



THETA

Ranger Class
CMA SECONDARY SCHOOL
CMA Underwater Expert Ltd.

Job Safety Analysis



Production of ROV

TASKS	HAZARDS	CONTROLS
Using hand tools, power tools and machine	Eye injury	<ul style="list-style-type: none"> Wear safety glasses to avoid flying debris from getting into eyes
	Hearing damage	<ul style="list-style-type: none"> Wear earmuffs for protecting ears from noise-induced hearing disabilities
	Physical injury	<ul style="list-style-type: none"> Turn off the tools when not in use Keep hand tools, power tools and machines in good condition Do not use hands to clean and touch the operating machine Press emergency stop button when objects get stuck into the machine Maintain a clean and well-lit working environment Tie up long hair when operating hand tools, power tools and machine
	Burns	<ul style="list-style-type: none"> Wear gloves when touching hot objects
Making buoyancy foam, Electronic Speed Controllers and cable connectors	Allergy-prone substances	<ul style="list-style-type: none"> Wear gloves when working with epoxy
	Flammable substances	<ul style="list-style-type: none"> Stay away from sources of ignition
	Substances that are harmful if inhaled, contacted with skin, or swallowed	<ul style="list-style-type: none"> Label substances clearly Specify symbols and classification Indicate risks Indicate safety precautions
Waterproofing electronic components	Irritation	<ul style="list-style-type: none"> Wear gloves when working with epoxy
	Chemical inhalation	<ul style="list-style-type: none"> Work in well-ventilated area
Building ROV, mission tools and Micro-ROV	Physical injury	<ul style="list-style-type: none"> Ensure no sharp edges on the ROV Ensure the thruster shrouds are on the thrusters Put warning labels on thrusters
	Food Poisoning	<ul style="list-style-type: none"> Do not put the epoxy, pool water, glue and tensol in your mouth
Using 3D printer	Burns	<ul style="list-style-type: none"> Do not use hands to clean and touch 3D printers in operation Do not print objects over night Wait until the objects are cool down to collect the print
	Respiratory irritation	<ul style="list-style-type: none"> Keep a safety distance from the extruder when printing to avoid toxic foam

Contributors: Jerry LUM, Terry AU



Operations

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Pool trials and lab	Slipping / falling	<ul style="list-style-type: none"> Wear non-slip shoes in the pool or lab Ensure water level does not exceed 1.2meters
	Eye damage	<ul style="list-style-type: none"> Wear safety glasses to shield your eyes from any possible hazards or material
Setting up the ROV system	Electrocution	<ul style="list-style-type: none"> Place the ROV, Electrical Distribution Control Panel and Micro-ROV on a dry location before operation Make sure all electronics and hands are dry all the time Make sure there is no electronics housing for leaks Ensure all extension cords are in safe condition with plugs and connections properly wired
	Physical injury	<ul style="list-style-type: none"> Wear closed shoes at all times Lift heavy objects, equipment in the presence of 2-4 members Bend your body forward slightly when loading and unloading Use a trolley for transporting the ROV Avoid placing fingers near thrusters
Setting up power supply	Overtoltage	<ul style="list-style-type: none"> Check that the voltage reads 12V normally
Using the air compressor	Physical injury	<ul style="list-style-type: none"> Never use at pressure greater than 120psi Do not attempt to tamper with safety valve Turn off the air compressor and release all air from the tank after used
Managing the tether	Tether damage	<ul style="list-style-type: none"> Store the tether into the tether reel after use it Always keep an eye on the tether Ensure the tether is not tangled at all times
	Loose tether	<ul style="list-style-type: none"> Secure the tether with carabiner strain reliefs on the ROV side and the Control Panel side
	Tangled tether	<ul style="list-style-type: none"> Stow the tether into the tether cart roll after every use
Turning on the ROV	Thruster malfunction	<ul style="list-style-type: none"> Step 1: Turn on remote control joystick Step 2: Turn on control panel
Turning off the ROV	Thruster malfunction	<ul style="list-style-type: none"> Step 1: Turn off control panel Step 2: Turn off remote control joystick
Blowing dry the ROV post-drive	Damage the functionality of entire ROV	<ul style="list-style-type: none"> Prevent the physical damage of ROV

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Operations

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Transporting the ROV	Foot injury	<ul style="list-style-type: none"> Secure all loose and moving parts are on the Control Panel with cable ties
	Impact with the Control Panel	<ul style="list-style-type: none"> Do not walk in front of the Control Panel Keep transported objects inside the cart
	Back Injury	<ul style="list-style-type: none"> Picking up heavy equipment with a neutral lower back to prevent spinal disc injury Call teammate to help you lift heavy objects together
Dry Running the ROV	Damaging the frame or manipulators	<ul style="list-style-type: none"> Put ROV on the stand to prevent any physical damage
	Flesh wound	<ul style="list-style-type: none"> Put warning labels on thrusters and sharp edges Keep hands at a safe distance when thrusters are turning
Deploying and retrieving ROV	Back, Shoulder and forearm strain	<ul style="list-style-type: none"> Carry ROV with at least two teammate Avoid twisting motions when retrieving ROV
	Flesh Wound	<ul style="list-style-type: none"> Keep hands at a safe distance when thrusters are turning
	Electrical shock	<ul style="list-style-type: none"> Keep electronic components away from the pool and protect them from splashes Check and secure all connections Ensure no exposed and loose wire

Required Training

- Loading and uploading procedures
- Power checking and setting-up the ROV
- Proper operation of specific tools and ROV
- Below dry running the ROV on the dry place
- Use of Heavy machinery and tools

Required Personal Protective Equipment

- Non-slip, closed shoes
- Safety glasses
- Gloves
- Earmuffs
- Hair Band (For people who have long hair)

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