

GENERAL RISK ASSESSMENT FORM

Faculty/Directorate

FACH (Greenwich Maths Centre)

Title of risk assessment/work being assessed

Workshop on angular momentum at Festival of Mathematics and its Applications, June 27 and 28 2017

Location of work being assessed (Campus, building, room)

Queen Anne Court – QA175

Date of assessment

15/5/17

Brief description of work being assessed

Include brief details of stages of the process, numbers of people involved, scale of operation, duration, timing and frequency of work (attach protocol or method if preferred)

This risk assessment describes a workshop that is taking place during the Festival and identifies risks specific to the activities that are being run during this workshop. Risks that relate to the Festival as a whole (such as crowd control, emergency evacuation, safeguarding) are covered in the Risk Assessment for the Festival as a whole, which was approved on 6 April 2017.

The workshop will include a number of demonstrations of the mathematics of angular momentum and stability. All of these are standard demonstrations frequently performed at events like this. These will include:

Spinning and releasing a soft toy around the presenter's head.

Balancing two long tools and finding their midpoint.

Spinning and releasing a bicycle wheel and watching it remain upright.

Audience members making a spinning top with a pencil and paper plate.

Audience members making a small cardboard boomerang from an A4 sheet of thin, light card

The audience for this workshop will be school students, supervised by teachers, and a small number of members of the general public. The maximum audience will be around 30. If the number of teachers is insufficient, trained student ambassadors will be used in addition. The presenter has many years of experience working with this sort of equipment in theatre and construction industries where safety is paramount.

The presenter will give a safety briefing at the start of the workshop for both teachers and students and other visitors.

Things to consider within the assessment – this list may not be exhaustive

- **Personal safety** e.g. Physical or verbal attack; disability or health problems; delayed access to personal or medical assistance; failure of routine or emergency communications; security of accommodation and support; getting lost, or stranded by transport; cultural or legal differences - List aspects of the work with significant hazards, and give brief details of how foreseeable harm/injuries could occur
- **Equipment hazards - Storage, handling and use of equipment and materials** e.g. Tools; machinery; vehicles; manual handling; noise; work at height; electricity; fire; vacuum; high pressure; high temperature; ultra violet; laser; vibration - List equipment and materials with significant hazards, and give brief details of how foreseeable harm/injuries could occur
- **Biological hazards - Storage, handling, use, and disposal of biological agents, intermediates, products and waste, "any micro-organism, cell culture or human endoparasite including any which have been genetically modified, which may cause infection, allergy, toxicity and other hazards to human health". This includes bacteria, viruses, fungi and parasites. Include routes of exposure** e.g. Blood borne infection; skin contact, skin sensitisation; sensitisation by inhalation; toxic by ingestion or inhalation. List biological agents with significant hazards, and give brief details of hazard classification and foreseeable harm/injuries
- **Natural physical hazards - Effects of the natural environment, climate, landscape, plants, animals** e.g. Extreme weather; earthquakes and volcanoes; mountains, cliffs and rock falls; glaciers, crevasses and icefalls; caves, mines and quarries; forests including fire; marshes and quicksand; fresh or seawater, tidal surges
- **Environmental impact** e.g. Pollution and waste, deposition of rubbish, disturbance of eco-systems, trampling, harm to animals or plants
- **Chemical hazards - Storage, handling, use, and disposal of chemical reagents, intermediates, products and waste** e.g. Toxic by inhalation or ingestion; irritant; corrosive, flammable; explosive; oxidising; radioactive. Include routes of exposure e.g. skin contact; skin sensitisation; sensitisation by inhalation; toxic by ingestion or inhalation. ***If the chemical is a group 3 or 4 chemical (see RA guidance sheet) then a separate COSHH assessment MUST be carried out.***

Risk Assessment:

