ENGINEERS
AUSTRALIA

The planet of Gondwana is in need of an engineering hero

Competition Rules 2017

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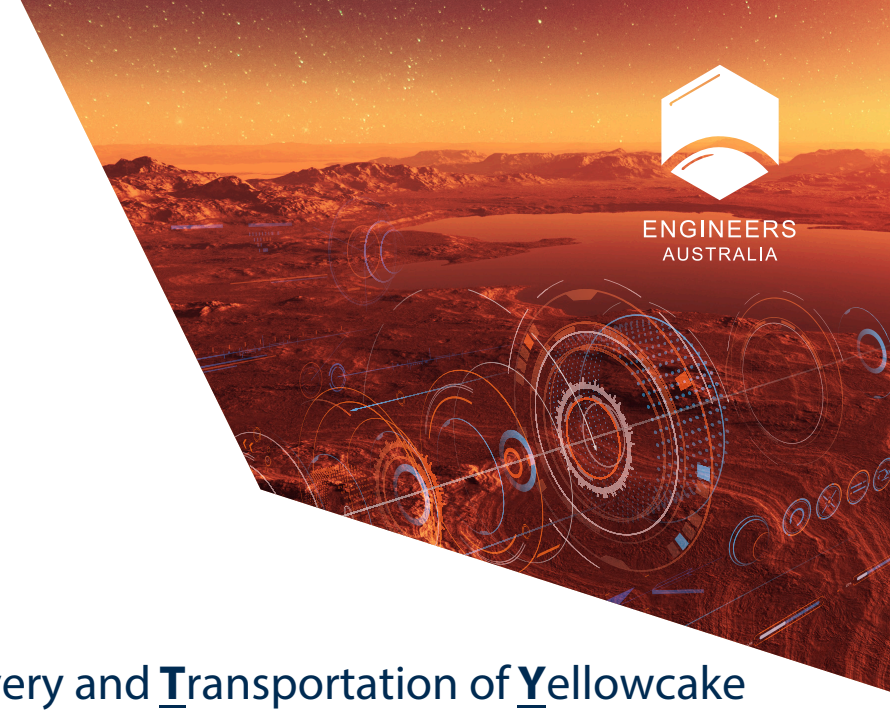

Project "THIRTY"

The Highly Ingenious Recovery and Transportation of Yellowcake

Context

Gondwana is a small planet orbiting a sun on the outer fringes of our Galaxy. Gondwana is in a large orbit where the sun's rays are weak. Fortunately there is a plentiful supply of concentrated Uranium ore in the form of hard crystals mixed with rocks. The concentration is sufficiently high to pose radiation risks to miners, so a transport and sorting system is required for the ore and rocks.

Dilemma

In the "ACME Pinnacle Laboratory", the Gondwanan Mining Agency (GMA) is currently examining the logistics of collecting and depositing the mined ore and waste. A concept for a new autonomous system to collect, sort and deliver the ore and waste is being investigated. The "run of mine" material is typically stored near the mine site in bins and must be delivered to waste and ore receival bins nearby. The GMA is struggling with the development of a system to efficiently and reliably collect and deliver the ore and waste in a timely manner.

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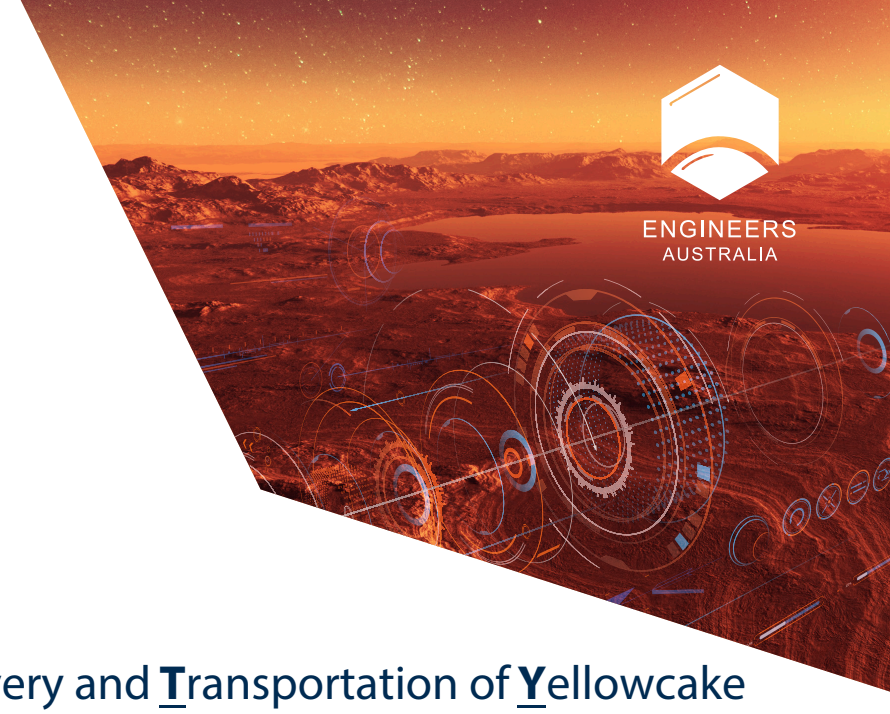

