

Mars

Mission



STEM Innovation Experience
STEMIE

STEM Innovation Experience

Task Information

Mars Mission

Introduction – The Mars Mission Proposal

Travelling to Mars is a goal for many organisations. NASA has already sent orbiters, landers and rovers to Mars. In 2012 the Curiosity rover collected valuable radiation data and the Opportunity rover has sent nearly 250,000 photos to Earth since landing in 2004, and in 2020 The Perseverance rover was launched to seek signs of ancient life and collect rock samples. NASA has already set the goal of humans reaching the red planet.

Elon Musk and the commercial space agency called SpaceX are also setting their sights on cargo missions and manned missions with up to 100 people per trip to create an inhabited city on the planet.

Other organisations have tried joining the space race, but not all have been successful. Mars One started looking for supporters in 2012 to help fund their goal of establishing a permanent human settlement on Mars but declared bankruptcy by 2019.

Australia was the third country in the world to launch a satellite into orbit from Woomera in the 1960's and is eager to once again join the leading space exploring nations. The development of our own space agency was announced on 25 September 2017 and has allowed Australia to be part of the global space industry, worth an estimated \$400 billion.

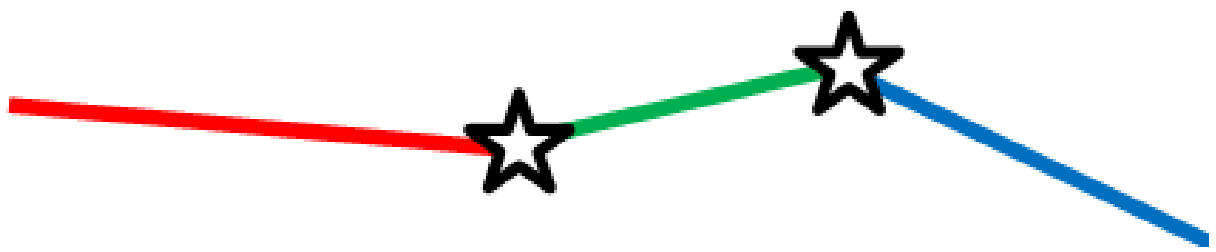
The next step will be the Mars Mission.

“The Earth is a cradle of humanity, but mankind cannot stay in the cradle forever.”

Konstantin Tsiolkovsky

“Mars is there, waiting to be reached.”

Buzz Aldrin



Mars Mission Proposal

The STEM Innovation Experience (STEMIE) will focus on developing a proposal for the Mars Mission. This will include problem solving for many aspects of the journey and landing requirements.

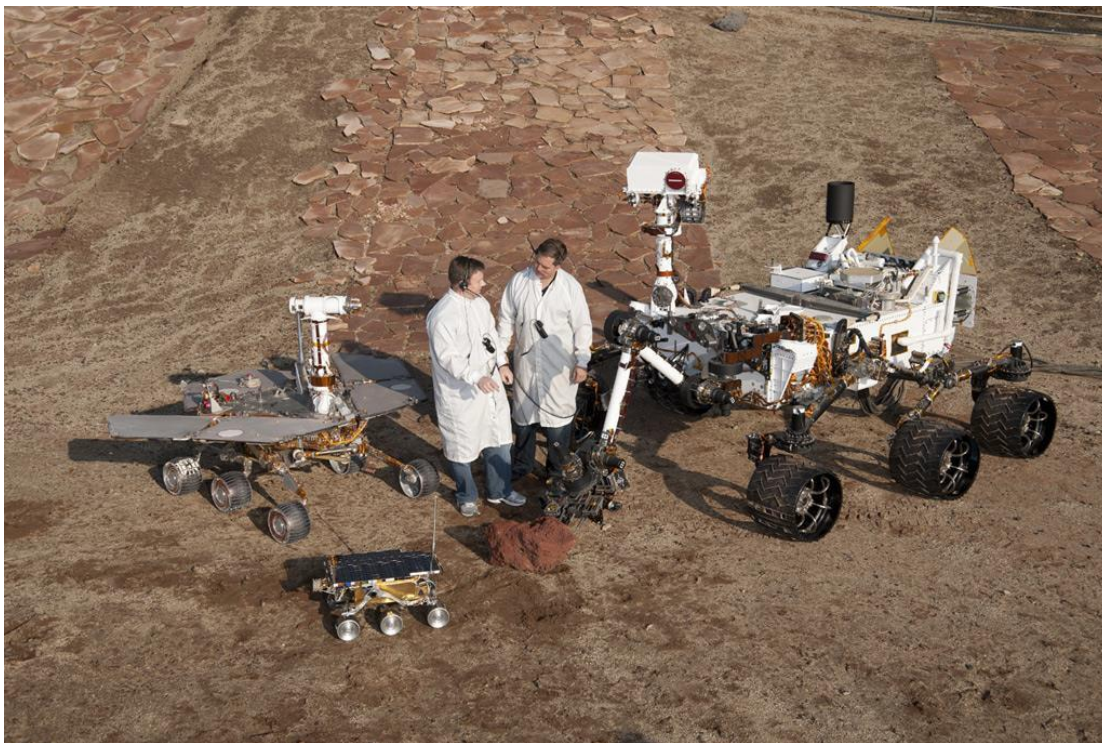
Mars Mission – The Requirements

The Mars Mission proposal will require the following tasks to be completed.

- Investigation on human physiology and developing astronaut selection criteria for astronauts on long missions, as outlined in the Science Component.
- Development of an Environmental Control System using Arduino Coding to detect and respond to changes in environmental conditions, as outlined in the Technology Component.
- The planning, design and construction of an automated vehicle and transit pod, as outlined in the Engineering Component.
- Creation of a tender for the catering component of the Mars Mission, with consideration of the requirements as set out in the Mathematics Component.

Mars Mission –

Your school needs to produce a summary proposal in the format of a brief report and will need to cover how STEMIE was delivered in your school and a summary of your work for the Mars Mission.



https://mars.nasa.gov/mer/gallery/press/opportunity/20120117a/PIA15279_3rovers-stand_D2011_1215_D521_br.jpg



STEMIE – The Three Parts

STEMIE will consist of three parts:

- The Learning Phase
 - This is completed at school and work is uploaded to an online platform with the link sent to the UniSA STEMIE email address STEMIE@unisa.edu.au. The purpose of this phase is to demonstrate the learning that has occurred within the experience and to provide evidence that students have met the requirements to qualify for the Regional Showcase event.
- The Regional Showcase
 - This part will consist of an online event with University of South Australia staff judging the Science, Technology, Engineering and Mathematics components that have been completed at school. Schools will have a 1 ½ hour judging timeslot to demonstrate their work in these four areas. At the conclusion of all judging, the winning schools will be notified via email. In the event of a tie between schools within a region, the online overall task will be used as a tie breaker to decide the winner.
- The STEMIE Final
 - The winner from each Regional Showcase event, in addition to any wildcard schools (selected by the panel of judges after all Regional Showcase events) will compete in unseen STEM challenges at the University of South Australia. Details of dates and locations can be found in the initial invite emailed to schools and will also be sent again to winning schools.

