Mechatronics Lab Safety Report

Testing of Electronic Components and assembly of a Tip-Thrust Rotary Aircraft

Date:	08/07/2024
Student & SU nr:	Rayde Krüger 24723061
Student contact nr:	063 694 9735
Supervisor:	Dr Andrew Gill
Lab engineer:	Mr Kevin Neaves
Head of safety:	Mr Cobus Zietsman

Emergency Contacts:

Contact:	Room nr.	Work nr.	Cell nr.
Mr K. Neaves	3001	-	021 808 4279
Mr C. Zietsman	M212	021 808 4275	-
Campus Security	-	021 808 2333	WhatsApp: 082 808 233
Fire Brigade	-	021 808 8888	-
Ambulance	-	021 883 3444	-

Signatures:

Student:
(Rayde Krüger) _____

Supervisor:
(Dr A. Gill) _____

Lab Engineer:
(Mr K. Neaves) _____

Head of Safety:
(C Zietsman) _____

Pressure vessels or pipes (check relevant box):

☒ No pressure vessels or pipes with pressure in excess of 50kPa are involved in this project.

☐ Pressure vessels or pipes in excess of 50kPa are involved – additional signature and report required (refer to Safety Report Guidelines on SUNLearn).

Hot work / working at heights / confined entry / excavation (check relevant box):

☒ No hot work / working heights / confined entry / excavation work involved in this project.

☐ Hot work / working heights / confined entry / excavation work (underline relevant work type(s)) involved in this project – additional signature and report required (refer to Safety Report Guidelines on SUNLearn).

Overview of Testing

Type of test and standard (if applicable):

Test type	Testing electronic components and assembly of tip-thrust rotary aircraft
Standard(s)	IEC 60950-1 / IEC 62368-1:

Equipment to be used:

Equipment type	Make & model	Measurement range (if applicable)	Resolution (if applicable)
Power supply	-	-	-
Oscilloscope	-	-	-
Soldering Iron	-	-	-

Detailed Experimental Procedure

The purpose of this section is to clearly communicate the purpose of equipment use and list the steps necessary to prepare the equipment for testing. This report will describe the testing of the electronic components as well as the assembly of the tip-thrust rotary aircraft and the risks associated with them. The purpose of the testing will be to determine the behaviour of the electronics and to test the microcontroller's programming to control these components. The tip-thrust aircraft will be assembled in the Mechatronics lab, but not tested and no propellers will be connected to the brushless motors during testing.

Electronics testing setup:

- Read through the electronic components datasheet and take note of the components' operating voltages
- Identify the emergency stop button (Power supply off switch)
- Ensure all wire connections are securely connected and no cables or components appear damaged.
- Label all wires to prevent incorrect connections
- Verify the power supply and the oscilloscope are functioning correctly

Testing procedure for electronics:

- Connect the electronic component being tested according to the wiring diagram
- Switch on the power supply and check the output voltage.
- Test the output signal from the microcontroller and the output of the electronic component being tested on the oscilloscope
- Run the microcontroller's program to be tested and observe how the components
- Change the program as needed and repeat

Assembly procedure for Tip-thrust Rotary Aircraft:

- Ensure all parts to be assembled are undamaged and function as intended.
- Assemble the parts as described by the CAD model.
- Install electronic components according to the design specifications
- Ensure all wiring is connected correctly and secured to prevent movement of the wiring.

Shut down procedure:

- Stop the software of the microcontroller and ensure all components are in a state to power down
- Turn off the power supply and oscilloscope
- Disassemble components to fit into storage
- Safely store components
- Clean up workstation

Warning Symbols

(a) Electrical hazard

(b) General Warning

Figure 1: Applicable warning/hazard symbols

General Laboratory Safety

The following general laboratory safety instructions are applicable:

- No afterhours testing may be performed without the necessary permissions[1].
- Full supervised training is required before testing may be undertaken. Permission to proceed with unsupervised testing should be signed off by the lab engineer.
- Closed shoes must be worn at all times.
- Emergency equipment must be located and easily accessible.
- Students may not work alone in the laboratory.
- Emergency exits must be known. The nearest exits applicable to the setup are provided in Appendix A of this document
- Loose clothing may not be worn. Loose hair must be tied up.
- Good housekeeping practices should be maintained during testing. The lab should be completely clean, including all equipment stored away, after testing. Refer to the General Housekeeping section for particulars regarding practices to be followed for this specific setup.
- No food or drink is permitted in the laboratory.

[1] Written permission from supervisor and approved by the chief safety officer. Attach proof of this permission to this document and note here the times and conditions of the arrangement.

- Safety report must be visible and accessible during testing.
- No equipment or test may be left unattended.

