

# SCHOOL OF ENGINEERING GENERAL RISK ASSESSMENT

Department/Work Area Location:  
MATH: [ 151] Monadelphous EECE Lab

Responsible Work Area Manager/Supervisor:  
Stuart Mather / Jega Gurusamy

## Applicant(s) involved in completion of this Risk Assessment:

Name(s)	UWA ID #(s)	Project End Date (when access will end)

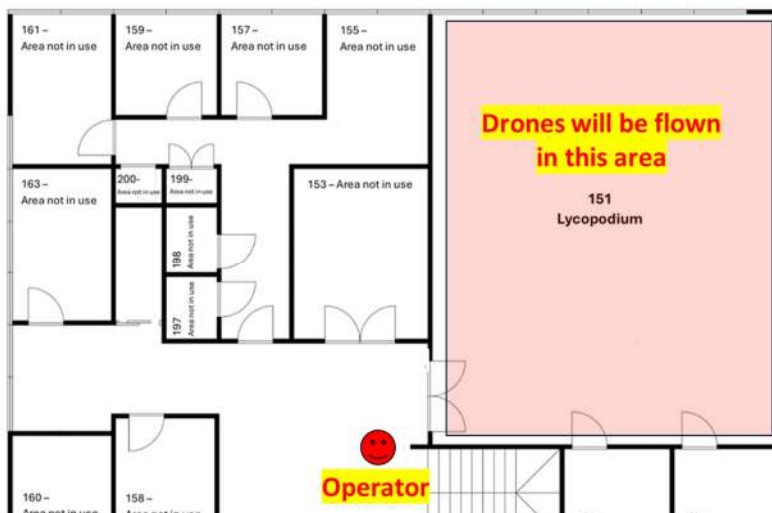
Description of Tasks/Activities being assessed (Provide as much detail as required)

### Purpose

The primary purpose of this room is to safely develop a fully functional autonomous indoor line-following drone based on a set of specifications.

### Tasks/Activities

- The mechanical assembly of the different drone parts will be conducted in the Lycopodium laboratory. Parts such as motors, propellers and the drone chassis will need to be fixed together using basic tools such as screwdrivers. The drone will be a small sized drone powered by battery less than 3S (max 6Wh) LiPo battery. The drones would generally weight about 100g (max 250g), limited by the size of the battery.
- All electrical testing will be conducted in the Lycopodium laboratory. Electrical connections between the on-board controller and interfacing components will require the use of a soldering iron with solder and flux. An air duster will be used to keep the electronic components free of dust.
- After prototyping the drone, the laboratory will be used for testing purposes. The students will first need to clear obstacles such as tables and chairs in the room as well as ensuring that all windows and doors are shut to comply with CASA's requirements to fly an indoor drone. The large screen TV will be covered with a cardboard to absorb the impact of the drone should there be any unwanted collision.
- Before the students tests their drone, it is a prerequisite to have a "kill switch" that immediately shuts the drone/lands the drone. The students will have to verify the functionality of the "Kill switch" without propellers every time before testing the line-following capability of the drone. The students also have the option to use a controller and land the drone manually if required. Once that functionality is verified, the drone will be placed on the floor right in front of the start line inside the lab.
- The operator will then leave the lab and observe the drone from outside the glass door of the lab. The picture below shows the isolated area where the drones will be flown. The operator observes the drones from outside this lab through the glass door and windows. The drone is totally isolated from any human at this point (physical barrier). This ensures that the students comply with the regular (CASA guidelines for outdoor drones) separation rules for drone activities. Once it receives a signal from the operator, it should take off and follow the line, stop and hover whenever required, and lands on the floor. All these operations are done based patterns on the floor.



### Hazardous Substances and Restricted Areas

The Lycopodium Room 15, located on Level 2 of the Monadelphous Integrated Learning Centre (Building 223), contains the following Hazardous Substances (HS) and Dangerous Goods (DG). The listed HS and DG are associated with specific tasks and activities as follows:

- Lead Solder
- Lead-free solder

- Isopropyl Alcohol Cleaner
- Self Mixing Epoxy
- HFC Free Flammable Air Duster 400ml
- Lithium-ion Polymer (LiPo) Battery

#### Safety Guidelines and Lab Usage Restrictions

The use of any other Hazardous Substances or Dangerous Goods during the design, construction and testing phase of the Indoor Line-Following Drone require separate risk assessments.

Due to the hazardous nature of the work, including the type of tasks performed, the materials used, and the associated health and safety risks, lab usage is restricted to weekdays from 8:00 AM to 5:00 PM, excluding weekends and public holidays. All student must work in pair with a member from the same group.