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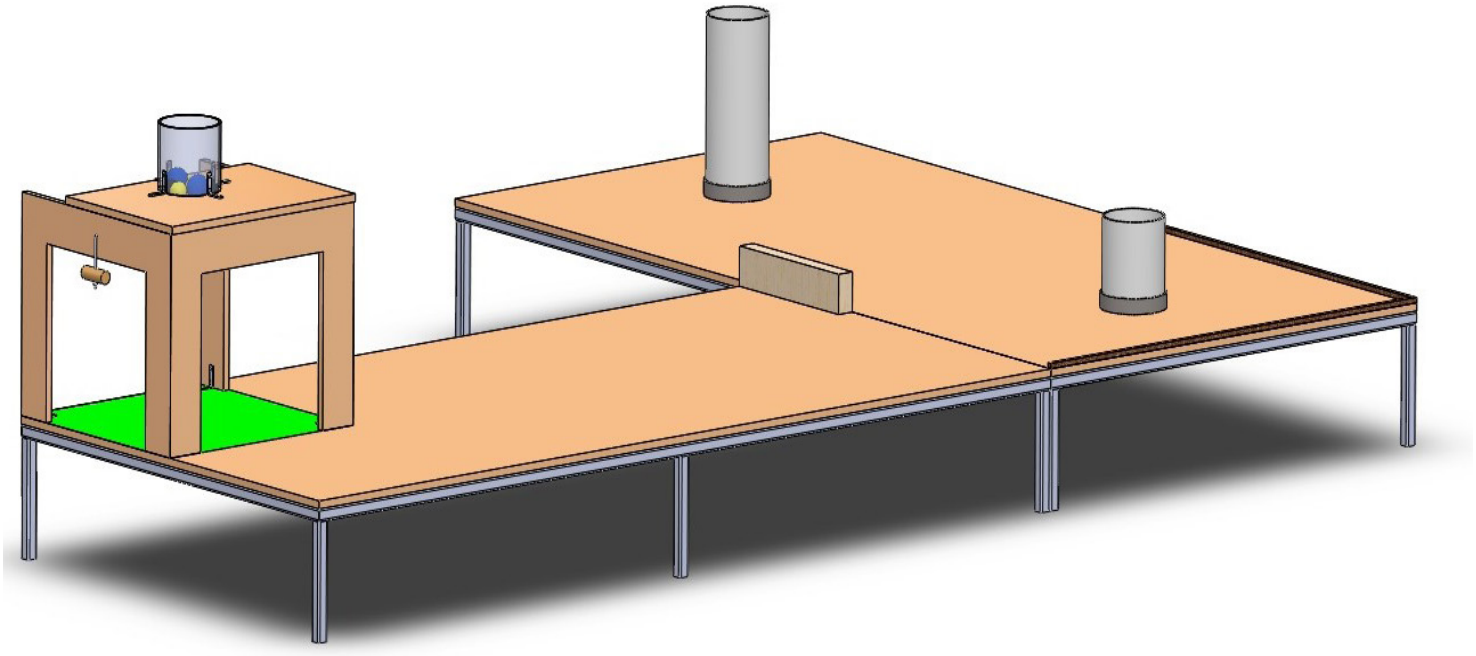
Challenge

The challenge is to design, build and test a "proof of concept" to collect and deliver the ore and waste to nearby receival bins. GMA staff are struggling to build a laboratory based concept to satisfy this task. Fortunately, teams of engineering students from Earth are about to visit Gondwana as part of their work experience programmes. On 29 previous visits engineering students have rendered invaluable assistance with such engineering problems, and on this thirtieth occasion the Gondwanans again seek help from these budding engineers.

Objective

The objective is to design, build and prove a "proof of concept" collection and delivery system in a laboratory environment that simulates conditions on the Gondwana mine site. For the "proof of concept" competition, points will be scored when your autonomous 'system' collects a mixture of two golf balls, two squash balls and two racquetball balls and when golf balls, representing valuable ore, are placed into one remote container and the other balls, representing waste, are placed in a second container, as quickly as possible and with the lightest 'system' possible.



