Imperial College London

GENERAL RISK ASSESSMENT

SUBJECT OR ACTIVITY:- Group 17: Design Manufacture Test Project

1. PERSONS CARRYING OUT, APPROVING AND CHECKING THIS ASSESSMENT. (MUST HAVE SUCCESSFULLY COMPLETED RAFT OR OTHER APPROVED TRAINING)							
Assessor	Group 17 (Johnny Chan, Alix Maillard, Nadir Hamidi, Ashley Tan, Summer Shao, Enoch Wong	**Position**	Student	**Date**	02/06/2023	**Confirm Training in Risk Assessment**	**Yes** ☒
Approved by	Dr Lubbock	**Position**	Professor	**Date**	02/06/2023	**Confirm Training in Risk Assessment**	**Yes** ☒
Checked by	Normally the safety officer or lab manager	**Position**	Safety Officer	**Date**	02/06/2023	**Confirm Training in Risk Assessment**	**Yes** ☒

2. DETAILED DESCRIPTION OF THE STEPS INVOLVED IN THE ACTIVITY (include storage, transport and disposal if relevant, and how often it is carried out)

We are a team of students undertaking the Design Manufacture Test Project. The initial design process consists of group work and collaboration in the form of discussion and individual work. This involves no risk as this is laptop based work. Following the design process, the implementation of the final design will conist of 3D printing, refining the rough surface by using sandpaper and adding a surface finish with Oracover. The 3D printed structure will be separated from its support. The final stages will include wind tunnel testing and the Company Technical Meeting. Storage of the design throughout the manufacturing process will be within our own lockers. Transport will be limited as all manufacturing will be done within the same building as the storing place (i.e. the lockers). Transport between lockers and workshop is likely to happen up to twice a day, assuming maximum manufacturing time which would be daily – though this may not be the case. Disposal will consist of the excess 3D printed material that comes for the base when 3D printing. This will be disposed of in the required bins in the workshop.

3. LOCATION					
Site	SK	**Building**	CAGB	**Room**	223

4. HAZARDS – WHAT ARE THEY, WHO IS AFFECTED, HOW ARE THEY CONTROLLED?

NOTES – PLEASE READ CAREFULLY!

List **all** the hazards associated with the work, decide who could be affected, give details of what could happen without any controls, and estimate the "raw" risk.

Then write down the control measures that are already in place to prevent any harm occurring, and estimate the "residual" risk using the matrix guide (Appendix1)

If the residual risk is not reduced to "LOW" (less than 4) then additional controls must be considered; however, aim to get the lowest risk score that is reasonably practicable.

HAZARD TYPE	**WHO DOES THE HAZARD AFFECT?**	**WHAT INCIDENT OR HARM COULD BE CAUSED WITHOUT ANY CONTROL MEASURES?**	**RAW RISK with no control measures. In your estimation, is it:- LOW, MEDIUM or HIGH?**	**EXISTING CONTROL MEASURES (E.g. PHYSICAL THINGS LIKE MACHINE INTERLOCKS; PROCEDURAL THINGS LIKE OPERATING PROCEDURES; TRAINING)**	**RESIDUAL RISK with existing controls (See appendix 1)**		
					Severity	**P**robability	Risk (**S** x **P**)
Breathing in harmful materials when 3D printing from particulate or chemical emissions (https://dt.cleapss.org.uk/resource-file/3d-printing-in-schools-and-colleges-managing-the-risks.pdf)	Students, technicians, anyone in the workshop or near the 3D printer.	Skin contact with released harmful chemicals / particulates / chemicals could cause irritation.	LOW	Boiler suits Lab goggles Wear surgical mask Plastic gloves if need be	1	1	1
Moving parts (e.g. Cooling fan and printing nozzle) of 3D printer	Students, technicians, anyone near the 3D printer	Hand injury/Hand getting stuck/Hair being torn off	MEDIUM	Tie back long hair and don't wear any loose clothing Not opening the doors (if applicable) of the 3D printer to access any interor parts of the printer during printing process. Boiler suits worn. 3D printer training and induction.	1	1	1