STEMIE – Referencing

Research elements used within STEMIE Checkpoint Submissions and the Regional Showcase need to be referenced. The preferred style of referencing may vary between each school participating in STEMIE.

UniSA Outreach recommends using the SACE Guidelines (or equivalent in each state) for Referencing Documents when submitting work for assessment within STEMIE.

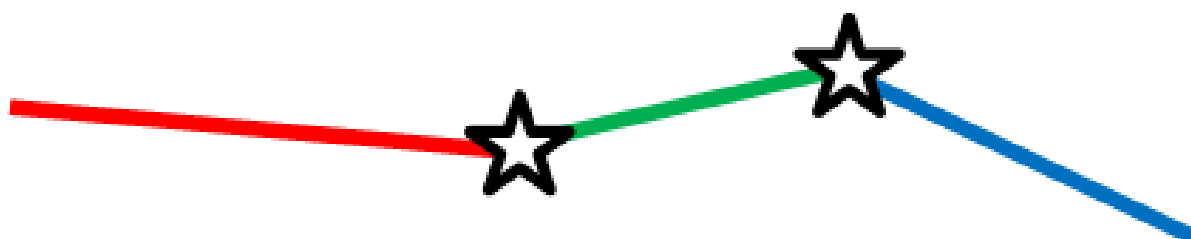
The Student Guide to Referencing and Guidelines for Referencing documents can be found at this link <https://www.sace.sa.edu.au/learning/research-advice/referencing>

STEMIE – The Learning Phase

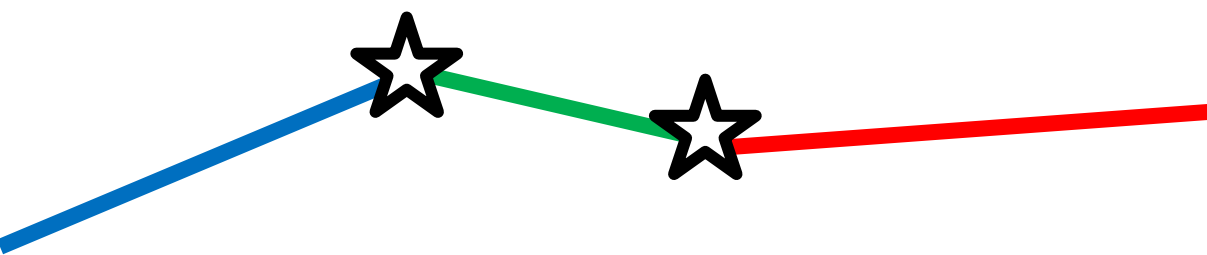
School Leaders and Teachers can choose how they implement The Learning Phase in their school. Components within The Learning Phase have been developed to be scalable from a small group of students to multiple classes interacting in the experience.

Throughout the Learning Phase, there are identified checkpoints where progress must be submitted. There are six (6) required tasks that must be submitted to qualify for the Regional Showcase. The additional tasks are optional for in school use only and do not need to be submitted to UniSA. Schools can use some, none or all of the optional tasks as they progress through STEMIE, but tasks R1 to R6 must be available for viewing via an online platform (website link or equivalent is preferred).

The range of assessment tasks requires team members to hold varied skill-sets, so working in teams with complementary abilities is advantageous. There are five key components within The Learning Phase – the Science, Technology, Engineering, Mathematics and Overall Summary components.



Notes:



STEM Innovation Experience Mars Mission

Science Component

Science Component – Background Information

Humans have long desired to travel into space but there are many factors that impact on the human body and must be considered. There are physical factors such as exposure to radiation and the lack of gravity during space travel impacting on muscle mass, bone density and even changing blood pressure. There are also psychological factors that need to be considered such as the isolation and confinement during the mission.

Space travel has developed substantially since Russian cosmonaut Yuri Gagarin was launched into space in 1961 but with missions now aiming to reach other planets, the journey alone will be many months in duration, leading to a new set of potential problems.

Science Component – The Requirements

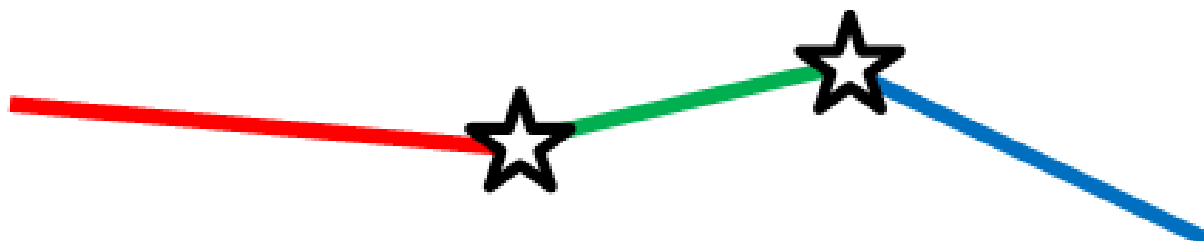
As a group, investigate the aspects that need to be considered when astronauts experience extended durations in microgravity.

Aspects that must be considered include researching current space travel concerns and methods used to reduce muscle atrophy. Additionally, an investigation into human physiology factors is to be completed.

Develop a set of selection criteria for the astronauts and for their Mars Mission journey.

This can be achieved by completing some, or all of the following:

- Research previous space travel missions and how their length compares to the proposed Mars Mission.
- Create and conduct a practical investigation methodology to observe a relevant aspect of physiology of the human body.
- Analyse results and draw conclusions from the practical investigation.
- Adhere to school laboratory safety when conducting the practical investigation.
- Discuss and critically analyse the practical investigation methodology, with reference to strengths and improvements.
- Summarise considerations with reference to the Mars Mission and if it is feasible for humans to travel that distance, what are the selection criteria for astronauts on the mission and what will they be required to do in order to maintain their fitness.



Science Component – Practical Investigation

The practical investigation methodology needs to be created to account for an aspect of human physiology. The purpose for conducting this investigation is to support the research about the impact of space travel on humans, and account for some strategies to reduce muscle atrophy or neuromuscular impairments during space travel while on the proposed Mars Mission.

Ideas for this investigation could include:

- how well circulatory or respiratory systems recover from various activities
- fitness or strength testing over a period of time
- reaction rate testing
- ability to physically function due to extreme stimulus
- Access to energy drinks/ caffeine and how they impact on the body
- Holding your breath or breathing through apparatus and the effect on the body
- Other relevant sets of conditions.