Anticipated Interactions with other Laboratory Users

If possible, the student's experimental setup will remain within the workspace with a space in between the nearest experiment.

General Housekeeping

- Keep workspace tidy while working
- Switch off power supplies after use
- Disassemble the rotor and place it in its storage
- Clean working surface, remove any debris and off cuttings
- Return all equipment to their storage
- Ensure the workstation is clear and clean
- Ensure no personal items are left behind

Fire Safety

The DC motors could potentially overheat. This can be avoided by ensuring the motors operate below the maximum operating voltage, ensuring that they do not overheat. Parts of the circuit could short and cause a fire. This hazard can be mitigated by using properly insulated wires and labelling the wires, so wires aren't incorrectly connected and by having neat solders. In case of a fire, the evacuation plan can be seen in Appendix A. No earphones should be worn while working so fire alarms can be heard.

Activity Based Risk Assessment

Activity	Risk	Risk Type* (P/E)	Mitigating Steps	Classification of Risk Severity
GENERAL				
Moving around the lab	Tripping or knocking over equipment	P	Be aware of the surrounding equipment and environment when walking in the lab	Acceptable risk
Power outages	Data loss and damage to equipment	E	Check the loadshedding schedule beforehand	Possible risk
Personal items	Theft of items	P	Don't leave personal items unattended	Acceptable risk
ASSEMBLY PHASE				
Soldering components	Burns from equipment and solder	P	Handle the equipment carefully	Acceptable risk
	Damage components	E	Ensure the soldering iron is not placed where it	Acceptable risk

			could damage the component	
Installing electrical components	Electric shocks	P	Ensure the power is off when working with the components	Acceptable risk
	Shorting electrical components	E	Ensure all components are connected correctly before powering them	Acceptable risk
	Incorrect connections	E	Ensure components are connected according to the wiring diagram	Acceptable risk
Using hand tools	Injuries due to slippage	P	Ensure if a tool slips, no injuries can occur	Acceptable risk
Installing motors	Dropping motors	E	Handle motors with care	Acceptable risk
Assembling rotor	Pinching fingers	P	Ensure fingers are not caught in between components while assembling	Acceptable risk
	Cuts from burrs	P	Clean the edges of cut components	Acceptable risk
TESTING PHASE				
Testing motor	Motors overheat	E	Ensure the motors operate within the rated values	Acceptable risk
	Burns occur from motor overheating	P	Ensure the motors operate within the rated values	Acceptable risk
Testing software	Code not working as intended	P/E	Ensure the code is fully understood before it is uploaded	Acceptable risk
Backing up data	Data loss	E	Use a USB/ hard drive which is frequently updated.	Acceptable risk

*P – personal, E - equipment

Disciplinary Actions

Failure to comply with any of the aforementioned safety regulations or procedures will result in disciplinary action. Students will be issued an initial warning: after three warnings, the lab access is revoked for a month.

Appendix A: Emergency Evacuation Plans

EMERGENCY EVACUATION PLAN

MECHANICAL & MECHATRONIC BUILDING

ESCAPE PLAN - LEVEL 3

Emergency Assembly Point at the corner of Banghoek Rd and Boonzaier St on the lawn of Process Engineering

Emergency Assembly Point on the lawn in front of General Engineering

LEGEND

IN CASE OF FIRE DO NOT USE THE ELEVATOR · EMERGENCY KEY BOX · FIRE ALARM · FIRE TELEPHONE · FIRE HOSE · FIRE HYDRANT · FIRE EXTINGUISHER · FIRE BLANKET · FIRST-AID EQUIPMENT · SAFETY SHOWER · DISTRIBUTION BOARD · EXIT · EXIT · GENERAL DIRECTION

EVACUATION INSTRUCTIONS

- The automated alarm system or staff will announce the evacuation.
- Follow the instructions and evacuate immediately to safe assembly points.
- When a venue is completely evacuated, close all doors and place markers on the outside door handles to indicate the evacuation is complete.
- Assist disabled individuals as well as visitors to safe assembly points.
- Any missing individuals must be reported immediately to the Evacuation Marshal on duty.

ONTRUIMING INSTRUKSIES

- Die geoutomatiseerde alarm stelsel of personeel sal die ontruiming aankondig.
- Volg die instruksies en ontruim doeltreffend na die veilige versamelpunte.
- Wanneer 'n lokaal ontruim is, maak alle deure toe en plaas merkers op buitenste deurhandvatsels om aan te dui die ontruiming is afgehandel.
- Verleen hulp aan gestremde individue asook besoekers na die veilige versamelpunte.
- Enige vermiste individue moet dadelik aan die Ontruimingsbeampte op diens gerapporteer word.

