will it happen? (Method/Strategy)	Who will do it?	How many or how much?	With what result or benefit
Mobile dual-arm robot	Kinematics for robot arm will be tested on real objects. Moveit will be used to program the joints in the physics simulator. Scripts will be tested for automatic object detection and procedures.	Software Developer	For two robot arm on one submersible.	The robot will be able to do scientific analysis on different objects that it deems necessary. Command and control center can further pin point specific instructions for each mission.

Object 2:

What are you going to do?	How will it happen? (Method/Strategy)	Who will do it?	How many or how much?	With what result or benefit
Joystick control	The joystick commands for the robot will be programmed. It will use either a	Software Developer	For one submersible	The robot will be able to be controlled in both Gazebo and the real testbed pool.

	Logitech or Xbox controller.			

Object 3:

What are you going to do?	How will it happen? (Method/Strategy)	Who will do it?	How many or how much?	With what result or benefit
Compliant Robot Arm				

Goal 6:

What?	What approach?	When?	How many or how much	Results/outcomes
System Design	Create a docking system for the submersible to upload data and recharge. Provide interface communication software.	1 month	For 1 submersible	The submersible will be able to recharge and communicate back to scientists that are in a stationed lab desktop environment. The submersible will be as close to real environment as possible with ROS 3D physics simulator.

Object 1:

What are you going to do?	How will it happen? (Method/Strategy)	Who will do it?	How many or how much?	With what result or benefit
Connect Gazebo to live robot using bag data	The robot will be able to reproduce commands that are	Software Developer	For one submersible	The robot will get instructions from simulation environment and

	preprogrammed in Gazebo.			do the commands in live test pool.

Object 2:

What are you going to do?	How will it happen? (Method/Strategy)	Who will do it?	How many or how much?	With what result or benefit
Create a docking to upload data and charge.	The robot will be programmed to do the docking maneuver.	Software Developer	For one submersible	The robot will be given commands on how to get back to the docking port and charge.

Goal 7:

What?	What approach?	When?	How many or how much	Results/outcomes
Sustained Interaction and Learning	Can be done in a testbed environment where something is built like a structure and then sent to robot to do task.	1 month	For 1 submersible	The robot will get simulated task and then carry out that procedure on a real object.

Object 1:

What are you going to do?	How will it happen? (Method/Strategy)	Who will do it?	How many or how much?	With what result or benefit
Ontological Database	The robot will have Java like objects in the code. Each one will be an instruction.	Software Developer	For one submersible.	The robot will learn to do the instructions. Picture building a house in the physics simulator then giving those commands to the robot. Bag data

				recorded would not work because of small changes in the actual environment. The advantage of doing things this way instead of a live wire type build is that this can be done repeatedly.

Object 2:

What are you going to do?	How will it happen? (Method/Strategy)	Who will do it?	How many or how much?	With what result or benefit
Human Robot Interaction				