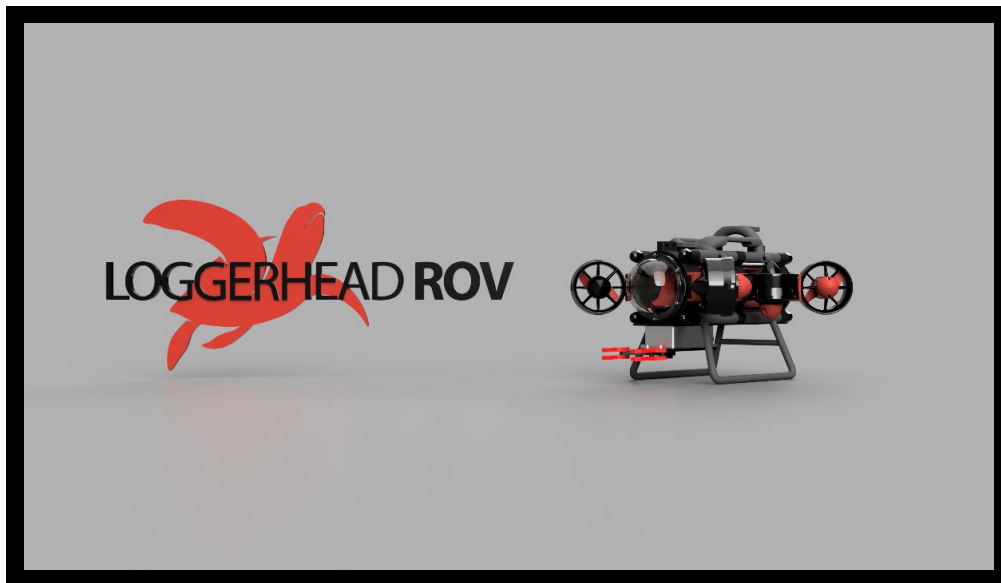# Loggerhead ROV

Mount Olive High School
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Flanders, New Jersey

Job Safety Analysis

2018 MATE International Competition

The Marauder Innovation Learning Lab (MILL) is the home to Loggerhead ROV. The MILL is where we design, prototype and build our company's ROV for the MATE International Competition. For photos of our facilities, please visit our company's website at www.loggerheadrov.com for further information.

Marauder Innovation Learning Lab

Task	Hazards	Controls
General Lab Safety	**1.a.** Clothing **1.b**. Eye Safety **1.c.** Lab Maintenance	**1.a.i.** Wear clothing which is conducive to work in the lab. Clothing should not be loose, baggy or highly flammable. **1.b.i.** Always wear eye protection. **1.c.i.** Keep Tools in Good Working Condition. **1.c.ii.** Establish regular tool inspection procedures. **1.c.iii.** Notify the instructor immediately in case of injury, accident or fire. **1.c.iv.** Notify the instructor in case defective tools and equipment. **1.c.v.** Clean your work area and return all tools to their proper storage at end of team meeting.
CNC Router	**2.a.** Mechanical Risks / Moving Parts **2.b.** Secure Material **2.c.** Eye Safety **2.d.** General Safety	**2.a.i.** Do not put any part of the operator closer than 6 inches to cutting tool when operating. **2.b.i.** Make sure that all workpieces are securely clamped down. **2.c.i.** Use safety glasses. **2.d.i.** Never leave the room while your machine is routing.

		2.d.ii. Always make sure you have inserted the correct bit for the job you are doing .
Disc/Belt Sander	**3.a.** Mechanical Risks/Moving Parts **3.b.** Eye Safety **3.c.** Secure Material **3.d.** General Safety	**3.a.i.** Remove ties, ring, watch and other jewelry, and roll up sleeves before using the belt/disc sander. **3.b.i.** Always wear eye protection when using a belt/disc sander. **3.c.i.** Always hold the work firmly our use clamp/vise on the table when sanding on the disc/belt. **3.d.i.** Do not sand pieces of material that are too small to be safely supported. **3.d.ii.** Make all adjustment on the belt/disc sander with the power OFF.
Vertical Band Saw	**4.a.** Mechanical Risks/Moving Parts **4.b.** Eye Safety **4.c.** Secure Material **4.d.** General Safety	**4.a.i.** Remove loose fitting clothing, jewelry, and tie back long hair. **4.a.ii.** Check the blade tension and tracking before starting. **4.b.i.** Safety glasses with side shields or a face shield must be worn. **4.c.i.** Don't cut stock that is not flat on the bottom without a jig/clamp/vise. **4.d.i.** Always keep fingers 3" from the blade. **4.d.ii.** Never clear small pieces while the blade is moving. **4.d.iii.** Never back out of a curve cut while the

