Job Safety Analysis 2024 Report

Sea-ing all the possibilities of underwater robotics!

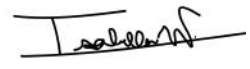
Night Owls
Florida Atlantic University High School
Boca Raton, Florida

Table of Contents

Job Step:	Potential Hazards:	Recommended Risk Mitigation Methods:	Member(s) Responsible For Risk Mitigation Methods:
1: Transport all materials and ROV to poolside station	**1-A:** Dropping the ROV and or other important materials **1-B:** Unwanted substances such as dirt getting on the ROV and inhibiting view **1-C:** Control box falling off of the table once it is placed on the table	**1-A-1:** Carry the ROV and all materials necessary for poolside use in a basket with wheels. This ensures that the ROV will not be dropped **1-B-1:** Cover the ROV with a towel while transporting it. This makes it harder for unwanted substances to come in contact with the ROV **1-C-1:** Anchor the control box to the table so that the control box cannot be moved and is sturdy.	Isabella Wong (Safety Manager) _____
2: Ensure that everyone required for product demonstration is present	**2-A:** Miscounting the amount of members and starting a product demonstration without adequate personnel	**2-A-1:** All members that are required to be poolside are required to wear vests that make them easier to identify	Joshua Silversten (Chief Operations Officer) Joshua Silversten _____

Job Step:	Potential Hazards:	Recommended Risk Mitigation Methods:	Member(s) Responsible For Risk Mitigation Methods:
3: Plug the control box into the power supply	**3-A:** An incorrect amount of voltage supplied to the box by the power supply would damage the electronics **3-B:** If positive is plugged into negative and negative is plugged into positive the electronics will be damaged	**3-A-1:** Conduct a visual inspection of the power supply before plugging the control box into the power supply **3-A-2:** Ensure that the power supply is set to the correct amount of volts **3-A-3:** Click the on button on the power supply, then use a multimeter to ensure that the power supply is emitting the correct voltage **3-B-1:** Ensure that all anderson connections are connected in a way in which positive can only be plugged into positive and ground can only be plugged into ground **3-B-2:** Turn the power supply off again and plug the power supply into the control box. Once the connection between the control box and power supply is secured, the power supply may be turned on	Eoghan McIvor (Chief Technology Officer) 

Job Step:	Potential Hazards:	Recommended Risk Mitigation Methods:	Member(s) Responsible For Risk Mitigation Methods:
4: Turn on the control box using the emergency stop lever	**4-A:** If one of the connections between the lever is wrong, it could cause the control box electronics to be damaged	**4-A-1:** Conduct a visual inspection of all Anderson Connections leading up to the lever and ensure that positive is only connected to positive and negative is only connected to negative	Eoghan McIvor (Chief Technology Officer) 
5: Plug the tether into the control box	**5-A:** If the tether is yanked it can cause strain on the tether **5-B:** If the tether is plugged in the wrong way, it can be problematic for the electronics on our ROV	**5-A-1:** Connect the strain relief to the box to ensure that any strain on the tether will be distributed along the frame of the control box **5-B-1:** Ensure that the Anderson connector gets plugged in the wrong way, and ensure that the emergency switch is off before plugging the tether into the box. Once the tether is plugged in and secured to the control box, the lever can be turned on. If the motors do not beep twice showing that they have received power, immediately turn off the ROV	Eoghan McIvor (Chief Technology Officer) 

Job Step:	Potential Hazards:	Recommended Risk Mitigation Methods:	Member(s) Responsible For Risk Mitigation Methods:
6: Plug the ethernet cable into the tether and laptop	**6-A:** If ethernet cable is not plugged in the right way, it can cause a loss of connection between the laptop and the ROV	**6-A-1:** Ensure that both sides of the ethernet cable click **6-A-2:** Wait until the light on the laptop for the ethernet port starts lighting up	Eoghan McIvor (Chief Technology Officer) 
7: Deploy the code to the ROV	**7-A:** If the code is deployed incorrectly or prematurely it can cause a delay and force the team to power down the ROV.	**7-A-1:** Ensure that an ethernet connection is being received in the terminal. **7-A-2:** Wait to receive camera connection before proceeding and ensure that the code is able to control all servos. **7-A-3:** Ensure that when the code is deployed there are three beeps to prove connection to the laptop. If there are not three beeps, power down immediately.	Eoghan McIvor (Chief Technology Officer) 
8: Lower the ROV into the water	**8-A:** If the tether operator falls into the water he or she could have trouble getting out. **8-B:** If the tether operators falls backwards, he or she could hit their head	**8-A-1:** All tether operators will wear a life jacket to ensure that they do not drown. **8-B-1:** All tether operators will wear hard hats to ensure that they do not hit their head.	Isabella Wong (Safety Manager)  Ava Palazzolo (Tether Manager) 