The methodology for the investigation can vary from school to school, however, the format for the submitted practical write-up tasks must include the following headings:

Practical investigation methodology of human physiology experiment

- Hypothesis
- Aim
- Materials
- Method
- Safety (Note: investigations must be approved by the school as per their requirements)

Results and conclusion from human physiology experiment

- Results
- Conclusion

Discussion and analysis of human physiology investigation methodology

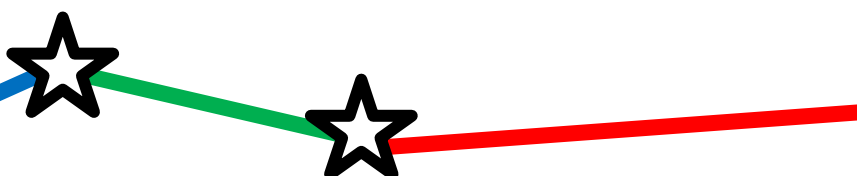
- Accuracy and Precision of Methodology
- Sources of Random Error
- Sources of Systematic Error
- Suggested Improvements and limitations

Science Component – Elements for the Regional Showcase event

At the Regional Showcase event, students representing their school will be required to deliver a formal presentation to staff from the University of South Australia regarding their astronaut selection criteria for the astronauts during transit.

This presentation will be held online via a Zoom link and time limits will need to be strictly adhered to.

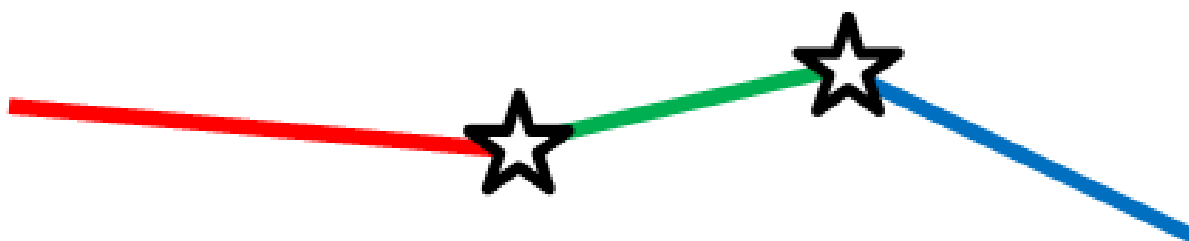
The presentation should be a maximum of seven (7) minutes, with up to an additional three (3) minutes for questions from the Mars Mission Representative (UniSA Staff) judging the presentation.



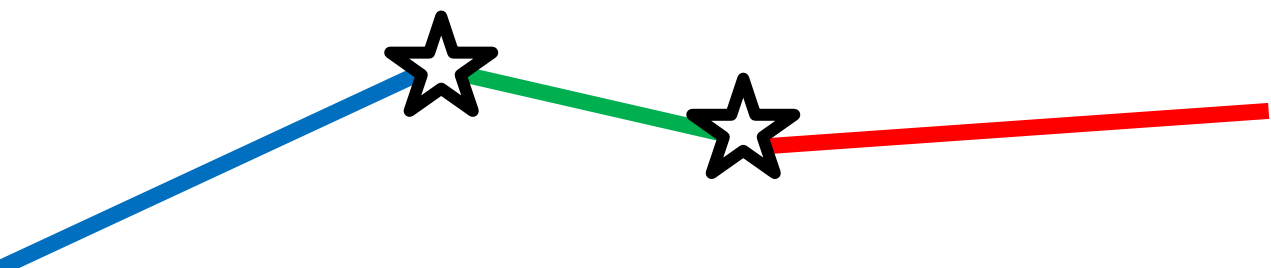
Mars Mission
STEMIE Regional Showcase
Science Component

School: _____

Criteria	Marks Available	Total Marks
1. Summary of conditions in space travel, living requirements and concerns.	3 2 1 0 N/A	
2. Understanding of the science behind your astronaut selection criteria, who makes the shortlist, how the astronauts will be chosen.	3 2 1 0 N/A	
3. Incorporation of research and practical results into presentation to make informed decisions about the astronaut selection criteria.	3 2 1 0 N/A	
4. Delivery of content knowledge, including the ability to answer questions posed by UniSA Staff.	3 2 1 0 N/A	
5. Communication and interaction with UniSA Staff, including the use of visual aids and appropriate presentation timing.	3 2 1 0 N/A	
Total Marks:		/15



Notes:



STEM Innovation Experience Mars Mission

Technology Component

Technology Component – Background Information

Space travel and potential colonisation of other planets requires strict management of living conditions. Despite many important similarities between the climate on Earth and Mars such as seasonal changes and weather patterns, there are still many differences that make survival reliant on controlling the conditions.

Movies like *The Martian* have highlighted the need for Environmental Control Systems. Air supply, temperature, light levels and available water all need to be managed for humans to survive in these hostile environments.

Technology Component – The Requirements

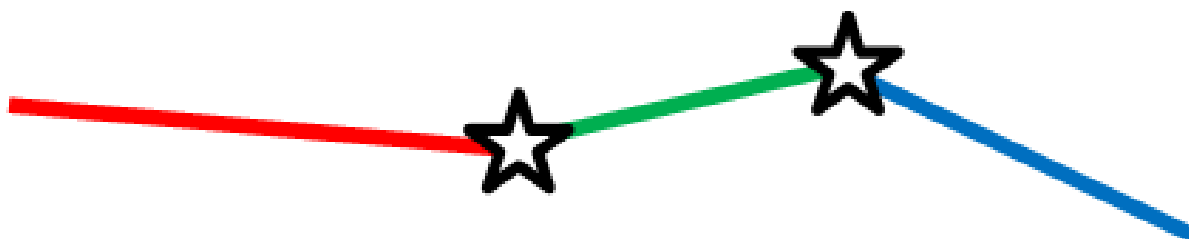
As a group, design, develop, prototype and test an Arduino coded Environmental Control System (ECS) to detect and respond to environmental changes.

The device must detect light and temperature changes and respond to these changes.
More sophisticated technology can be included to detect and respond to other environmental conditions.

The device must also contain a 3D printed component.

This can be achieved by completing some, or all of the following:

- Brainstorm and research environmental conditions that would need to be monitored.
- Develop and code a working Environmental Control System (ECS) device that can detect a change in these conditions, using Arduino and appropriate code comment conventions.
- Investigate and develop additional features of the ECS device to respond to a change in conditions.
- Evaluate the development of the prototype and final ECS device which will be used for testing at the Regional Showcase event.



Technology Component – ECS Device Production

Create an Environmental Control System (ECS) that will detect changes to environmental conditions and respond to those changes appropriately.

The intended purpose of this ECS is to control the living conditions during transit through space or at a colonised location on Mars. For the purposes of judging, the conditions that will be tested are a change in temperature, light intensity and then other additional features can be demonstrated for additional marks.

Computer Aided Design (CAD) software can be used to create 3D printed components for your device.

Technology Component – Elements for the Regional Showcase event

At the Regional Showcase event, students representing their school will be required to demonstrate a working ECS device.

As a minimum, the device should be able to detect and show changes to temperature and light levels.

To be awarded further points, the ECS will need to demonstrate a response to a change in temperature and light intensity. Additional points will be awarded for detecting additional conditions and responding to these and for additional features, such as remote options.

The judging will be held online via a Zoom link. We recommend having a mobile phone, iPad or similar device in the meeting to allow the prototype to be viewed from different angles.

