

# SAFE OPERATING PROCEDURE (SOP)

## AUTONOMOUS QUAD BIKE

<b>LOCATION</b>	Off Campus and Thebarton Labs	<b>DATE</b>	23/09/2016
<b>TASK</b>	Testing of all quad bike subsystems while sensor payload (metal detector and ground penetrating radar) is mounted, engine in running and vehicle is operating autonomously in a large open area (restricted to outdoor operations).		
<b>PEOPLE INVOLVED IN PREPARING SOP</b>	Rahul Kalampattel		
<b>PERSON AUTHORISING SOP</b>	<b>NAME</b>	Maziar Arjomandi	<b>SIGNATURE</b>
	<b>POSITION</b>	Project Supervisor	
<b>SCHOOL SAFETY OFFICER</b>	<b>NAME</b>	Richard Pateman	<b>SIGNATURE</b>
	<b>POSITION</b>	SSO – Mech Eng	
<b>LABORATORY MANAGER</b>	<b>NAME</b>	Marc Simpson	<b>SIGNATURE</b>
	<b>POSITION</b>	Thebarton Labs	



<b>RISK ASSESSMENT NAME / ID:</b>	2099: Autonomous Quad Bike TASK (Assessment Record Number 3227)		
<b>Date:</b>	23/09/2016	<b>Risk Rating:</b>	<input type="checkbox"/> Low <input checked="" type="checkbox"/> Medium <input type="checkbox"/> High <input type="checkbox"/> V/High
<b>HAZARDS IDENTIFIED</b>	Caught between moving machinery (Low) Caught on rotating parts (Low) Contact with chemicals, fumes or gas (Low) Contact with electricity or potential for electric shock (Medium) Contact with hot object or friction burn (Medium) Entangled on moving machinery (Low) Exposure to noise (Low) Exposure to non-ionising radiation (Low) Struck by vehicle (Medium)		
<b>COMPETENCIES REQUIRED</b>	Completion of UofA Health and Safety for students induction Completion of School of Mechanical Engineering HSW induction Completion of Thebarton Laboratory site-specific induction (if appropriate) Completion of Field Trip & Excursions Acknowledgement form (if appropriate) Signed-off induction into the use of this plant (sign-off register on page 3)		

### SAFE OPERATING PROCEDURE DETAILS

## Preliminary Information

- ☐ This SOP covers testing of the quad bike with all subsystems integrated and the sensor payload (metal detector and ground penetrating radar) mounted.
- ☐ The engine may be running while the quad bike is on the ground, and the vehicle may be operated autonomously.
- ☐ The testing area must be clearly marked and cordoned off, sufficiently large and free of obstructions (outdoor operation only).
- ☐ All operators must sign-off that they have read this SOP and been inducted to the use of this plant on the attached register.
- ☐ If appropriate, the Field Trip & Excursions Acknowledgement form must be completed and signed prior to commencement.

## Pre-operational Checks

### Work Area Inspection

- ☐ Work area is sufficiently large, with an unobstructed length 10 times the size of the quad bike in the direction of travel (30 metres), and 5 times the size of the quad bike on either side (15 metres).
- ☐ Area is free from slip and/or trip hazards such as grease, oil, debris and objects. Use diatomaceous earth ("kitty litter") or absorption pillow to soak up grease, coolant, oil and other fluids.
- ☐ Area is clearly marked, cordoned off and cleared of unauthorised people before commencing work.
- ☐ Be aware of other activities happening in the immediate area.

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### Personal Attire & Safety Equipment (PPE)

- ☐ **Required:** Closed toe shoes, safety glasses, hearing protection (as appropriate).



- ☐ Approved closed toe shoes to be worn at all times.
- ☐ Approved safety glasses to be worn at all times.
- ☐ Approved hearing protection to be worn at all times if noise levels are measured to be above an 85dB(A) 8 hour equivalent and 140dB(C) peak (measure using noise indicator in the labs, red flashing light means hearing protection is required).
- ☐ Authorised people present are to be issued appropriate safety equipment and are to be trained in how to correctly use it, prior to the commencement of any work.
- ☐ Clothing must be tight fitting.
- ☐ Long hair must be confined close to the head by an appropriate restraint.
- ☐ Finger rings and exposed loose jewellery (e.g. bracelets and necklaces) must not be worn. Medic Alert bracelet must be taped if exposed.
- ☐ Pockets and clothing must not contain any loose articles, which may fall out.