Appendix A: Deck Checklist

Pre Power:

- [ ] Area is clear and safe
- [ ] All team members wearing appropriate PPE (safety glasses, safety vest, life vest, hard hat,)
- [ ] Tether wires are connected and secured
- [ ] Tether is connected to strain relief and is secured to the back of the ROV
- [ ] Visual inspection of ROV electronics tube
- [ ] M10 Enclosure and Vent Plug is sealed
- [ ] Thrusters are free of obstructions

ROV Maintence:

- [ ] Make sure there is no moisture in electronics tube (may need to cook silica beads to dehydrate them)
- [ ] Orings are regreased every time the tube is closed
- [ ] Make sure electronics tube is sealed
- [ ] Vacuum test to hold 15 in.hg vac (inches of mercury)
- [ ] Self test electronics

Power-On ROV:

- [ ] Control computer powered on and running
- [ ] Ensure all deck members are on deck and attentive
- [ ] Co-Pilot says "We are now going to power on the ROV."
- [ ] ROV thrusters should beep
- [ ] Test and verify thrusters are working properly (should not last long)

Deploy ROV:

- [ ] Tether Operators carefully place ROV in water
- [ ] Visual inspection for air bubbles and water leaks in tube
- [ ] If issue detected, proceed with leak detection protocol.
- [ ] If no issues are found, Tether Operator covers ROV camera lens until ready to launch
- [ ] Pilot/Co-Pilot request props and where to put them
- [ ] Tether Operator Removes hand from camera
- [ ] Pilot moves the ROV and begins mission tasks.

Buoyancy Engine:

- [ ] Deck members in charge of buoyancy engine should ensure the safety cap is secured.
- [ ] Deck members should establish a connection with the device before it is deployed
- [ ] Deck member gives buoyancy enginee to tether operators to be deployed by the ROV
- [ ] ROV should deploy the buoyancy engine in designated area
- [ ] Buoyancy engine should complete profiles and communicate each time.
- [ ] If buoyancy engineer is unable to complete profiles, deck members should ask for given data to complete the task manually.

ROV Retrieval:

- [ ] Pilot steers ROV to deployment area and surfaces
- [ ] Tether Operators grab ROV and put a hand over camera for Pilot to see
- [ ] Tether Operator says "Disarm ROV"
- [ ] Pilot Disarms and powers down ROV, thrusters should stop moving
- [ ] Tether Operators remove ROV from water and place it on designated stand
- [ ] Tether Operators detach tether and coil it up neatly to avoid tripping hazards
- [ ] Deck members proceed to clean up work area

If Leak is found:

- [ ] Tether Operators immediately remove ROV from water
- [ ] Visual inspection of tube to identify source of leak.
- [ ] If not found with a visual inspection, use soap (bubbles will appear from air escaping tube)
- [ ] Once source is identified, you may then proceed.
- [ ] Create a plan to repair leak.
- [ ] If leak is dealt with, you may then proceed
- [ ] Check electronics for damages
- [ ] Check systems to make sure ROV is in working order and no other issues have arisen.