Heat elements of 3D printer (eg. Printing nozzle (around 200-300˚C) and heated print bed(around 50-100˚C)) (https://dt.cleapss.org.uk/resource-file/3d-printing-in-schools-and-colleges-managing-the-risks.pdf)	Students, technicians, anyone near the 3D printer	Burnt hands	HIGH	Not opening the doors (if applicable) of the 3D printer to access any interior parts of the printer during printing process. Wear heat proof gloves. Remove the printed part only when the printer is fully cooled down. 3D printer training and induction.	1	1	1
Heat gun (up to 650˚C) https://uk.rs-online.com/web/content/discovery/ideas-and-advice/heat-guns-guide#	Students, technicians, anyone near the 3D printer	Burnt hands and hair	HIGH	Wear safety goggles and heat-resistant gloves when using a heat gun, as well as a respirator mask if working in a restricted area. Keep a fire extinguisher on hand in case of any problems. Tie back long hair and don't wear any loose clothing Inform everyone nearby the use of the heat gun. Good ventilation in the area where the heat gun is being used. Fully cool down the heat gun before storing. Don't block the air inlet grills on the heat gun when it's being used. Heat gun training and induction.	1	1	1
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5. WHAT ADDITIONAL CONTROL MEASURES ARE NEEDED?	**If none, please tick box ☐ and move on to next section**		
Please describe:-	**Responsible Person(s)?**	**By what date?**	**Completed? (Date)**
The room should be well ventilated so that the 3D Printing machine does not over-heat and dust does not accumulate on the 3D printer which would possibly reduce it's efficiency.	Students and 3D Printing room supervisor.	05/06/2023	05/06/2023
Volatile Organic Compounds or VOCs can be released from the process of 3D printing. These are harmful therefore in addition to the room being well ventilated to ensure that these compounds do not build up, if possible precautionary masks should be worn near the 3D printer.	Students and 3D Printing room supervisor.	05/06/23	05/06/23
All workspaces near the 3D printer must be cleaned via a wet method. Sweeping and other dry methods can create airborne particles which is not ideal for the 3D printer.	Students and 3D Printing room supervisor.	05/06/23	05/06/23
The printer nozzle must be cleaned before and after each use, to ensure that it is free of materials like dust and lint.	Students and 3D Printing room supervisor.	05/06/23	05/06/23
The 3D Printer should be placed on a stable and non slippery surface during it's operation. This would ensure that the mechanism of the 3D printer is stable which would reduce the risk of the object being printed being damaged/distorted.	Students and 3D Printing room supervisor.	05/06/23	05/06/23

The 3D printer should be placed away from any flammable material such as curtains, rugs, wood cabinets, couches, flammable liquids, batteries or pressurized canisters.	Students and 3D Printing room supervisor.	05/06/23	05/06/23

6. LONE WORKING (This can increase the risk from other hazards, and must always be considered.)

NOTE – READ CAREFULLY! USE THESE LINKS FOR THE COLLEGE GUIDANCE, THE COLLEGE CODE OF PRACTICE AND THE LONE WORKING CONSENT FORM

Lone working is not a hazard in itself, but will increase the risk of harm occurring from other hazards.

Record *why* Lone working will or won't take place, state *who* will be lone working and *what* controls and permissions are in place.

WHY WILL (OR WON'T) IT TAKE PLACE?	WHO MIGHT BE WORKING ALONE?	WHAT ARE THE CONTROLS / PERMISSIONS?
We have not planned for any lone working to take place. Manufacturing will take place in minimum pairs, or 3s. Due to the limits in the workshop we can only work with 3 people maximum at a time. We wish to collaborate through all stages of the process of the project so we will be at least 2 when manufacturing in order to be able to discuss any decisions that need to be made.	Not applicable as no lone manufacuturing is set to take place.	Not applicable as no lone manufacturing is set to take place.

7. EMERGENCY ACTIONS

INCLUDE:-

- Dangerous failure of equipment or experiment;
- Evacuation procedures if the (Fire) Alarm sounds (Evacuation route and muster point);
- How to raise the alarm;
- What to do and who to call in the event of an Injury or accident.

If equipment or an experiment were to fail in a dangerous manner, the lab technicians would immediately be consulted for guidance. The adequate steps from the induction would be taken. If the fire alarm goes off we would stop working and evacuate the workshop, following the emergency evacuation route by exit signs and go to the Queen Tower Rooms assembly point, and wait for further guidance from the people in charge. If the fire alarm was to ring, the group members would immediately stop their current task and evacuate the workshop. The group members would follow the emergyency evacuation route indicated by exit signs and make their way quietly to the assembly point by the Queen Tower rooms. The alarm can be raised according to according guidelines. If someone in the workshop were to injure themselves or require medical attention the first aid kit would be used and the appropriate people would be contacted.