MEDICAL EMERGENCIES

- Campus Health Services (CHS): 076 431 0305 (all hours) for CHS ambulance services during office hours and stand- by doctor after hours.
  If the person involved in the medical emergency has medical aid, also contact ER24 ambulance: 084 124

MEDIESE NOODGEVALLE

- Kampusgesondheidsdiens (KGD): 076 431 0305 (alle ure) vir KGD se ambulansdiens gedurende kantoorure en na-ure 'n bystanddokter.
  Indien die persoon betrokke mediese fonds dekking het, kontak ER24 ambulans: 084124

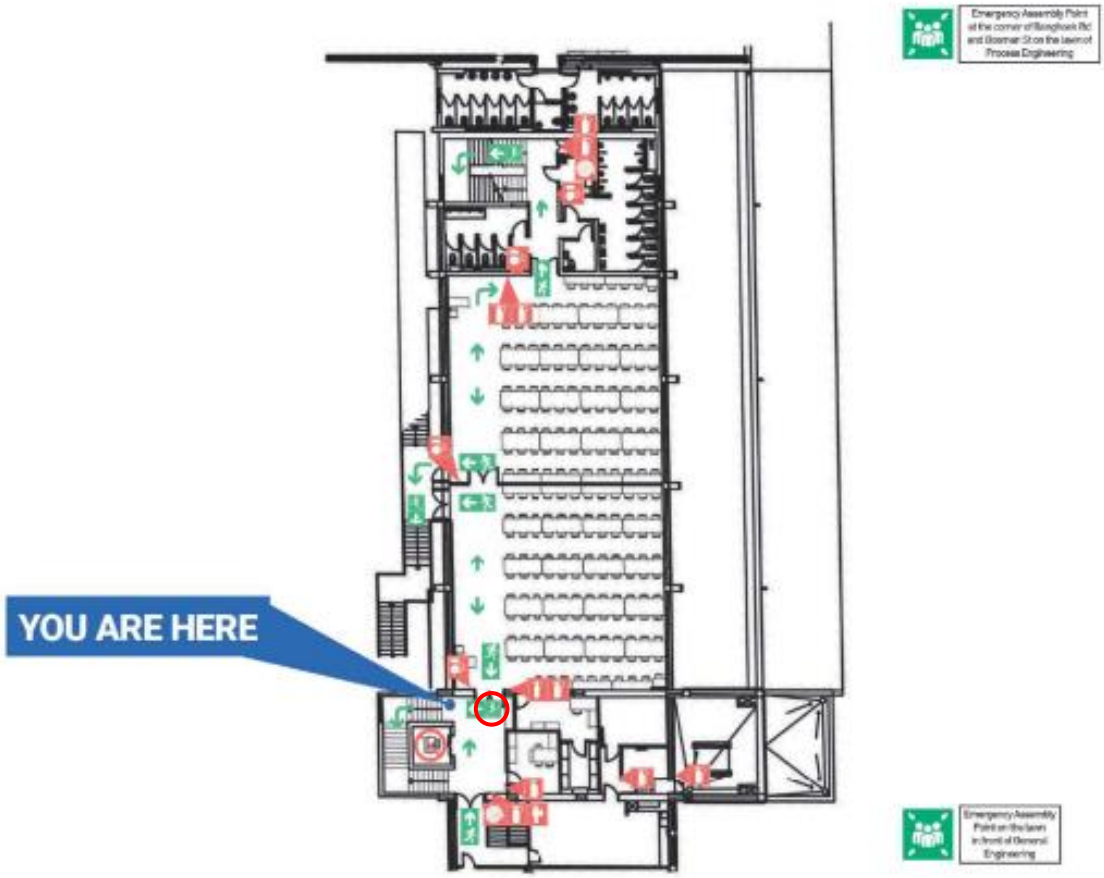
EMERGENCY NUMBERS

CAMPUS SECURITY (USBD)	021 808 2333
CAMPUS HEALTH SERVICES (CHS)	021 808 3496
Police Flying Squad	021 937 0500/10111
Ambulance	999/10177
Stellenbosch Medi-Clinic	021 861 2095/021 886 9999
Stellenbosch Hospital	021 808 6108/021 808 6147
Stellenbosch Fire and Rescue	021 808 8888
24-Hour Rape Crisis Stellenbosch	082 977 8581
24-Hour Psychology Crisis Service	082 557 8880

EMERGENCY EVACUATION PLAN

MECHANICAL & MECHATRONIC BUILDING

ESCAPE PLAN - LEVEL 2



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ESCAPE PLAN - LEVEL 1

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