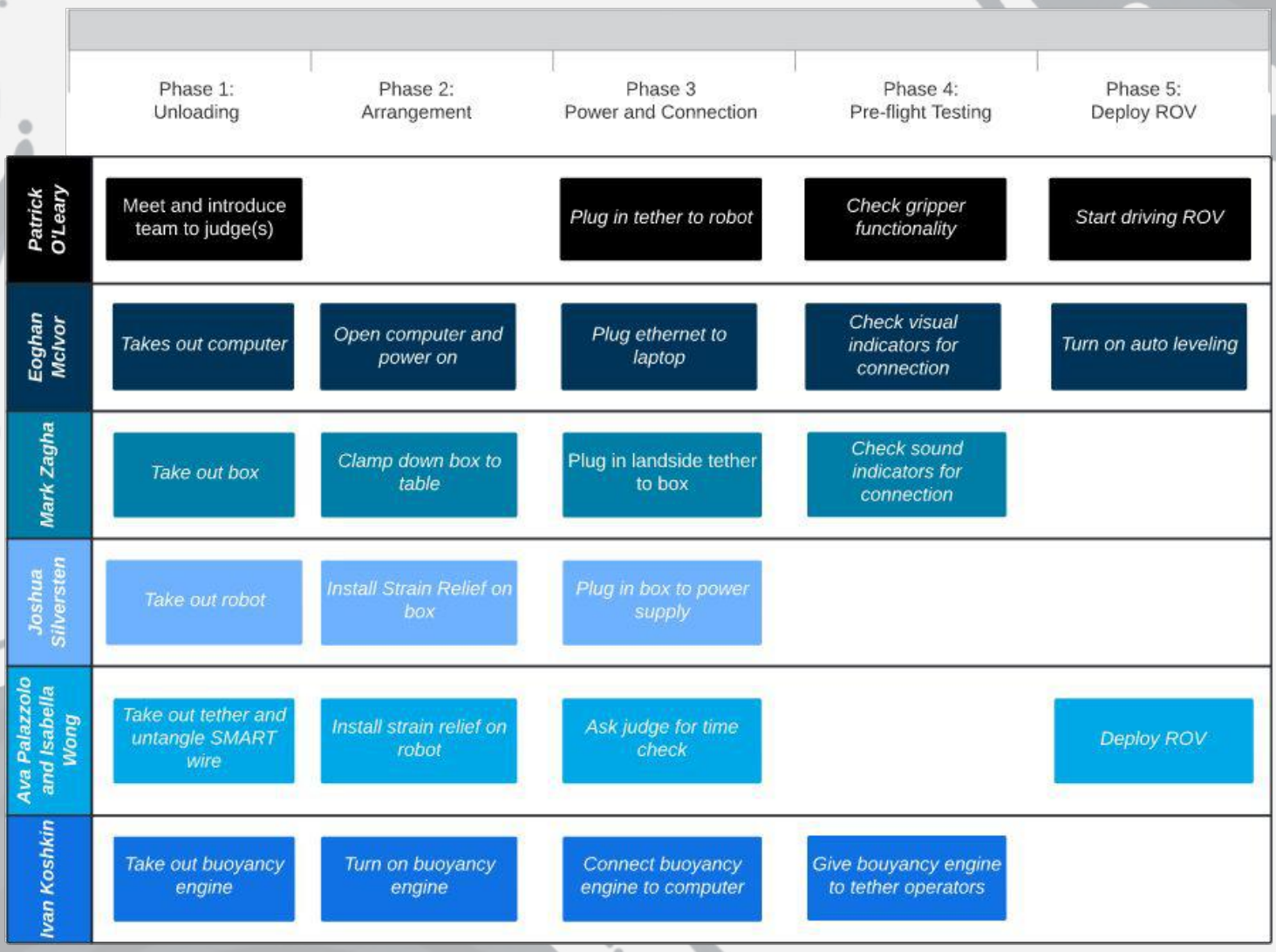
If Loss of Communication:

- [ ] Pilot makes team members aware that there has been a loss of communication
- [ ] Pilot powers down ROV
- [ ] ROV is powered back on (while still in water if this was during a mission)
- [ ] If no communication has been restored, tether operators reel ROV back in from tether
- [ ] Try once again to reboot ROV
- [ ] If no communication has been restored, begin trouble shooting procedures till issue is found and fixed .

Deck Maintenance:

- [ ] Area is clear, organized, and safe
- [ ] All tools, cables, and equipment are safely stored in their designated spaces
- [ ] Make sure there are no electrical hazards
- [ ] All props should be stored away neatly as to not be a tripping hazard
- [ ] Power Supply, ROV, and Tether are clean, dry, and stored away safely.
- [ ] Electrical connections are covered with protective casings.
- [ ] If any supplies are needed to be bought / replaced, they are kept track of.
- [ ] Power Supply, ROV, and Tether are ready for use on next mission run.

Appendix B: Deck Flowchart



Appendix C: ROV Safety Features

Electrical Safety Features	Mechanical Safety Features	Software Safety Features
- 25 amp fuse on surface - 20 amp fuse for four motors (2x) - 5 amp fuse for servos - 5 amp fuse for USBs - 7.5 amp fuse for Navigator Pi Hat with Raspberry Pi 5 - Amperage and voltage displays - Custom PCB for organization and low chance of wires coming undone	- Front and back motor guards - Strain relief on craft and power box - M10 Enclosure and Vent Plug	- Coded limit of 18 amps for the motors - Amperage and voltage displays, input from within ROV, output on land display - Coded emergency stop button

Appendix D: Buoyancy Engine Features

Electrical Safety Features	Mechanical Safety Features	Software Safety Features
- 7.5 amp fuse on the buoyancy engine - Custom PCB for organization and low chance of wires coming undone	- Bottom and top enclosures act as pressure relief valve	- Two-way communication between engine and receiver

Appendix E: On Deck Personal Protection Equipment

	Image	Pilots	Tether Operators	Float Operators
Safety Glasses		✓	✓	✓
Safety Vests		✓	✓	✓
Hard Hats		✓	✓	✓
Emergency Flotation			✓	✓

All photos on slide taken by Nidhi Begur.