8. Monitor and review

This risk assessment should be reviewed monthly until the extra controls are fully implemented, and annually thereafter.

It should also be reviewed Immediately in the event of process / location change or incident or accident.

REVIEW DATES	02/06/2023	16/06/2023	30/06/2023	Click or tap to enter a date.	Click or tap to enter a date.	Click or tap to enter a date.

9. Other Specialised Risk Assessments

Some of your hazards may require additional risk assessments - ask your safety officer for guidance or visit the Central Safety forms web pages. For example:-

Chemical and Hazardous Substances – needs a COSHH assessment.

Biological Hazards – visit the Biological Safety web pages – may need a College Bio1 risk assessment

Off-site Work and Fieldwork – there are specific forms for Fieldwork, Hosted Research and Conferences etc.

Ionising Radiation, inc. X-rays – the College Radiological Protection Team will help, but you need to register the work.

Lasers - need to be registered and risk assessed

Significant Manual Handling – Speak to your departmental manual handling advisor

Compressed Gases and Cryogenics – need separate risk assessments.

PLEASE LIST BELOW ANY SPECIALISED RISK ASSESSMENTS THAT ACCOMPANY THIS ONE.

Type of Risk Assessment:	Title (and reference number if applicable):	Name of Assessor:	Date:
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10. Standard Operating Procedure (SoP)

This describes the full method by which the experiment or activity takes place. Please include all steps, thinking about setup, running, packing up, disposal etc

You may wish to provide a separate SoP. If so, please indicate this below and leave this section blank.

1. Set up 3D printer
2. 3D Printing
3. Removing 3D Printed Support
4. Disposal of excess PLA
5. **Sanding**
6. **Oracover surface finish**
7.

APPENDIX 1

Category	SEVERITY (s) Examples	Score
MINOR	Superficial injuries - cuts, bruises, mild skin irritation, mild aches and pains – requiring first aid only. Minor property damage.	1
SERIOUS	More serious injuries or ill-health, requiring time off work or study or a hospital visit, e.g. burns, sprains, strains and short-term musculoskeletal disorders, cuts requiring stitches, back injuries, fractures to fingers or toes. More serious property damage.	2
MAJOR	Broken limbs, amputations, long-term health problems resulting from work, or acute illness requiring medical treatment, loss of consciousness, serious electric shock, loss of sight. Major property damage.	3
FATAL	Injury or ill-health which leads to death either at the time or soon after the incident, or eventually, as in the case of certain occupational diseases, such as asbestos-related cancers.	4

- These tables are designed to help you to gauge whether your risks are low or high.
- However, there are many factors that affect one's judgment of risk – for example, you may not have all the information you need to make a realistic assessment. Lack of space, lack of training, working to deadlines, and working late and alone could all act as risk increasing factors.
- Your assessment of risk will always be subjective, as it depends on not only your knowledge and experience but also the information you have available. The more information you have, the more accurate the assessment will be.
- Remember, any effective, appropriate control measures will lower risk.

Category	PROBABILITY (p) The *likelihood* of the hazard causing harm (example for guidance only - some or all may apply for each category)	Score
VERY UNLIKELY	Good control measures are in place. Controls do not rely on a person using them (i.e. personal compliance). Controls are very unlikely to break down. People are very rarely in this area or very rarely engage in this activity.	1
UNLIKELY	Reasonable control measures are in place but they do rely on a person using them (some room for human error). Controls unlikely to breakdown. People are not often in this area / do not often engage in this activity / this situation is unlikely	2
POSSIBLE	Inadequate controls are in place, or likely to breakdown if not maintained. Controls rely on personal compliance. People are sometimes in this area or sometimes engage in this activity / this situation sometimes arises	3
LIKELY	Poor or no controls in place. Heavy reliance on personal compliance (lots of room for human error). People are often in this area / engage in this activity on a regular basis / this situation often arises.	4

Risk Level	
Low	
Medium	
High	
Very high	

RISK SCORE = S X P		SEVERITY OF OUTCOME (S) Minor	Serious	Major	Fatal
PROBABILITY (P)	Very Unlikely	1	2	3	4
	Unlikely	2	4	6	8
	Possible	3	6	9	12
	Likely	4	8	12	16