		machine is running.
Drill Press	**5.a.** Mechanical Risks/Moving Parts **5.b.** Eye Safety **5.c.** Secure Material **5.d.** General Safety	**5.a.i.** Remove loose fitting clothing, jewelry, and tie back long hair. **5.b.i.** Safety glasses with side shields or a face shield must be worn. **5.c.i.** Use a clamp or vise to securely fasten the stock to the drill press table. **5.c.ii.** Support the underside of the stock to be drilled with a backer board secured to the drill press table. **5.d.i.** Make all drill press adjustments with the power shut off. **5.d.ii.** Don't touch the drill bit and shavings; they are hot immediately after drilling.
Hand Tools	**6.a.** Cuts **6.b**. Eye Safety **6.c.** Misuse/Poor Maintenance	**6.a.i.** Select the Right Tool for the Job. **6.a.ii.** Use tools the right way and for the right job. **6.b.i.** Always wear eye protection. **6.c.i.** Provide proper training. **6.c.ii.** Follow proper procedures. **6.c.iii.** Keep Tools in Good Working Condition. **6.c.iv.** Establish regular tool inspection procedures.
Power Hand Tools	**7.a.** Mechanical Risks/Moving Parts **7.b.** Eye Safety **7.c.** Secure Material **7.d.** General Safety	**7.a.i.** The proper apparel should be worn. Loose clothing, ties, or jewelry can become caught in moving parts. **7.b.i.** Always wear eye

		protection. **7.c.i.** Secure work with clamps or a vise, freeing both hands to operate the tool. **7.d.i.** Never carry a tool by the cord or hose. **7.d.ii.** Cords are required to be free of frays/cuts. **7.d.iii.** Avoid accidental starting.
Heat Gun	**8.a.** Fire **8.b.** Burns	**8.a.i**. Do not leave the heat gun unattended while running or cooling down. It could tip, causing fire or burns. 8.b.i. Do not point the heat gun at clothing, hair or other body parts **8.b.ii.** Do not touch nozzle or accessory tips, or store heat gun until the nozzle has cooled to room temperature
Laser Cutter	**9.a.** Laser Light **9.b.** Fire **9.c.** Air Contaminants	**9.a.i.** DO NOT modify or disable any safety features of the laser system. **9.a.ii.** DO NOT operate the laser unless all covers are in place and interlocks are working properly. **9.a.iii.** DO NOT look directly into the laser beam. **9.b.i.** DO NOT use materials that are highly flammable, explosive or produce toxic byproducts. **9.b.ii.** DO NOT leave a laser cutter operating unattended.

		9.b.iii. ALWAYS keep a properly maintained fire extinguisher nearby. 9.c.i. DO NOT cut a material that has not been approved by the manufacturer. 9.c.ii. DO NOT use a laser cutter with a malfunctioning exhaust system or clogged air filter.
3D Printer	**10.a.** Mechanical Risks / Moving Parts **10.b.** Electrical Risks **10.c.** Toxic Emissions **10.d.** Volatile Organic Compounds Emissions	**10.a.i.** Be aware that moving parts can trap a user's finger, long hair, loose clothing, head coverings or head scarves **10.b.i.** Users must always turn off 3D printer and unplug it completely when servicing printer/swapping extruders. **10.c.i.** Use 3D printers only in well ventilated areas **10.c.ii** Choose a low-emitting filament (such as PLA) **10.d.i.** Use 3D printers only in well ventilated areas
Personal Protective Equipment (PPE)	**11.a.** Dust, dirt, metal or wood chips entering the eye **11.b.** Chemical splashes **11.c.** Radiant energy for laser	**11.a.i.** Safety glasses **11.b.i.** Fully enclosed safety goggles **11.c.i.** Laser safety goggles. T
Solder Iron	**1.a.** Burns **1.b.** Improper ventilation	**1.a.i.** Wear appropriate PPE **1.a.ii.** Provide appropriate training on soldering. **1.a.iii.** Work area is clean and free from obstructions.