Appendix F: Training and Safety

Each member of the Night Owls was required to obtain an official Florida boating license. The Florida boating license is valid for each company members' entire life. To obtain the license, each member had to take a eight hour course about boating and water safety, as well as passing a final exam. Having taken the course, all members of the Night Owls are familiar with standard water safety procedures and have the knowledge on how to act in emergency situations. The boating course units and topics are outlined on slide 10.

Training and Safety Continued

- **Unit 1: Before Getting Underway**
  - Topic 1: The Many Parts of a Boat
  - Topic 2: Types of Boat Hulls
  - Topic 3: Boat Length
  - Topic 4: Types of Engines and Drives
  - Topic 5: Personal Watercraft
  - Topic 6: Sailboats
  - Topic 7: Your Boat's Capacity
  - Topic 8: Float Plans
  - Topic 9: Fuel Your Boat...Safely
  - Topic 10: Trailering Your Boat
  - Topic 11: Tying Nautical Knots
  - Topic 12: Taking Care of Your Boat and Engine
  - Topic 13: Summary
- **Unit 2: Getting Out on the Water**
  - Topic 1: Casting Off
  - Topic 2: Docking
  - Topic 3: Navigation Rules: Traffic Laws of the Waterways
  - Topic 4: Navigation Lights
  - Topic 5: Night Navigation
  - Topic 6: Sound Signals
  - Topic 7: Summary
- **Unit 3: Navigation and Safe Operation**
  - Topic 1: U.S. Aids to Navigation System (ATON)
  - Topic 2: Anchoring
  - Topic 3: Dams, Locks, and Bridges
  - Topic 4: Changing Water Levels
  - Topic 5: Compasses and Charts
  - Topic 6: Personal Watercraft
  - Topic 7: Engine Cut-Off Switches
  - Topic 8: Avoiding Jet Stream and Propeller Strike Injuries
  - Topic 9: Summary
- **Unit 4: Florida's Legal Requirements of Boating**
  - Topic 1: Your Boat's Identification
  - Topic 2: Who May Operate
  - Topic 3: Unlawful Operation
  - Topic 4: Alcohol and Drugs
  - Topic 5: Staying Clear of Other Boats
  - Topic 6: Personal Flotation Devices (PFDs)
  - Topic 7: Fire Extinguishers
  - Topic 8: Other Engine Requirements
  - Topic 9: Navigation Lights
  - Topic 10: Federally Controlled Waters
  - Topic 11: Signaling and Sound Devices
  - Topic 12: Additional Regulations and Safety Considerations
  - Topic 13: Personal Watercraft
  - Topic 14: Skiing and Tubing
  - Topic 15: Waste, Oil, and Trash Disposal
  - Topic 16: Protect the Environment
  - Topic 17: Boating Accidents and Casualties
  - Topic 18: Enforcement and Penalties
  - Topic 19: Summary
- **Unit 5: Boating Emergencies**
  - Topic 1: Risk Management
  - Topic 2: Rescue Techniques
  - Topic 3: Capsizing, Swamping, or Falling Overboard
  - Topic 4: Avoiding Collisions
  - Topic 5: Dealing With Fire Emergencies
  - Topic 6: Running Aground
  - Topic 7: Cold Water Immersion and Hypothermia
  - Topic 8: Carbon Monoxide (CO) Poisoning
  - Topic 9: Personal Injuries
  - Topic 10: Weather Emergencies
  - Topic 11: Summoning Help
  - Topic 12: Summary
- **Unit 6: Enjoying Water Sports**
  - Topic 1: Responsibilities of a Boat Operator
  - Topic 2: Small Boats and Paddlecraft (Canoes, Kayaks, and Rafts)
  - Topic 3: Water-Skiing and Tubing
  - Topic 4: Scuba Diving and Snorkeling
  - Topic 5: Windsurfing and Sailing
  - Topic 6: Fishing and Hunting
  - Topic 7: Summary

References

References

1. Kalkomey Enterprises, LLC. (n.d.). *Take your Florida Boating License & Safety Course*. Boat Ed. Retrieved May 16, 2024, from https://www.boat-ed.com/florida/