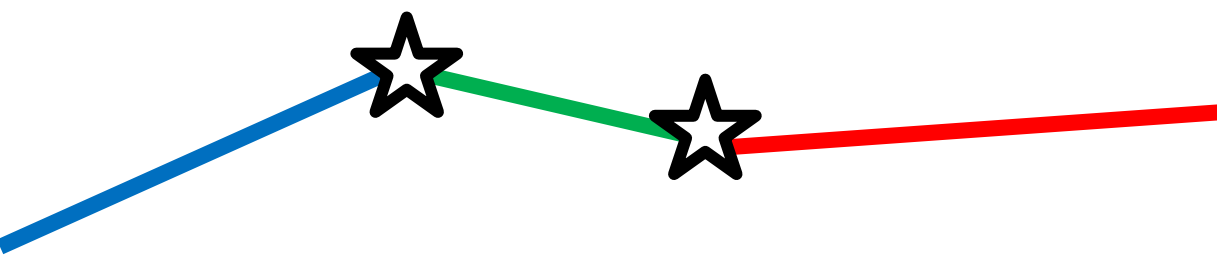
Programming Component – Elements for the Regional Showcase event

Students will also be required to complete a trouble shooting activity to identify simple errors in a section of Arduino code. The errors will be based on the activities covered in the student workshop “Introduction to Coding” section of the STEMIE Moodle.

The UniSA Staff judging the ECS device will work through the criteria on the marks sheet. For additional features to be awarded marks, they must be successfully demonstrated in the allocated judging time.

Troubleshoot a sample code with errors (errors will be based on the introduction to coding activities on the STEMIE Moodle) This will have a 2 minute time limit.

Each school will have a maximum of 10 minutes to demonstrate their prototype and 2 minutes to find the errors in the sample code supplied.



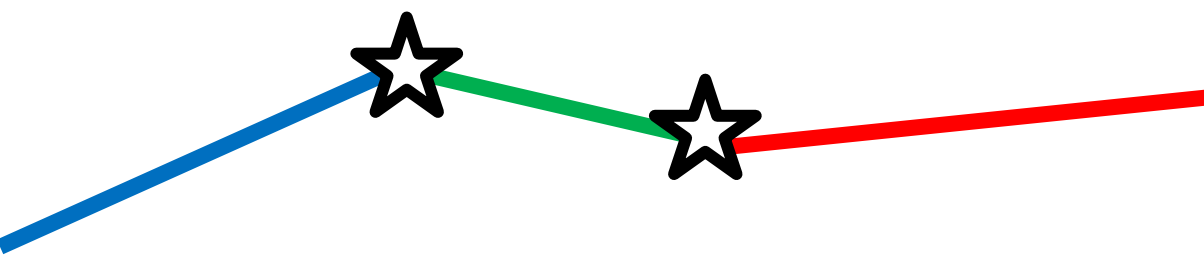
Mars Mission STEMIE Regional Showcase *Technology Component*

School: _____

Criteria	Marks Available	Total Marks
3D printed component	<p>1 Mark – Printed but has visible scaffolding/rafting or general flaws in the print, and no obvious function in the device</p> <p>2 Marks – Well printed but only serves an aesthetic purpose</p> <p>Or 3 Marks – Well printed and has a set function in the device</p>	
Input Detection <i>Does the ECS detect changes in the environment?</i>	<p>1 Mark – Detects changes to light</p> <p>+1 Mark – Detects changes to temperature</p> <p>+1 Mark – Detects changes autonomously using a sensor</p>	
Output response <i>Can the ECS respond to the environmental change?</i>	<p>1 Mark – Responds to a change in light</p> <p>+1 Mark – Responds to a change in temperature</p> <p>+1 Mark – Can display light and/or temperature readings</p>	
Additional Features <i>These must be successfully demonstrated within the judging time limit</i>	<p>+1 Mark – Additional relevant ECS feature is successfully demonstrated</p> <p>+1 Mark – Another additional relevant feature successfully demonstrated</p> <p>+1 Mark – Another additional relevant feature successfully demonstrated</p>	
Can find errors in the sample code	<p>1 Mark – Can find 2 errors in the sample code</p> <p>+1 Mark – Can find additional errors in the sample code</p> <p>+1 Mark – Can find all errors in the sample code</p>	
Total Marks:		/15



Notes:



STEM Innovation Experience Mars Mission

Engineering Component

Engineering Component – Background Information

The Mars Mission aims to travel to the red planet with humans and allow them to start colonising the new land. On arrival, the people will need some method of transport on the surface of the planet.

Engineering Component – The Requirements

As a group, design and construct a model of a vehicle that can cover the set terrain as well as a transit pod to house the vehicle.

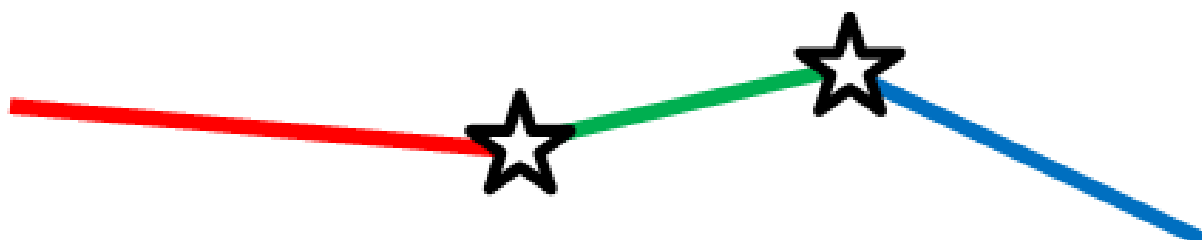
The vehicle must be able to fit within the transit pod. The best vehicle will be able to complete the entire terrain track and stop at the end.

A prototype for a transport vehicle that can fit within the transit pod will need to be developed. The vehicle will need to be able to navigate a test track and fit within the pod for transit. This can be achieved by completing some, or all of the following:

- Brainstorm and investigate existing terrestrial vehicles used in space exploration, while identifying their strengths and weaknesses.
- Sketch designs of vehicles and the transit pod for construction and testing.
- Test the properties of different types of construction materials (e.g. glue, masking tape, lego, balsa wood etc.) to evaluate the best construction method.
- Construct a transit pod and vehicle. (Pre-constructed vehicles not permitted)
- Explain the functions of the preferred design.
- Produce sketches of the chosen design (by drawing and/or CAD packages).
- Construct the chosen design for testing at the Regional Showcase event.

Engineering Component – Vehicle and Transit Pod Construction

The model of the transit pod must not exceed 30cm x 30cm x 30cm and must be able to house the vehicle completely inside. The transit pod must house the vehicle but also allow it to exit the capsule without vertical lifting unless the lifting device forms part of the transit POD itself (there will be no crane access on Mars). Any materials can be used in construction except pre-constructed vehicles without modification. The vehicle should be able to navigate the test track and stop at the 3 metre mark.