### Plant and Work

- ☐ Complete visual inspection of metal detector panel to verify that there is no damage to the cables, control box or detector panel. Any unsafe equipment is to be reported to authorised staff.
- ☐ Complete visual inspection of the ground penetrating radar (GPR) to verify that all parts are present in the container, and that there is no damage to any cables, batteries, the control unit or the antenna heads. Any unsafe equipment is to be reported to authorised staff.
- ☐ Notify bystanders if the operation of the GPR is likely to affect their activities (e.g. mobile phone users).
- ☐ Attach the sensor mount to the quad bike, then attach the metal detector and GPR to the sensor mount.
- ☐ Connect the metal detector panel and control box to the power supply, ensuring all knobs are at the minimum position.
- ☐ Switch the power supply on and set the voltage to 12 V and the current to 0.5 A.
- ☐ Place batteries in the control unit and then connect and switch on the GPR.
- ☐ Complete visual inspection of quad bike to verify that it is in good operational order, ensuring there is no damage to any stationary or moving parts, electrical cords etc. Any unsafe equipment is to be reported to an authorised staff member and tagged out.
- ☐ All loose or removable components on quad bike must be adequately secured.
- ☐ Be aware of other activities happening in the immediate area, and notify other lab users if the operation of the quad bike is likely to affect their activities.
- ☐ Ensure that no slip and/or trip hazards are present (e.g. spills on the ground, unused cables).
- ☐ Locate and be familiar with the operation of the starting, operational and emergency stop controls.
- ☐ Wear appropriate PPE for task being performed (as specified above).

Continued on next page

Safe Operating Procedure		School of Mechanical Engineering	Effective Date:	23 September, 2016	Version 1.0
Prepared by	Rahul Kalampattel		Review Date:	23 September, 2018	Page 2 of 4

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## Operation

- ☐ Ensure quad bike is in a level, open area with no obstructions and sufficient room to manoeuvre.
- ☐ Carry out Pre-operational Checks (as specified above).
- ☐ If the area is not adequately ventilated, obtain suitable PPE.
- ☐ Ensure that there are no people inside the cordoned off area, except for individuals involved in starting the quad bike.
- ☐ Clearly notify bystanders that the vehicle will be started shortly.
  
- ☐ Start the tablet application and establish a communications link with the Arduino on the quad bike.
- ☐ Make sure that the brakes are applied, the throttle is at a minimum, the gear is in neutral and the steering is centred.
- ☐ Put the key in the ignition and make sure the quad bike emergency stop (on the control panel) and the remote emergency stop (on the tablet app) are deactivated.
- ☐ Open the fuel line and the choke valve, then start the quad bike using the switch on the control panel.
- ☐ After the engine has warmed slightly, close the choke valve.
- ☐ Test the emergency stop on the control panel and on the tablet app to ensure both are operational.
- ☐ Exit the cordoned area, and proceed with tests.
- ☐ Ensure that no-one enters the area for the duration of testing.
- ☐ If the quad bike is too close to the edge of the testing area, stop immediately.
- ☐ NEVER LEAVE QUAD BIKE RUNNING WHILST UNATTENDED.
- ☐ When testing is complete, stop the quad bike with the tablet, the switch the quad bike off at the control panel, close the fuel line and take out the key.

## Emergency Shutoff Procedures

- ☐ **Emergency Shutoff (1):** Send a stop signal to the Arduino through the tablet application.
- ☐ **Emergency Shutoff (2):** Flip the emergency stop switch on the quad bike control panel.
- ☐ **Emergency Shutoff (3):** Remove the key from the ignition.

## On completion of work

- ☐ Allow 5 minutes before touching any parts of the vehicle that may have heated during operation, or wear gloves.
- ☐ Turn off the power supply and disconnect the metal detector panel and control box.
- ☐ Turn off the control unit and take out batteries, disconnect the GPR and ensure all parts of the GPR system are returned to the container.
- ☐ Remove the sensor mount from the quad bike.

Continued on next page

Safe Operating Procedure		School of Mechanical Engineering	Effective Date:	23 September, 2016	Version 1.0
Prepared by	Rahul Kalampattel		Review Date:	23 September, 2018	Page 3 of 4

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Safe Operating Procedure		School of Mechanical Engineering	Effective Date:	23 September, 2016	Version 1.0
Prepared by	Rahul Kalampattel		Review Date:	23 September, 2018	Page 4 of 4
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