Description of Hazard <small>(only include significant hazards inherent within the task or the activity)</small>	Person(s) at risk <small>e.g. staff, students, visitors, new & expectant mothers etc.</small>	Current control measures in place	Current risk rating			Further control measures required and by whom <small>(usually only necessary where the risk rating is either high or medium)</small>	Final risk rating		
			Likelihood	Severity	Risk Rating		Likelihood	Severity	Risk Rating
Equipment failure or injury due to initial incorrect setting up of equipment.	Presenter	<p>The presenter's equipment is industry standard, is in good working order and has been safely used for several construction jobs supporting heavy loads. The presenter has used this equipment elsewhere for similar demonstrations with no problems occurring.</p> <p>The stands are commercially available lightweight aluminium lighting stands designed for use by photographers on location, so detail of clamps, weight etc are appropriate for domestic/ commercial etc locations. The bicycle wheel is a standard wheel, and will be elevated no more than 2.5 meters, which limits the energy that can be imparted to it should it fall, prior to being rotated. The suspension will be with paracord, strong nylon cord as designed for use in parachutes.</p>	2	3	6	The presenter will be given plenty of time to set the equipment up properly and this will stay set up for the whole of the festival. The door will be locked when the room is not in use. The equipment will be checked once it has been set up. There will be an additional person present at all times (including set up) and set up will take place before any members of the public are admitted. (Presenter and Supervisor).	1	3	3
Trip hazard for presenter or audience.	Presenter or audience.	<p>Make sure floor is clear before workshop starts. None of the demonstrations will create an additional trip hazard.</p>	1	1	1	Check room before audience is admitted before each session.	1	1	1

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Demo of centrifugal force – soft toy on string spun around presenter's head. Risk is someone being hit by the soft toy.	Presenter	Make sure that demo is done correctly with soft object. The toy is a pig toy for a dog. It is approximately 6 inches across. This demo is usually done with a solid ball so using a soft toy minimises any risk of injury should the object come untied or the string break. Since the soft toy is inelastic it will not rebound from walls. The audience will be watching the toy and so will not be taken unawares.	1	1	1	Ensure audience are far enough away that if the toy unties in mid-flight it will not hit an audience member (Presenter)	1	1	1
Demo with plasterer's float and hawk to see if they can be balanced one on top of the other. Risk of injury to presenter with falling tool.	Presenter	Take care not to drop tools. The fact they are spinning means they are stabilised, the nature of the demo, so where they can end up is very limited. Presenter is a trained and qualified plasterer who is well used to handling these tools.	1	3	3	Ensure audience are far enough away that if a tool is dropped it will not hit an audience member (Presenter)	1	3	3
Bicycle wheel demo – A conventional commercially purchased bicycle wheel, unmodified except for two commercially bought stunt pegs attached to the axle, is suspended vertically by 2 pieces of paracord, one each from each stunt peg.	Presenter	Take care not to get close to wheel and use drill safely. Drill is battery powered so no cables leading to trip hazards etc or electrocution risk. The wheel on the drill is spokeless so no fingers can get caught in spokes. The drill has an instant brake if the operator releases their trigger finger.	2	3	6	Demo will take place in a corner of the room ensuring that the audience are far enough away so that if the wheel drops off the stand it will not hit any member of the audience. (Presenter)	1	3	3

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<p>The paracord is tied to a horizontal low mass bar, which straddles two lightweight stands.</p> <p>The wheel is spun up to moderate speed using either a hand, or preferably a battery powered drill driving a 6 inch diameter wheel held against the bicycle tyre for 5 seconds.</p> <p>Once spun up, one of the suspending paracords is cut with scissors, and wheel is seen to precess, and not drop as one's intuition suggests. The wheel remains firmly attached to the frame by the second cord at all times. This demonstrates both the stability of spinning objects, and precession of gyroscopes.</p> <p>Risk injury from falling wheel or presenter catching finger in spokes of wheel.</p>		<p>The drill drive wheel is made of plastic with a rubber outer tread.</p> <p>The two stands are as above –aluminium lighting stands (so low mass if they fall over).</p> <p>Once spun up the wheel is stabilised by the stands, and by the fact it is spinning (the point of the demo).</p> <p>If the suspension (paracord) fails, the wheel will drop and roll till the outer tyre bounces off the first obstacle that is reached, and hence cannot make contact with anything with a pointed impact.</p> <p>There is a risk to the demonstrator of catching fingers in the spokes of the bicycle wheel once turning, hence no audience member will be allowed to be close or involved, and the demo will have been rehearsed with no audience present.</p> <p>This demo has already been performed by the presenter in front of a large close audience without mishap.</p> <p>This is a classic demo performed numerous times around the world by numerous demonstrators.</p>							