#### After-Hours Work Protocols

Individuals wishing to work outside of normal hours must submit a work plan that clearly outlines the proposed tasks and any limitations specific to working after hours, using the "Work After Hours" template.

### Determine Potential Risk Factors:

Tick ☒ the below boxes to signify identified risks

Ergonomic

Fatigue & Stress

Manual Handling

Personal

<p>Can anyone be injured due to:</p> <p><input type="checkbox"/> Seating design</p> <p><input type="checkbox"/> Excessive effort</p> <p><input type="checkbox"/> Repetitive body movement or posture</p> <p><input type="checkbox"/> Poor workplace or experimental design</p> <p><input type="checkbox"/> Controls layout and design</p> <p><input type="checkbox"/> Lack of consideration for human behaviour causing mental or physical stress</p> <p><input type="checkbox"/> Other:</p>	<p>Can anyone suffer ill health due to:</p> <p><input checked="" type="checkbox"/> Works being conducted over long duration or increased hours than normal work</p> <p><input type="checkbox"/> Other:</p>	<p>Are manual handling risks present or increased due to:</p> <p><input type="checkbox"/> Loading and unloading</p> <p><input type="checkbox"/> Work repetitive in nature</p> <p><input type="checkbox"/> Participants are not normally engaged in physical tasks</p> <p><input checked="" type="checkbox"/> Other: Use of mechanical tools</p>	<p>Are there personal factors for any member involved in the activities that may increase risk to themselves or others?</p> <p><input type="checkbox"/> Does any party involved have Medical condition?</p> <p><input type="checkbox"/> Low physical fitness relative to tasks to be undertaken</p> <p><input type="checkbox"/> Sensitivity or Susceptibility i.e. allergic reactions or increase due to medications being taken i.e. sensitive to sunlight</p> <p><input type="checkbox"/> Mobility that may affect helping themselves or others</p> <p><input type="checkbox"/> Other:</p>
<b>Slip, Trip, Fall Injuries</b>	<b>Crush Injuries</b>	<b>Temperature</b>	<b>Electrical</b>
<p>Is anyone at risk of slip, trip or fall due to:</p> <p><input type="checkbox"/> The working environment</p> <p><input type="checkbox"/> Uneven work surfaces</p> <p><input type="checkbox"/> Lack of guardrails</p> <p><input checked="" type="checkbox"/> Poor housekeeping</p> <p><input type="checkbox"/> Slippery work surfaces</p> <p><input type="checkbox"/> Unstable terrain</p> <p><input type="checkbox"/> Other:</p>	<p>Can anyone be crushed due to:</p> <p><input type="checkbox"/> Falling, uncontrolled or unexpected movement of equipment or</p> <p><input type="checkbox"/> Unexpected movement of object while loading unloading</p> <p><input checked="" type="checkbox"/> Other contact with moving objects</p> <p><input type="checkbox"/> Other:</p>	<p>Can anyone be exposed to:</p> <p><input type="checkbox"/> High ambient temperatures</p> <p><input type="checkbox"/> Low ambient temperatures</p> <p><input checked="" type="checkbox"/> Objects or sources at high temperatures</p> <p><input type="checkbox"/> Objects or sources at low temperatures</p> <p><input type="checkbox"/> Other:</p>	<p>Are electrical hazards present due to:</p> <p><input checked="" type="checkbox"/> Equipment with out-of-date testing and tagging</p> <p><input type="checkbox"/> Electronic equipment in proximity to liquid</p> <p><input type="checkbox"/> High or extreme voltage</p> <p><input type="checkbox"/> Other:</p> <p><i>All electrical equipment must be visually inspected prior to use</i></p>
<b>Entanglement, Dismemberment &amp; Degloving Injuries</b>	<b>Atmospheric &amp; Environmental Risks</b>	<b>Biohazard or Gene Technology</b>	<b>Dangerous Goods &amp; Hazardous Substances</b>
<p>Can the following items become entangled with moving parts of the plant, or materials in motion?</p> <p><input type="checkbox"/> Hair</p> <p><input checked="" type="checkbox"/> Jewelry</p> <p><input checked="" type="checkbox"/> Rags</p> <p><input checked="" type="checkbox"/> Gloves</p> <p><input checked="" type="checkbox"/> Clothing</p> <p><input type="checkbox"/> Discarded items</p> <p><input type="checkbox"/> Other:</p> <p>Is there potential for the following incidents to occur?</p> <p><input type="checkbox"/> Body or part of caught between two solid objects?</p> <p><input type="checkbox"/> Ropes or lines wrapping around limbs fingers etc.</p> <p><input type="checkbox"/> Other:</p>	<p>Can anyone be exposed to:</p> <p><input type="checkbox"/> Low oxygen</p> <p><input checked="" type="checkbox"/> Atmospheric contamination</p> <p><input checked="" type="checkbox"/> Dusts, Vibration &amp; Noise</p> <p><input type="checkbox"/> Other:</p>	<p>Do your activities involve the presence of:</p> <p><input type="checkbox"/> Biohazards</p> <p><input type="checkbox"/> Human or animal samples i.e. blood, faeces</p> <p><input type="checkbox"/> Other:</p> <p><i>If you have ticked any of the boxes above, please ensure that you have adhered to <a href="#">UWA gene Technology and biosafety requirements</a></i></p>	<p>Do your activities involve the use of:</p> <p><input checked="" type="checkbox"/> Dangerous Goods</p> <p><input checked="" type="checkbox"/> Hazardous Substances</p> <p><i>If so, complete the <a href="#">Dangerous Goods (DG) and Hazardous Substances (HS) Risk Assessment</a></i></p>
<b>Cut, Stab or Puncture Injuries</b>	<b>Radiation Risks</b>	<b>High Pressure Energy Risks</b>	<b>Other Risks</b>