Transit Pod Specifications

- **Length, Width and Height: Maximum 30cm for each dimension**
- **Note, if the transit pod shape is irregular the widest, tallest and longest points will be used to measure the dimensions.**

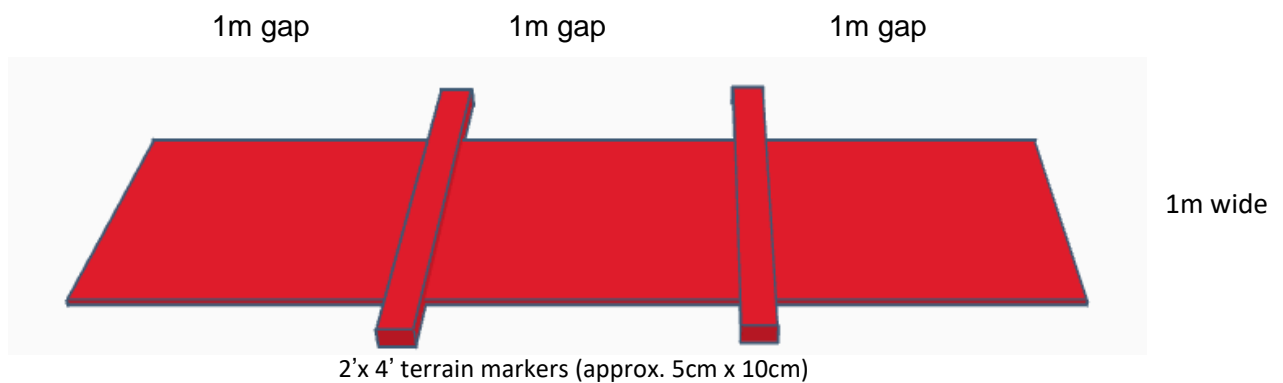
Vehicle Specifications

- **Must fit completely inside the transit pod**
- **Can exit the transit pod without requiring manual vertical lifting**
- **Can navigate the terrain track autonomously once released**
- **Can stop at the end of the terrain track**

Requirements:

- Materials are not prescribed but it is an advantage to keep the vehicle and transit pod clearly under the size limits to ensure eligibility.
- The vehicle must be able to exit the transit pod without manual vertical lifting.
- The vehicle can be adjusted and set up on the track, but once released it must function autonomously for the duration of its run.
- The vehicle needs to be able to navigate as far along the test track as possible.
- The vehicle needs to be able to stop at the end of the terrain track (3m mark).

Note – the supply of building materials is the responsibility of the school.



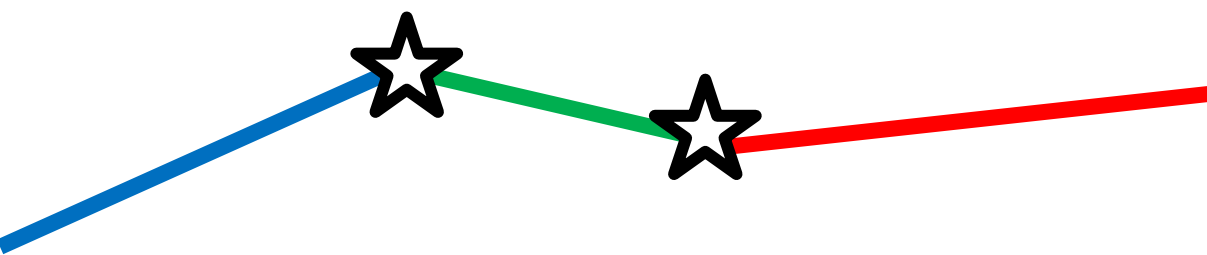
Engineering Component – Elements for the Regional Showcase event

At the Regional Showcase event, students representing their school will be required to demonstrate their vehicle. This test track will need to be set up before the allocated judging timeslot begins. We recommend a smooth surface and clearly marked perimeters, such as the use of masking tape to show the track width limit and start and finish marks.

The judging will be held online via a Zoom link. We recommend having a mobile phone or iPad in the meeting to allow the device to be easily viewed from different angles.

Each school will have two (2) attempts at the track (as per diagram above) and the best result will be recorded.

Functionality of the POD and vehicle, accuracy of the travel and autonomous features will need to be demonstrated to the UniSA Staff. Additional features also need to be demonstrated within the judging time limit.



Mars Mission

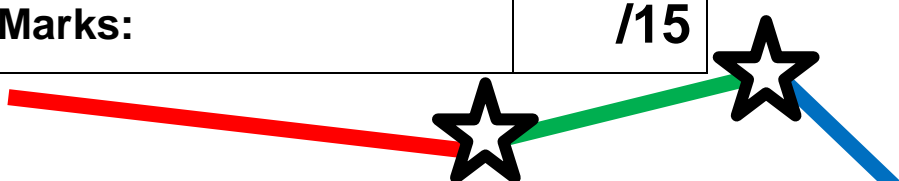
STEMIE Regional Showcase

Engineering Component

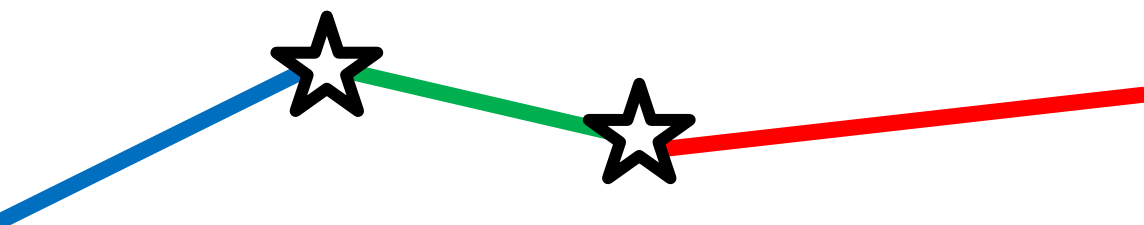
School: _____

Transit pod dimensions			Total distance travelled on the terrain test track	
Width	Height	Length	Run 1	Run 2

Criteria	Marks Available	Total Marks
Functionality <i>Vehicle and Transit pod</i> <i>Release of vehicle from transit pod</i>	1 Mark – Vehicle fits inside the pod +1 Mark – Vehicle can be removed from the transit pod without damaging the pod +1 Mark – Vehicle can become larger than the transit pod after release + 1 Mark – Vehicle can be released without vertical lifting +1 Mark – Vehicle can be returned to the POD after the test run without vertical lifting.	
Accuracy Travel distance on the terrain test track within perimeter boundaries	1 Mark – Vehicle moves to first hurdle +1 Mark – Vehicle navigates over the first hurdle +1 Mark - Vehicle navigates over the second hurdle +1 Mark - Vehicle reaches the end of the terrain track (3m mark)	
Autonomy <i>Ability to travel</i>	+1 Mark – Vehicle can be released remotely/autonomously from the pod +1 Mark – Vehicle starts travel remotely/autonomously after release from the pod +1 Mark – Vehicle can stop autonomously at the end of the terrain track	
Additional features	+1 Mark – Additional relevant feature +1 Mark – Additional relevant feature +1 Mark – Additional relevant feature	
Total Marks:		/15



Notes:



STEM Innovation Experience Mars Mission

Mathematics Component

Mathematics Component – Background Information

Space food has improved dramatically since the early missions where food was limited to tubes of semi liquid meals or freeze-dried powders that were difficult to rehydrate. Now astronauts can select from a variety of meals that incorporate fruit, vegetables, meat, and even special requests provided they meet the nutrition plan.