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Demo Newton's first law – soft toy on string, spun around presenter's head and then thrown to demonstrate trajectory, showing that the toy proceeds tangentially once the centripetal force through the string is eliminated. Risk is an audience member being hit by the toy.	Audience	Object (same as before) is soft and thrown gently away from audience. The circle the toy describes will be in a vertical plane, parallel to the audience, so wherever the string is released it cannot fly into the audience. The toy never has a velocity vector towards the audience. Safety for the audience does not rely on timing of letting the string go. Object is inelastic and will not bounce off walls or other objects.	1	2	2	Ensure toy is released away from audience. Note that soft toy is chosen so that even in the unlikely event that the demonstration goes wrong there is no risk of injury	1	2	2
Demo with pencils and paper plates. Risk of children stabbing themselves or others with pencils.	Audience	Give careful instructions so children to not harm themselves with pencils.	1	1	1	Make sure supervisors are watching children with activity.	1	1	1
Making boomerang from card. Risk is scissor injury.	Audience	Give careful instructions so children to not harm themselves with scissors.	2	2	4	Make sure supervisors are watching children with activity. Presenter will have contact details for first aider and these details are in every University room.	1	2	2
Risk of injury if someone is hit by a cardboard boomerang.	Audience	Boomerang is made of very soft card which is unlikely to cause an injury. The boomerangs are small and so distance of travel is not more than about 2m away from thrower.	1	2	2	Presenter will tell audience not to throw boomerang when people are near.	1	2	2
Lack of supervision of school students	Audience	Sufficient teachers will be present to supervise. If there	2	2	4	Provide safety instructions at the	1	1	1

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		are not enough teachers, trained student ambassadors will be assigned to help.				beginning of each session (Presenter)			

Person(s) completing this assessment:

(Person carrying out or managing the activity day-to-day)

Name Noel-Ann Bradshaw Title Faculty Director Employability Signature _____ Date 15/5/17

Other person(s) commenting on this assessment (where required under Faculty/Directorate arrangements)

(Line Manager or Supervisor responsible for the activity, others involved in the decision-making process, others advising on the activity eg Health & Safety Manager, Health & Safety Local Officer)

Name Mary McAlinden Title Head, Department Mathematical Sciences Signature _____ Date _____

Person approving this assessment:

(Person with overall responsibility for the activity e.g. Faculty Operating Officer/Director of Professional Service, Senior Academic or Manager)

Name Tariq Effendi Title Faculty Safety Manager Signature _____ Date _____

Review of assessment, and revision if necessary

(For continuing work: the assessment must be reviewed for each visit in a series; when there are significant changes to work materials, equipment, methods, location or people involved; and if there are accidents, near misses or complaints associated with the work. If none of these apply, the assessment must be reviewed at least annually)

REVIEW DATE	--/--/----	--/--/----	--/--/----	--/--/----
Name of reviewer				
Signature				
No revisions made				
Changes to activity, hazards, precautions or risks noted in text.				

Appendix 1 – Risk Matrix

The hazards identified within the risk assessment should be assigned a risk rating – this should be assigned for any control measures which are currently in place and any further control measures which will be required.

You should assign a value for the likelihood of an incident occurring based on the hazard from 1 to 5 and a value for the severity / impact of the hazard from 1 to 5. These should then be multiplied together to give a final risk rating e.g. 3 x 2 = 6.

IMPACT	5 CATASTROPHIC	5	10	15	20	25
	4 MAJOR	4	8	12	16	20
	3 SERIOUS	3	6	9	12	15
	2 MODERATE	2	4	6	8	10
	1 MINOR	1	2	3	4	5
		1 RARE	2 UNLIKELY	3 POSSIBLE	4 LIKELY	5 ALMOST CERTAIN
LIKELIHOOD						

Risk score = likelihood of the hazard to cause harm x impact		
High	Medium	Low
Rating 15 or more Immediate action is required to control and/or lower the level of risk. Exposure to the identified hazard is prohibited or severely restricted.	Rating 8 - 12 Urgent review of the equipment, activities, system of work within the workplace with the aim of lowering the risk to the next level.	Rating 1 – 6 Usually, no further action will be required except for monitoring to ensure the risk does not change. However, if it is possible to reduce the risk levels still further, by using controls that are “reasonably practicable”, then this should be done.