<p>Can anyone be cut, stabbed or punctured by:</p> <p><input type="checkbox"/> Moving animals, equipment, samples</p> <p><input checked="" type="checkbox"/> Sharp or flying objects</p> <p><input checked="" type="checkbox"/> Work pieces ejected</p> <p><input type="checkbox"/> Other:</p>	<p>Can anyone be exposed to:</p> <p><input type="checkbox"/> Ionising raditation</p> <p><input type="checkbox"/> Lasers</p> <p><input type="checkbox"/> Ultraviolet light</p> <p><input type="checkbox"/> Microwaves</p> <p><input type="checkbox"/> Radio waves</p> <p><input type="checkbox"/> Magnetic resonance</p> <p><input type="checkbox"/> Other:</p>	<p>Do your activities involve the presence of:</p> <p><input type="checkbox"/> High pressure fluids</p> <p><input type="checkbox"/> High pressure gases</p>	<p>Is there a risk of:</p> <p><input checked="" type="checkbox"/> Non-inducted or untrained personnel gaining access to the lab</p> <p><input type="checkbox"/> Communication issues due to insufficient communication equipment provided. E.g. poor reception, lack of lab phone</p> <p><input type="checkbox"/> Unauthorized after-hours access or working alone</p> <p><input type="checkbox"/> Other:</p>
--	--	---	---

## General Lab Safety Risk Control Measures and Actions

Where risks or hazards are identified above complete the following listing all controls that will be undertaken to reduce the risk rating:

**Assessment Matrix and Hierarchy of Controls** document to determine risk ratings and the most appropriate controls

Add additional pages if required.

Hazard/Risk Identified above	General Description of Hazard/Risk	Risk Rating Before Controls			Controls Implemented More than one control may be required to effectively mitigate an identified hazard	Risk Rating After Controls		
		Likelihood	Consequence	Risk Rating		Likelihood	Consequence	Risk Rating
Works being conducted over long duration or increased hours than normal work	Extended working hours or increased workload leading to fatigue and stress	Almost Certain	Minor	Moderate (Mo1)	<b>Administrative Control</b> – Ensure optimal fatigue management by requiring task breaks every two hours.	Possible	Minor	Minor (Mi3)
Slip, trip or fall due to poor housekeeping	Poor housekeeping, such as cluttered walkways increases the risk of slips and trips.	Possible	Moderate	Moderate (Mo2)	<b>Administrative</b> – Ensure all walkways are clear at all times by removing the hazard entirely	Unlikely	Moderate	Minor (Mi6)
Objects or sources at high temperatures	The motors attached to the drones can heat up during the testing phase. Soldering iron are heated up to 360C.	Possible	Moderate	Moderate (Mo2)	<b>Administrative</b> – Check that all soldering stations are deenergised after use to ensure minimal risk of accidental contact. Only competent users are allowed to use the soldering station (Maker's training) Ensure the motor has cooled down before handling it.  <b>PPE</b> – Use safety glasses and gloves when soldering	Unlikely	Moderate	Minor (Mi6)
Electrical hazard due to equipment with out-of-date testing and tagging	Equipment with out-of-date testing and tagging, increasing the risk of electrical shock or fire.	Possible	Major	Major (Ma2)	<b>Elimination</b> – Remove all out-of-date electrical equipment from the premises until appropriately tested and tagged again	Unlikely	Major	Moderate (Mo5)
Electrical hazard with electronic equipment in proximity to liquid	Electronic equipment in proximity to liquids, posing a risk of electrical shock or short circuits.	Possible	Major	Major (Ma2)	<b>Administrative</b> – Leave drinks close to the entrance of the lab and away from any electrical equipment. At no point users of the lab are allowed to bring drinks past the entrance.	Unlikely	Major	Moderate (Mo5)
Entanglement, dismemberment & degloving injuries due to jewelry, gloves, rags, clothing & hair	Risk of entanglement with moving motors or propellers	Possible	Moderate	Moderate (Mo2)	<b>Elimination</b> – Remove all loose jewelry when performing mechanical construction of the drone.  <b>Engineering</b> – Ensure the emergency stop (E-Stop) button is working before testing the drone. Use the E-Stop button in case of any emergencies.  <b>Administrative</b> – Conduct the line following drone experiments from outside the test area (Lycopodium Lab) and observe from behind the glass doors. Only return to the lab once the motor is turned off. Tie up your hair if you have long hair.	Unlikely	Moderate	Minor (Mi6)