Food in space needs to be as light weight as possible to reduce transit costs. Dehydrated foods are often used for this reason and with access to hot water can be rehydrated and heated in a similar time frame to making a snack at home.



<https://humans-in-space.jaxa.jp/en/life/food-in-space/>

Mathematics Component – The Requirements

Create an interactive spreadsheet for the catering costs on the Mars Mission.

The spreadsheet will need to meet set parameters, show variations in meal plan requirements and needs to be mathematically justified. It needs to account for costing changes if astronaut dietary requirements or length of travel changes.

This can be achieved by completing some, or all of the following:

- Brainstorm the requirements to consider for the meal plan
- Demonstrate a variety of foods in the meal plan, including catering for an astronaut with a dietary requirement such as, gluten free, vegetarian or low FODMAP diet
- Calculate costing of meals
- Develop a contingency plan for an additional 20% travel time in the event of a delay and justify this cost mathematically
- Produce a spreadsheet for the catering costs for the Mars Mission



Mathematics Component – Mars Mission Catering Tender

The Catering Tender needs to:

- Account for the dietary requirements for six (6) astronauts for the duration of the journey. This can be:
 - based on standard recommended dietary intake (RDI) values
 - based on basal energy expenditure calculations
 - linked to the selection criteria for astronaut selection in the Science Component
- Show that the plan can accommodate for a dietary requirement (gluten free, vegetarian, low FODMAP etc)
- Demonstrate a variety in the meal plan
- Demonstrate a contingency plan including costing for an additional 20% journey duration

It is suggested that online tools such as GeoGebra and food label calculators such as the one at <http://www.foodstandards.gov.au/industry/npc/Pages/default.aspx> could be utilised in the process of developing a mathematically justified Catering Tender. This list is not exhaustive, and groups should use resources available to them to work through this component.

Mathematics Component – Elements for the Regional Showcase event

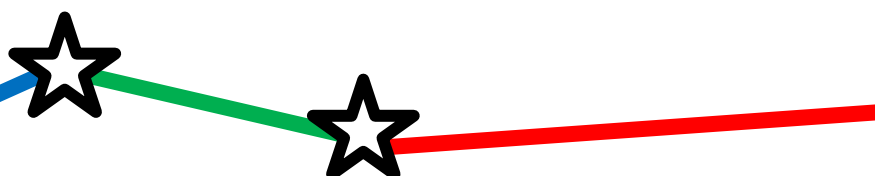
At the Regional Showcase event, students representing their school will be required to present their Catering Tender to the UniSA Staff for judging. Schools will be assessed by means of Question and Answer. From a list of five (5) seen questions, schools will need to respond to two (2) questions chosen by the judge, before being asked to respond to one (1) unseen question. Students will also need to demonstrate how the spreadsheet can cater for dietary requirements and contingency plans.

Each school will be allocated a 10-minute timeslot for judging at the online Regional Showcase. The spreadsheet will need to be shared in the Zoom meeting during the judging timeslot.

UniSA Staff will judge the responses in a Question and Answer session, incorporating two (2) seen and one (1) unseen questions.

They will also judge the ability to demonstrate adjustments for dietary requirements and contingency plans.

The spreadsheet will need to be on the device that is logged in to the Zoom meeting to allow it to be shared and viewed in the judging timeslot.



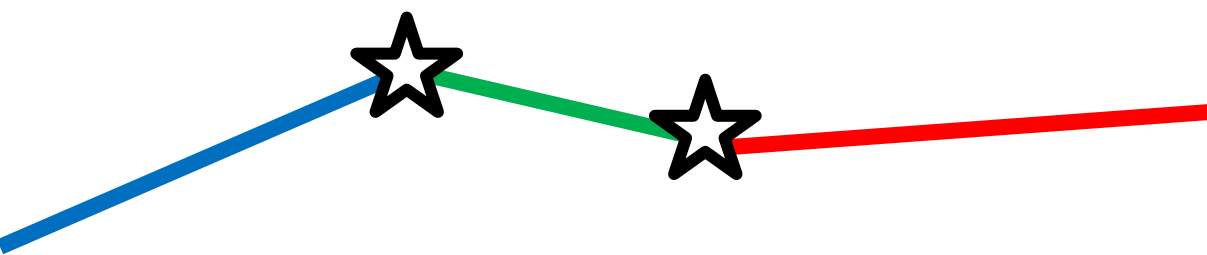
Mars Mission
STEMIE Regional Showcase
Mathematics Component

School: _____

Questions	Marks Available	Total Marks
1. Explain the criteria you have used to determine what the astronaut's dietary requirements are?	3 2 1 0 N/A	
2. Describe how you have created variety in the meal plan?	3 2 1 0 N/A	
3. Reflect on the graph of your costing of the food supplies for the trip?	3 2 1 0 N/A	
4. Justify mathematically how the dietary requirements are being met in your plan.	3 2 1 0 N/A	
5. Explain how the incorporation of variety and/or dietary requirement in your meal plan altered the cost?	3 2 1 0 N/A	
Demonstrate variations using your spreadsheet (as requested by UniSA Staff) Variation One – Show how the cost would change if the number of astronauts with dietary requirements changed. Variation two – Show how you have accounted for the contingency plan if additional food is needed during transit. Show how total cost changed when adding food needed if the trip was extended.	 3 2 1 0 3 2 1 0	
Unseen Question 1.	3 2 1 0	
Total Marks:		/15



Notes:



STEM Innovation Experience Mars Mission

Checkpoint Tasks and Overall Summary Component

Checkpoint Tasks and Overall Summary Component – Background Information

The Required Tasks need to be available for viewing via an online platform by the checkpoint dates. We recommend a website or similar platform with access via a link. If this is not possible, individual checkpoint tasks (R1-R6) can be submitted via a Google drive, drop box or similar with unrestricted access.

The purpose of these tasks is to ensure that progress has been made throughout The Learning Phase. It also allows the UniSA team to gather information relating to the implementation of STEMIE at each school site, and to gather any evidence of promotion of STEM within the school and the local and broader communities.

