Job Safety Analysis

Macau PuiChing Middle School

Ranger - Delphinus

MATE ROV 2016

P.C.M.S. ROV DELPHINUS

PUI CHING MIDDLE SCHOOL 1889

Job safety analysis and control measures

Prevention is better than cure, so prior to starting any task, evaluate the potential hazards and take the necessary control measures can make our work more efficient and productive. Therefore, job safety analysis is one of the essential procedures in our ROV production.

1. Safety measures in assembling the ROV

During the construction of our ROV, certain tools have been used frequently, like laser cutters, manual cutting devices, jigsaws, electric drills etc. We have made a specific job safety analysis of all the potential hazards we may encounter during our work as well as the prevention we can make to reduce our risk over these hazards.

TASK	POTENTIAL HAZARDS	CONTROL MEASURES
Laser cutter	- Air contamination: Gaseous or particulate contaminants may be produced, when the beam strikes the materials, like plastics, wood or metals. - Fire hazard: Extremely high temperature may be produced when the high intensified beam of laser light comes into contact with the materials it is cutting. - Optical radiation hazard: Ultraviolet emissions may be produced	a) All users should be trained as to its use and how to use it safely. b) Ensure the filtration or exhaust systems and properly cleaned and maintained and they are on during the use of the laser cutter. c) Never operate the laser cutter unattended. d) Adjust power, speed and frequency settings to reduce the beam. e) Always keep the area around the cutter free of flammable materials. f) Always keep a fire extinguisher in the area. g) Wear electric arc welding eye protection which affords a comfortable viewing brightness of any secondary emissions.
Manual cutting device and jigsaw	Injury - Blade may disengage due to failure to tighten the adjustment screws - Fingers or hands will get hurt - Blade can become hot after prolonged use and will cause burns - Material may splash	a) Make sure the devices are properly maintained. b) Make sure all adjusting screws are firmly tightened. c) Use PPE all the times d) Keep your fingers away from exposed parts of the blade e) Use clamps or other tools to keep hands away from dangerous actions f) Always wear eye protection. Dust mask must be used for certain conditions.

TASK	POTENTIAL HAZARDS	CONTROL MEASURES
solder	- Burns	a) Place a mat on the table to catch any solder that will be dripped. b) Be aware of the direction of the heat. c) Use a vise or frame to secure the items you are soldering. d) DO NOT touch the tip of the iron while you are soldering. e) Goggles must be worn.
3D printer	- Printing Inappropriate materials - Ultraviolet radiation - High temperature is produced during the printing process, and the print-out is hot and may cause burn	a) Always follow the user guidelines. b) Make sure that the appropriate printing materials are used. c) If material may shatter wear safety goggles. d) DO NOT look directly at the lamp; make sure the UV screen is intact. e) DO NOT touch the print-out until it cools down.
Electrical drill	- Accidental starting; - Lose control of the device; - Material may shatter.	a) Make sure the switch is turned off before plugging in. b) Never leave the device with the trigger left in the locked “On” position. c) Disconnect the power before making any adjustments, changing accessories or handling the tool. d) Keep proper footing and balance at all times. e) Use clamps or other practical ways to secure and support the work-piece to a stable platform. f) Always wear eye protections. Dust mask must be used for certain conditions. g) DO NOT wear gloves.

2. Safety measures in lifting and transporting the ROV

TASK	POTENTIAL HAZARDS	CONTROL MEASURES
Lifting the ROV	- The ROV is heavy and may cause hands and back injury while lifting - Lifters not synchronizing may drop the ROV - The ROV may not be well secure and dangling parts may fall off - The ROV may not be safe when the power is on	a) Ensure the lifters wearing gloves. b) Ensure that there are enough people to lift the ROV safely. c) All lifters should have a secure footing and do the lifting with their legs and arms, instead with their back. d) All lifters should synchronize their movement and one person should be the coordinator to make sure they all react at the same pace. e) Make sure all the parts of the ROV are secured and the power of the ROV is off.
Transporting the ROV	- Lifters moving in different directions may cause the ROV to fall; - There may be obstacles in the path; - Transporting in crowded areas may cause injury to transporters or passers-by.	a) Decide the path before lifting. b) Ensure that the areas and paths are clear of obstacles. c) DO NOT run and be patient while transporting the ROV, especially in crowded areas.

3. Safety measures in the Pit station and playing field

1. Use working gloves for uncrating and re-crating.
2. Required PPE must be worn all the times.
3. Keep the pit station neat and orderly and store all tools after use.
4. Signs, banners and displays should be mounted firmly and securely.
5. DO NOT run between the pit and the playing field.
6. Beware of slippery floor.
7. Wear substantial shoes that cover the entire foot completely.

