Job Safety Analysis (JSA)

HOUSEKEEPING

TASK HAZARD PROTOCOL Follow safety checklist, use personal protection equipment (PPE), Keep all non-authorized people out of work areas, and/or at a safe distance.

Smithsonian Machine Room:

- Mentor Supervision of Machine Room on Site at all times as per Smithsonian protocol.

Keep a Well Organized CLEAN Environment at all times. Follow Safety Check List for each situation.

- Machine Rooms
- Electrical Work Area
- Pool Side Protocol

PERSONAL PROTECTIVE EQUIPMENT

HAZARD PROTOCOL

- MUST WEAR PPE (personal protection equipment) at all times.
- Use Personal Protection Equipment when working with machinery and electrical equipment
- Safety Glasses, Gloves, Thermal Gloves, Close toe shoes, appropriate clothing; no lose clothing that can entangle in machinery or catch fire. Hair appropriately restrained.
- Deck Crew near edge of pool wear life vests in case of unexpected immersion in water. Deck crew handling ROV wear helmets in case of slip and fall while carrying/handling ROV.

Electrical Work Area Protocol:

- Follow safety checklist, use personal protection equipment (PPE)
- Electrical wiring avoid equipment failure - use correct voltage-power down before any work or connection of electrical wires.
- Proper grounding, double, triple check wires are in proper location before powering on. All PCB, Microcontroller current turned off while connecting, splicing or soldering.
POOL SIDE PROTOCOL: Mission Runs, Perform Operational and Safety Checklist (see add.list)

- all electrical wiring and motor are appropriately waterproofed and sealed prior to submersion. No exposed wires or motors.
- WPC is vacuumed checked prior mission to ensure NO LEAKS!
- Leaking and breaching of electrical systems preform immediate shut down and removal from water.
- Keep all electrical tools and extension cords at a sake distance from the pool side, ask for driver assistance if unforeseen problem occur with ROV or Tether entanglement.
- No Running

General Shop work:

- Keep tools organized and area swept at appropriate intervals,
- Wear PPE:
- Prevents stepping on sharp items and tools, Putting all items back where they belong,
- Wear close toed shoes, no lose clothing or hair to prevent entanglement or a fire hazard.
- Electrical Power Tool (soldering iron), use appropriate holding stand and wear PPE, keep at specified safe temperatures.
- Avoid Unsafe contact with skin or clothing, flying or hot debris.
- Hold and use tools as per manufacturer’s instruction for intended use.
- Accident Prevention: Puncturing of skin, burns, flying debris; WEAR Eye protection, gloves, close toed shoes.
- Stay alert of your surroundings.

HAND SAFETY

HAZARD PROTOCOL

- Laser Cutter: Contact with fingers, keep lid closed, watch for sharp edges.
- Drilling: Contact with fingers, wear work gloves, keep hand clear of drill bit.
- Soldering: The use and contact of hot objects, keep clear of hot surfaces, notify others of hot surfaces, stow hot iron in designated areas.
- Drill Press: To prevent hitting fingers, use designated clamps, Keep hands clear.

LIFTING & BACK SAFETY

HAZARD PROTOCOL

- Moving the ROV- Heavy lifting injury prevention; appropriately lift heavy objects- Lift with the knees.
- Launch/Recovery of ROV poolside from awkward position. Kneel on deck, use caution, don’t overreach and don’t fall in the water.
• ROV supply boxes- Lift with the knees, use handholds, keep the load close, Moving
   ROV Monitors, Batteries, Case- Use wheels when possible, ONLY lift in pairs; transport
   of ROV Heavy weight/ Use rolling cart.

TOOL SAFETY
HAZARD PROTOCOL
• Drill Press; Damage to skin / Crushing of fingers
  Safety Glasses, Gloves, Close Toed Shoes
• Dremel; Breaking of skin, flying debris eye injury; Safety Glasses, Gloves, Close Toed
  Shoes
• Soldering Iron; Serious burning of skin or eye injury, solder splattering- Safety Glasses,
  Close Toed Shoes,
• Hot tip always returns to holder/cleaner
• PVC cutter; Cutting of fingers, flying debris eye injury- Safety Glasses, Close Toed Shoes
• Compressed Air /Pneumatics – MATE Fluid Pressure Quiz- must Pass.

ELECTRICAL SAFETY
HAZARD PROTOCOL
• ROV Operation / Electrical Shock Prevention
• Follow all checklists, keep extension cord dry.
• Troubleshooting ROV Control System/ shock - Power Off.
• ROV Electrical Design & Fabrication
• Electrical systems failure: Use fuse, diodes, comply with MATE regulations.
• No AC Current on ROV
• Non-ROV powered equipment limited to DC power with 3 amp fuse.
• OBS WP container built in such a way that it cannot hold pressure more than a few PSA
  above ambient in case of venting of gases. Two rubber stoppers at each end of a Lucite
  tube held only by friction applied by hand
• Marine approved waterproof power cables- power supply in water.
• Anderson Pole Connectors/ No Lithium Batteries on board
Operational and Safety Checklist

Vacuum Test Procedure

• Connect vacuum hand pump to ROV electronics housing
• Pump electronics housing to -35 kpa vacuum
• Verify electronics chamber holds -35 kpa vacuum for 5 minutes
• Remove vacuum pump and securely cap vacuum port

Pre-Power

• Area clear/safe (no tripping hazards, items in the way)
• Tether laid-out on deck
• Tether connected to Control Box and Secured
• Control Box/Composite Camera connected to Monitor
• Power source connected to Monitor
• Tether connected and secured to ROV
• Tether strain relief connected to ROV
• Electronics housing sealed
• Visual inspection of electronics for damaged wires, loose connection
• Penetrators tight on electronics housing
• Thrusters free from obstructions
• Check vacuum port is securely capped
• Deck crew check each other to make sure all wearing appropriate Personal Protection Equipment.

Power-Up

• Air Compressor connected/receiving 12 Volts nominal
• Control computers up and running
• Ensure deck crew members are attentive
• Call out, “powering on!”
• Power on: Top control box, Xbox, Monitors
• Call out, “performing thruster test”
• Verify video feeds, QGround Control
• ROV lights indicate “Safe Mode” (blue)
• Calibrate Sensors

Launch

• Call out, “prepare to launch”
• Deck crew members handling ROV call out “ready”
• Call “launch”
• Launch ROV, maintain hand hold
• Perform thruster test/verify thrusters are working properly (xBox movements correspond with thruster activity) Test Thrusters: Forward, Reverse, Left, Right, Up, Down
• Wait for release order

In Water

• Visually inspect for water leaks
• If there are large bubbles, pull to surface immediately
• Engage thrusters and begin operations
**ROV Retrieval**

- Pilot calls “ROV surfacing”
- Deck crew calls “ROV on surface”
- “ROV captured”, kill thrusters
- ROV lights indicate “Safe Mode” (green)
- Power Down
- Call out “safe to remove ROV”
- After securing the ROV on deck, deck crew calls out “ROV secured on deck”

**Leak Detection Protocol**

- Surface immediately
- Power down ROV
- Inspect (may require removal of electronics)

**Loss of Communication**

- Cycle power on TCU to reboot ROV
- If no communication, power down ROV, retrieve via tether
- If communication restored, confirm there are no leaks, resume operations

**Pit Maintenance**

- Verify thrusters are free of foreign objects and spin freely
- Visual inspection for any damage
- All cables are neatly secured
- Verify tether is free of kinks
- Visual inspection for leaks
- Washdown ROV