Overall Summary Component – The Requirements

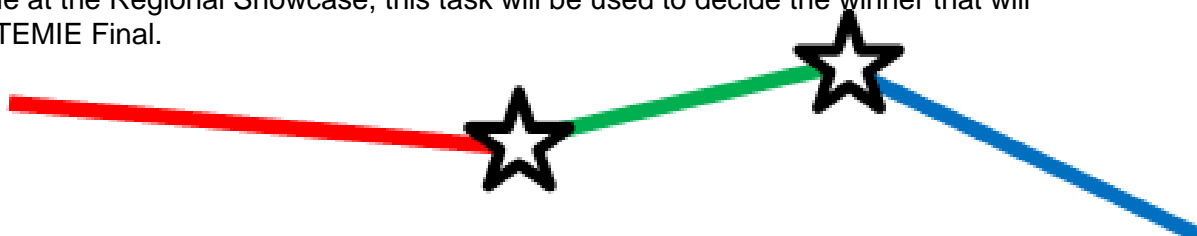
The Overall Summary Component consists of Required Task R6, this is the preparation of a summary report about how STEMIE was run in the school and the proposed Mars Mission, including explanation of catering costs, environmental control during transit, ground transport and astronaut selection criteria.

Required Task R6 (Summary Report) needs to include:

- Summary of how STEMIE was implemented within the school site.
- Evidence of any promotion of the STEMIE program within the school, local and broader communities.
- Summarise aspects of STEMIE in the form of a Summary Report, addressing the following (maximum 2 pages, excluding photographs):
 - Summary of the STEM components and how they were completed at school
 - Reflect on the learning, any problems encountered and how difficulties were overcome. Which parts were more difficult than others,
 - Summary of the final Mars Mission Proposal.

Signed UniSA Media Release Forms must be supplied for anyone that appears in any photographs or video in the STEMIE tasks, and for anyone attending the STEME Final.

In the event of a tie at the Regional Showcase, this task will be used to decide the winner that will progress to the STEMIE Final.



STEM Innovation Experience Checkpoint Task Assessment

Assessment within STEMIE will be through an online platform (Website link is the preferred platform) Schools must submit the 6 required tasks to a satisfactory standard to qualify for the Regional Showcase event. There are 20 Assessable Tasks, only 6 are **required** and the 14 remaining tasks are **optional**. If students or teachers have any questions they can send them to the UniSA STEMIE email address STEMIE@unisa.edu.au

Assessment – The Process

At school, groups of students will need to work through STEMIE to produce evidence of Assessable Tasks (at a satisfactory standard) for submission at Checkpoints throughout the year.

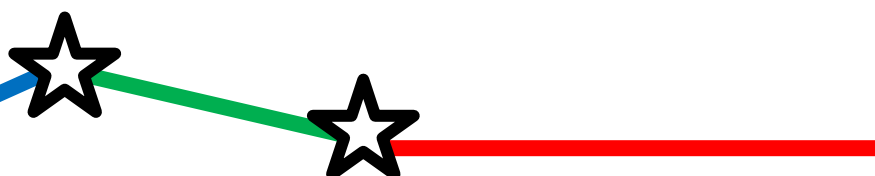
The submission requirements for each of the three Checkpoints are as follows:

- Checkpoint 0 (End of May) – optional checkpoint task
Feedback will be provided for any schools that have sent a link to view tasks by the end of May. This is not a required deadline; it is optional for early feedback on qualification status to those schools working on STEMIE in Semester 1.
- Checkpoint 1 (Friday, Week 2 of Term 3)
Required Task (R1) Submission of Timeline showing proposed dates and progress
- Checkpoint 2 (Friday, Week 8 of Term 3)
Required Tasks (R2-5) Submission of required tasks in each of the Science, Technology, Engineering and Mathematics components
- Checkpoint 3 (Last day of Term 3) – **Final Progress task**
- **Required Task (R6)** Submission of STEMIE Summary Task

The deadline for all checkpoints is 8:00pm on the dates listed above.
The link to access the content (website link, drop box link or other) need to be emailed to STEMIE@unisa.edu.au by this deadline so checkpoint submissions can be viewed online.

The link will be shared with other qualifying schools after checkpoint 3 so that students can see each other's progress. Unlisted links are recommended so they are not found by searching the content, but can be viewed when the specific link is supplied. Schools will need to ensure any students in the content have school media consent, or ensure the student can not be identified from any images on the platform.

School checkpoint tasks will be assessed to ensure they meet a satisfactory level. Work that does not demonstrate a satisfactory completion will be returned via email with feedback, along with an opportunity to resubmit. For a school to qualify to compete at their Regional Showcase event, all 6 required tasks must be submitted by Checkpoint 3.



Assessment

There should only be one submission to UniSA for each required task, regardless of how many students are working on STEMIE at the school. As long as the six required task submissions are to a satisfactory standard the school will qualify to compete at the Regional Showcase.

The link containing the required tasks needs to be emailed to STEMIE@UniSA.edu.au. The link must be viewable without the use of passwords. Websites or similar online platforms are preferred, but if this is not possible the link can be to a Google Drive or Drop Box.

Any unsuccessful submissions will have feedback and an opportunity to resubmit. Marks earned in the process of qualifying for the Regional Showcase event do not carry over into the event. That is, each school starts on an even level at the commencement of the Regional Showcase event.

The winner of the Regional Showcase event will be the school who, at the end of the event, has gained the highest number of marks at the Regional Showcase event. Winners will be emailed once all schools in that region have completed the judging process.

Assessment – Optional Tasks

The remaining 14 tasks on the matrix are optional, schools can choose to use them as part of their own assessment at school level, but they do not need to be submitted to UniSA. They are not compulsory.

Assessment – The STEMIE Final

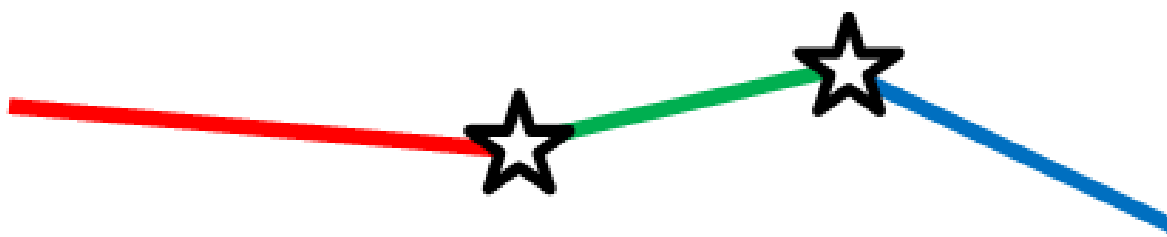
One school from each Regional Showcase will progress to the STEMIE Finals.

The school who wins their Regional Showcase event will be invited to the STEMIE Final, to be held at The University of South Australia, in November. Specific details will be supplied to winning schools.

In addition to the winners of the Regional Showcase events, there may be potential Wildcard entries into the STEMIE Final. These positions will be awarded to schools by UniSA Outreach at the conclusion of all the Regional Showcase events.

Marks awarded at the Regional Showcase do not carry over into the STEMIE Final. Each of the schools competing at the State Final will start on an even level with no advantage awarded to any school.

The school who gains the most marks at the STEMIE Final event will be crowned the winners of the STEM Innovation Experience for that year.