8. Beware of any electric dangers as if the place is wet.
9. Ensure that the playing field is clear of debris and free of tripping hazards.
10. Locate the emergency supplies and the emergency medic.
11. Locate the emergency exits and have a look of the evacuation route map.

4. ROV Safety

If we ignore the safety part, things can never be well carried on, thus safety is the biggest concern in manufacturing the ROV. Our ROV was designed specifically for safety. For personal safety, we have prepared different safety gears such as goggles, ear protectors or face shields to prevent us from getting hurt. To make sure that safety measures are followed strictly, we have made a job safety analysis (JSA) to evaluate all the potential hazards, and decide which of the personal protective equipment (PPE) should be worn and what safety measures should be taken. When student operates heavy machinery, they are also required to be monitored by mentors. Most importantly, new members are required to have a safety session and couple of lectures on safety and marine protection.

Considering the safety features on the ROV, there are protective shrouds covering the thrusters' blade and caution marks are put to remind people to keep high safety awareness while working with thrusters and propellers. In addition, no sharp edge can be found on the ROV frame. A 25-amp fuse is used to prevent overpowering. There is a main switch on the control panel which enables us to stop the whole system immediately in case of an accident.

Lastly, we have developed a safety checklist to let teammates make self-regulations before every ROV testing, hence increasing teammates' safety awareness and keeping them from any potential hazards.

General Safety Check List – For Team Member

item	check	remark
Company members		
1. All members are wearing safety goggles when using power tools.		
2. Long hair is tied up and accessories are removed.		
tether		
1. Ensure that all wires are tucked into the nylon wire mesh guard.		
2. Make sure all wires in the tether are not tangled.		
Structure		
1. There are no exposed motors and all propellers are completely shrouded.		
2. No exposed copper wire/all splices are soldered and sealed.		
3. There are no sharp edges on the ROV that can cause harm.		
4.Double-check the waterproofing.		
Control System/ Motor		
1. Ensure that the control box is securely attached to the tether.		
2. Ensure that there are no visible shorts or broken connections in the system.		
3. Ensure that the plugs are inserted correctly and not flipped.		
4. Check that all motors are working and thrusters are free of obstruction.		
5. Ensure all components are responding to control system.		
6. Double check the system		
Camera		
1. Ensure camera wires are not punctured or tangled.		
2. Check camera image/angle.		
3. Cameras are securely attached		
4. Spray the cameras with fresh water, to get chlorine water off, which prevents corrosion.		

Officer's signature: _____

Safety Check List – Before Vehicle Trial runs

item	check	remark
Hardware		
1. Make sure all the connectors are secured		
2. Make sure there are no sharp edges on the ROV		
3. Make sure the tether is straightened		
4. Make sure the sensors are properly installed		
5. Make sure the power cable is connected correctly		
6.Check if all buckles are secured		
Software		
1. Check if the computer is showing sensory data		
2. Check if the tether is connected to the onshore panel correctly		
3. Check if the optical fiber is working (by checking the LED of the fiber convertor)		
4. Check if the vertical thrusters are working perfectly		
5. Check if the horizontal thrusters are working perfectly		
6. Check if the camera works properly		

Officer's signature: _____

General Safety checklist

For safety officer's use

Date:___/____/_____ Location:_____Inspector: _____

No.	Inspection	Y	N	N/A	Describe the situation and the corrective measure taken
	WORKSHOP				
1.	Are guards and safety devices in place and functional?				
2	Are tools properly stored when not in use?				
3.	Do team members follow the workshop general safety rules?				
4.	Are eye and ear protections worn in appropriate condition?				
5.	Do team members follow the special rules while using electrical drill, manual cutter and jigsaw, and 3-D printer?				
6.	Do team members comply with the safety rules while lifting and transporting the ROV?				
	Electric Aspect				
1.	Are cords and plugs in good condition with no exposed wiring?				
2.	Are electrical outlets within the limit?				
3.	Are the batteries visibly ok?				
	PIT STATION				
1.	Are all the equipments and materials put and stored properly within the designated area? Path clear?				
2.	Are all the signs, banners and displays securely mounted?				
3.	Are all the walkways clear of obstruction and debris?				

No.	Inspection	Y	N	N/A	Describe the situation and the corrective measure taken
	APPROVED PPE				
1.	Have the required PPEsbeen worn by team members?				
2.	Are PPEs properly maintained and stored?				
	ROV SAFETY				
1.	Is the frame free of sharp edges?				
2.	Have protective nets been added to prevent contact with the blade of thrusters?				
3.	Have caution marks been placed to remind people the dangers while working with thrusters and propellers?				
4.	Has a suitable fuse been added to prevent overpowering of the electrical system?				
5	Have cables been tied neatly around the frame?				

Observation and comments:

Officer's signature: _____