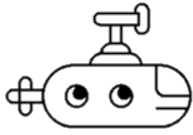
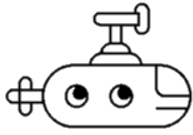


JOB SAFETY ANALYSIS

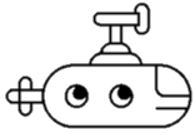
Tasks	Hazards	Controls
General ROV Development		
Using heavy machinery and power tools	Hearing Damage	Wear earmuffs to prevent noise-induced hearing loss
	Eye injury	Wear safety goggles to prevent flying debris from causing eye injury
	Flesh wound	Ensure the machinery/tool is in good condition before use
		Keep a safe distance from moving blades or drill bits
		Touch heavy machineries if and only if they are completely stopped
	Burns	Turn off the machine when not in use
Do not touch the cut pieces immediately after cutting or drilling		
Respiratory irritation and damage	Wear protective gloves when touching hot metal pieces	
Making buoyancy foam	Irritation	Wear particulate respirators to filter out airborne particulate matter
		Wear protective gloves when working with epoxy
	Burns	Turn off the foam cutter when not in use
		Wear protective gloves when handling the cutter
Respiratory irritation and damage	Wear particulate respirators to filter out airborne particulate matter	
	Perform sanding under a fume hood	



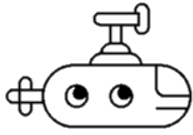
Waterproofing electronic components	Irritation	Wear protective gloves when touching epoxy
	Chemical inhalation	Perform work under a fume hood or in a well-ventilated area
Soldering circuit board and other electronic components	Fire hazard	Turn off soldering iron when not in use Do not leave hot iron unattended
	Skin burnt	Remove combustible material from work area Place soldering iron on its holder after each use
	Chemical inhalation	Perform work under a fume hood or in a well-ventilated area
Using 3D printer	Burns	Do not touch the extruder at all time Wait until the print bed cool down to collect the print
	Flesh wound	Keep anything away from stepper motor when it is printing
	Respiratory irritation	Keep a safety distance from the extruder when printing to avoid toxic foam
	Foot injury	Keep the printer in a safe and secure place
	Eye injury	Wear safety goggles to prevent from snapped 3D print material to get into our eyes
Transporting the ROV	Foot injury	Wear close-toed shoes when pushing transportation cart
	Impact with the transportation cart	Secure all loose and moving parts on the transportation cart with cable ties Do not walk in front of the transportation cart Keep transported objects inside the cart



Setting up power supply	Overvoltage	Check the voltage reading that it shows nominal 12V
Loading or unloading the ROV system into or from the transportation cart	Back Injury	<p>Picking up heavy equipment with a neutral lower back to prevent spinal disc injury</p> <hr/> <p>Carry heavy objects according to one's limits</p> <hr/> <p>Lift heavy objects together</p> <hr/> <p>Do not lift anything above the shoulder level</p>
	Hand Injury	<p>Make sure all handles are strong and safe</p> <hr/> <p>Ensure no sharp objects around handles</p>
	Foot injury	<p>Wear close-toed shoes</p>
	Slipping	<p>Wear non-slip shoes near the pool</p> <hr/> <p>Do not run near the pool</p>
	Dry Running the ROV	Damaging the frame or manipulators
Flesh wound		<p>Put warning labels on thrusters and sharp edges</p> <hr/> <p>Yell "contact!" when someone needs to touch the ROV, signalling the pilot to put down the controller</p> <hr/> <p>Keep hands at a safe distance when thrusters are turning</p>
Checking buoyancy	Water Leakage	<p>Check all connections before putting ROV in water</p>
	Back, Shoulder and forearm strain	<p>Carry ROV with at least two people</p> <hr/> <p>Keep a neutral lower back when picking up ROV from the pool</p>



Managing the tether	Tripping over tether	Make sure the tether is neatly laid on the floor
	Tether damage	Supply enough tether to ROV to prevent excessive tension on the tether Hold the tether up to prevent friction with the pool edge
Setting up the tether	Loose tether	Secure the tether with carabiner strain reliefs on the ROV side and the control box side
	Tangled tether	Stow the tether into the tether cart roll after every use
Setting up air pump	Over-pressurized	Set pressure regulator to 275kPa Ensure no air leaks in the pneumatics fittings Depressurize the compressor tank after every use
Product Demonstration	Thruster malfunction	Ensure that someone is on standby to push the emergency kill switch
Deploying and retrieving ROV	Back, Shoulder and forearm strain	Carry ROV with at least two people Maintain a neutral lower back when picking up ROV from the pool Avoid twisting motions when retrieving ROV Do not reach too far into the water
	Flesh Wound	Yell "contact!" when someone needs to touch the ROV, signalling the pilot to put down the controller Keep hands at a safe distance while thrusters are turning
	Electrical shock	Keep electronic components away from the pool and protect them from splashes Check and secure all connections Ensure no exposed and loose wire



**OVERFLOW
ROBOTICS**

CONTROL THE FLOW

		Kill power immediately when there is an indication of electrical problems
Required Training		Required Personal Protective Equipment
Use of heavy machinery and tools		Close-toed shoes
Loading and unloading equipment		Gas masks and respirators
Setting up power supply and air pump		Protective gloves
Dry running the ROV on deck		Noise-blocking earmuffs
Launching the ROV		Protective goggles