Atmospheric contamination	Risk of motor insulation degradation during testing ("rubber smell")	Possible	Moderate	Moderate (Mo2)	<p><b>Engineering Controls</b> – HVAC systems within the Lycopodium in place to keep fresh air circulating.</p> <p><b>Engineering</b> – Ensure the emergency stop (E-Stop) button is working before testing the drone. Use the E-Stop button in case of any emergencies.</p> <p><b>Administrative Controls</b> – Ensure the operator understands the limitation of the motor when testing them.</p>	Unlikely	Moderate	Minor (Mi6)
Dusts, vibration and noise	The noise from the motor	Likely	Minor	Minor (Mi4)	<p><b>Administrative Control</b> – Conduct the line following drone experiments from outside the test area (the lab itself) and observe from behind the glass doors. Only return to the lab once the motor is turned off.</p>	Possible	Minor	Minor (Mi3)
Sharp or flying objects	Cut, stab or puncture injuries from collision with drone that is in motion or while using sharp objects such as knife, tweezers etc.	Possible	Moderate	Moderate (Mo2)	<p><b>PPE</b> – When testing the motors of the drone within the Lycopodium, provide all members in the vicinity with safety goggles.</p> <p><b>Engineering</b> – Ensure the emergency stop (E-Stop) button is working before testing the drone. Use the E-Stop button in case of any emergencies. The large TV screen will be covered with a cardboard to absorb impact of any drone crash.</p> <p><b>Administrative Controls</b> – Members using sharp hand tools need to be aware of safe handling methods. Conduct the line following drone experiments from outside the test area (the Lycopodium lab) and observe from behind the glass doors. Only return to the lab once the motor is turned off.</p>	Unlikely	Moderate	Minor (Mi6)
Work pieces ejected	Work pieces ejected if the drone crashes inadvertently	Possible	Moderate	Moderate (Mo2)	<p><b>PPE</b> –Safety goggles to be used during any testing done within the laboratory.</p> <p><b>Engineering</b> – Ensure the emergency stop (E-Stop) button is working before testing the drone. Use the E-Stop button in case of any emergencies. The large TV screen will be covered with a cardboard to absorb impact of any drone crash.</p> <p><b>Administrative Controls</b> – Conduct the line following drone experiments from outside the</p>	Unlikely	Moderate	Minor (Mi6)


					test area (the Lycopodium lab) and observe from behind the glass doors. Only return to the lab once the motor is turned off.			
Non-inducted or untrained personnel gaining access to the lab	Non-inducted or untrained personnel gaining access to the lab, increasing the risk of accidents and injuries.	Likely	Moderate	Moderate (Mo3)	<b>Engineering Controls</b> – Lycopodium RFID scanner denies all members who have not completed induction. <b>Administrative Controls</b> – All inducted members to the lycopodium are advised they are responsible for ensuring that doors are not left open so non-inducted members cannot enter.	Possible	Moderate	Moderate (Mo2)

## INDUCTEES DECLARATION


I will comply with UWA's Safety and Health Policy and associated procedures and guidelines. I acknowledge receipt of this induction and have received the necessary information, instruction and training required to enable me to work safely.

[illegible]


**PROJECT SUPERVISOR DECLARATION (if applicable)**

Name: Jega Gurusamy	Signature: 	Date: Click or tap to enter a date. 29/08/24
------------------------	---	---

### LAB SUPERVISOR DECLARATION

Name:	Stuart Mather	Signature:		Date:	Click or tap to enter a date. 29/08/24
-------	---------------	------------	---	-------	---

**HEAD OF SCHOOL AUTHORISATION**

Name: Tim Sercombe	Signature: 	Date: Click or tap to enter a date. 05/09/2024
-----------------------	---	---

Email completed and signed form to School Operations Engineering [schoolops-eng@uwa.edu.au](mailto:schoolops-eng@uwa.edu.au)