		1.b.i. Ensure soldering is taking place in a well ventilated area.

ROV testing in our Ocean Engineering Lab provides an opportunity to test concepts and technologies early in the design process where technical, operational, and programmatic risks can be identified and corrected. The earlier risks can be identified, the greater the opportunity for overall product and mission success.

<div style="background-color:red; color:white; text-align:center; font-weight:bold;">Ocean Engineering Lab</div>

Task	Hazards	Controls
Tank Filter Operation	**1.a.** Electrical	**1.a.i.** Ensure all electrical connections are in good condition. No exposed wires. **1.a.ii.** Ensure all outlets are GFI compliant.
Test Tank Water Quality	**2.a.** Water Quality **2.b.** Water Filtration System Malfunction	**2.a.i.** Complete weekly water quality tests using pool water test kit. **2.a.ii.** Based on water test results, adjust chemical levels to ensure acceptable water quality. **2.b.i.** Inspect weekly the tank filter system to ensure water is being properly circulated and cleaned.
Drowning Safety	**3.a** Drowning **3.b.** Tank Safety Barrier	**3.a.i.** Make sure doors are self-closing, self-locking and are never propped open. **3.a.ii.** No one is permitted in test tank lab without adult supervision. **3.a.iii.** Keep reaching and throwing aids, such as poles and life preservers,

	in lab. **3.a.iv.** Install a phone in lab. **3.a.v.** Post the emergency medical services phone number (9-1-1) in the lab. **3.b.i.** Install a lockable safety cover to ensure no one can enter test tank.

Off-Site/Competition/ROV Tasks

Task	Hazards	Controls
ROV Pre-Flight	**1.a.** Sharp Edges **1.b.** Mechanical Risks / Moving Parts	**1.a.i.** File down any sharp edges to ensure ROV is safe to handle. **1.b.i.** Check thruster shrouds are secure and not damaged. **1.b.ii.** Inspect ROV gripper and tagged as a possible pinching point.
Tether Management	**2.a.** Tripping **2.b.** Electrical Shock	**2.a.i.** Check that tether is neatly coiled for deployment. **2.a.ii.** During ROV flight, ensure that excess tether is coiled. **2.b.i.** Check tether for any exposed wires or cuts to sheathing.
ROV Power Up	**3.a.** Electrical Shock **3.b.** Wire/cable Management **3.c.** Emergency Stop Malfunction	**3.a.i.** Ensure that power is off to the ROV and Controls until team is ready. **3.a.ii.** Inspect all wires/cables for exposed wire. **3.a.iii.** Use GFI grounded outlets **3.b.i**. Ensure that all

		cables and wires are safely routed to minimize potential for tripping. **3.c.i.** Once ROV is powered up, test the emergency stop button to ensure it is operational.
ROV Launch and Recovery	**4.a.** Lifting ROV **4.b.** Tripping **4.c.** ROV Controls Malfunction	**4.a.i.** Use proper lifting techniques. **4.a.ii.** Use ROV handles designed to assist with safe lifting. **4.b.i.** Check that tether is neatly coiled. **4.c.i.** Ensure that ROV Controls are disabled during launch/recovery.
ROV Operation	**5.a.** Mechanical Risks / Moving Parts **5.b.** Tripping **5.c.** Wire/cable Management	**5.a.i.** Keep hands away from ROV moving parts and pinch zones. **5.b.i.** Check that tether is neatly coiled. **5.c.i.** Ensure that all cables and wires are safely routed.
Post Flight Safety	**6.a.** Tripping **6.b.** Lifting ROV	**6.a.i.** Check that tether is neatly coiled. **6.b.i.** Use ROV handles designed to assist with safe lifting. **6.b.ii.** Use proper lifting techniques.
ROV Transport	**7.a.** Back Injury **7.b.** Tripping while transporting ROV	**7.a.i.** Use proper lifting techniques. **7.a.ii.** Use ROV handles designed to assist with safe lifting. **7.b.i.** Check that tether is neatly coiled.