STEM Innovation Experience Assessment Matrix

Science Tasks	Score	Technology Tasks	Score	Engineering Tasks	Score	Maths Tasks	Score	Overall Tasks	Score
S1. Summary of referenced research into space travel and human requirements	1	T1. Evidence of research into environmental conditions in space and on Mars	1	E1. Evidence of research of strengths and weaknesses of all-terrain vehicle designs	1	M1. Mathematical justification of dietary requirements and contingency plan	1	R1. Checkpoint 1 Timeline, showing tasks and proposed progress	1
S2. Practical investigation of physiological factor experiment, including methodology, results and discussion	1	T2. Explanation of PriO board components and their function and annotated code samples	1	E2. Sketch or digital 3D model (using CAD design program) of vehicle and transit pod design	1	M2. Mathematical justification of food weight ratios when dehydrated	1	O1. One page summary outlining how STEMIE is implemented at school	1
S3. Justified astronaut selection criteria and their prescribed exercise plan	1	T3. Evaluation of prototype development and discussion of any additional features	1	E3. Explanation of design function and summary of progress and changes over time	1	M3. Tender for the Mars mission catering contract showing food variety and total costings	1	O2. Promotion of STEMIE within the school community, local community or wider community	1
R2. Checkpoint 2 Photos of progress on investigation, with dates and captions	1	R3. Checkpoint 2 Photos of prototype build and screen shots of code development, with dates	1	R4. Checkpoint 2 Photos of vehicle and transit pod build & testing, with dates	1	R5. Checkpoint 2 Mars Mission mathematical calculations/ screenshots/photos	1	R6. Checkpoint 3 STEMIE Summary Report	1
Possible Marks	4	Possible Marks	4	Possible Marks	4	Possible Marks	4	Possible Marks	4

Possible Total	20
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Note: Only the Required Tasks (R1-R6) need to be shared with UniSA.
All other tasks are for optional use within any internal school assessment.

STEM Innovation Experience Rules and Requirements

STEMIE Rules and Regulations

- While there is a competitive aspect to STEMIE, where possible, schools are actively encouraged to collaborate to share ideas, methodologies and resources.
- Accessing assistance from the wider community is also encouraged, should the required expertise to complete tasks not be available within the school.
- The first point of contact for any questions or queries relating to STEMIE is the Moodle site <https://lo.unisa.edu.au/course/view.php?id=25118> This site contains electronic copies of resources provided to schools, additional web links, resources and student workshop activities.
- Additional questions can be sent to STEMIE@unisa.edu.au Teachers and their students are welcome to use this address to get assistance with their work.
- Question and Answer sessions can also be booked by schools (subject to staff availability). This will allow a UniSA staff member to Zoom link with your students and answer any potential questions they have or provide feedback on their ideas.

STEMIE Regional Showcase Judging Requirements

- To qualify for the Regional Showcase event, Required Tasks R1-R6 must be available for viewing online by the checkpoint deadlines, and to a satisfactory standard.
- The additional tasks on the assessment matrix are for optional use at school, they do not need to be submitted to UniSA for assessment.
- It is the responsibility of each school to ensure that the requirements for assessment at the Regional Showcase event are set up and that devices required to demonstrate the work during the Zoom meeting are functional.
- Each of the other Regional Showcase elements will have an allocated judging time, this will need to be strictly adhered to. Content of presentations or answers to questions that exceed the allocated judging time will not be considered.
- The supervision of students and set up of equipment for the Regional Showcase event is the responsibility of the school.
- Please ensure you have tested your devices and installed any required apps to access Zoom prior to the allocated judging time. One device must be portable during the judging of the technology and engineering tasks to allow the judges to view the prototypes from requested angles.
- The deadline for all Checkpoint items is 8:00pm on the date listed in the timeline. All submissions must be available online by this time and link received electronically via the UniSA STEMIE email STEMIE@UniSA.edu.au
- It is the responsibility of the school to keep copies of all work submitted
- Please ensure the student team representing the school and presenting ANY CONTENT at the Regional Showcase does not exceed a total of six (6) students.
- Teachers contributing to content during the judging allocations could result in the team being ineligible for the STEMIE Final position.
- Students and teachers are welcome to watch the presentations and assistance with IT issues, holding cameras etc. are not considered content linking in the judging process.



STEM Innovation Experience Regional Showcase

STEMIE – The Regional Showcase

Students present a selection of their work in a judging timeslot via Zoom for the Regional Showcase.

Once qualified, a team of six (6) students will represent your school.

Each school will be judged on the following:

- Science Component – Formal presentation of the learning in the science activity.
- Technology Component – Judging of the Arduino coded prototype linked to their chosen theme.
- Engineering Component – Judging the function of the Engineering prototype
- Mathematics Component – “Question and Answer” session of seen and unseen questions and demonstration of their dynamic spreadsheet.

The dates for each of the Regional Showcase events are as follows:

- Allocation of judging timeslots opens in September; links will be sent to the schools contact teacher.
- Judging occurs as per allocated timeslots.
- Emails will be sent to announce the winners of each Regional Showcase once all the schools within that region have completed the judging process.

Schools will need to have the following on the day:

- Six (6) student representatives to present to judges, and their teacher to supervise.
- Presentation materials for the science component.
- Arduino coded Prototype for demonstration.
- Engineering device to be tested and judged.
- Dynamic spreadsheet and prepared answers to seen questions.
- Access to the Zoom link that will be sent to the school contact teacher on an iPad, Tablet, mobile device or similar to allow judges to view prototypes.
- Access to the Zoom link on a device that can share science presentation content and/or the mathematics spreadsheet.

Each school will be allocated a total on 1 ½ hours for their official judging timeslot, during which they will complete all assessment for the Regional Showcase event.

Students and their teacher will be required to be logged into the Zoom meeting for the duration of the judging timeslot.

In the event of a tie within a region, the overall task (Required Task 6) will be used to determine the winner. This needs to be available from the date of checkpoint 3, until the STEMIE Final date, via the online link supplied from the school.



STEM Innovation Experience

The STEMIE Final

STEM Innovation Experience – STEMIE Final

The winners from each of the Regional Showcase events and any Wildcard entries will be eligible to compete at the STEMIE Final to be held at the University of South Australia.

The STEMIE Final will consist of a series of unseen STEM and teamwork challenges to be completed against the clock. Errors will result in time penalties, so accuracy is important. Schools from across South Australia and any participating interstate teams will be competing at the event. The winning team will be the fastest team (including any time penalties) to complete all the challenges on the day.

The event will be held in November. Specific details will be sent to the winning schools and can be found in the *Key Dates* tab on the STEMIE Moodle.

<https://lo.unisa.edu.au/course/view.php?id=25118>

A maximum of six (6) students per participating school, accompanied by their teacher, will compete in unseen STEM challenges on the day. The teacher will have duty of care for their students at all times, including lunch breaks, but will not be able to assist students with the challenge content in any capacity.

All students that participate in the STEMIE Final will require a signed UniSA Media Release Form.

Note – Transport of students to and from the STEMIE Final is the responsibility of the school.

Further details about the event will be provided via email to the Regional Showcase event winners and any Wildcard entries closer to the date.

If you have any questions about STEMIE you can email
STEMIE@unisa.edu.au