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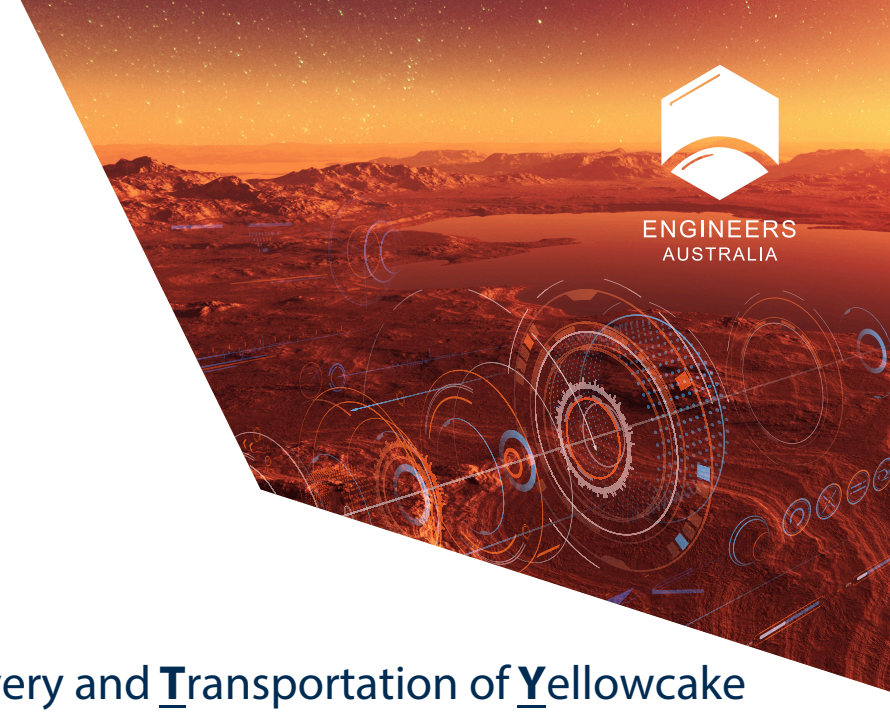

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Details to follow

- Competition Guidelines
- Competition Rules
- Frequently Asked Questions
- Further Competition Details
- Appendix A - General Arrangement and Detailed Drawings of Competition Track.

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Document Control

Version 1.0 - Released: 10 February 2017

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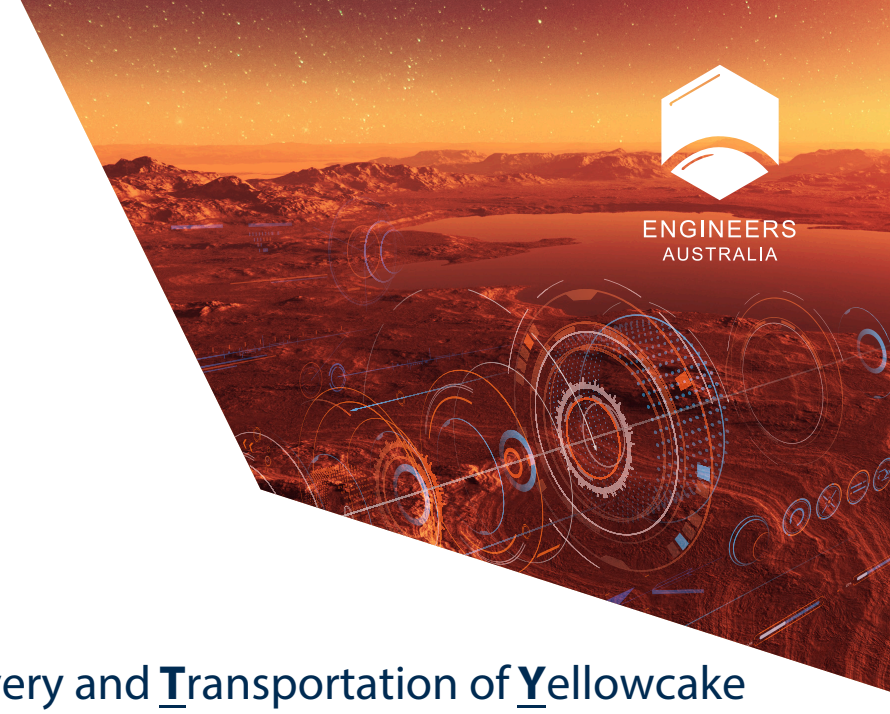

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Competition Guidelines

Glossary of Terms

Run of mine (ROM) - refers to ore and waste (ie; rock) in its natural or unprocessed state, as it comes from the mine.

Yellowcake - is a type of uranium oxide concentrate obtained in an intermediate step in the processing of uranium ores on Earth, or in natural, crystalline form on Gondwana.

Eligibility

G 1. Teams that are eligible to represent their campus in the National Final will consist of students from a first or second year engineering design course/subject/unit in an Australasian (or other countries, by arrangement) mechanical-based BE or 3+2 ME programme. Teams shall consist of at least two students, with teams of three or four strongly recommended, but it is recognised that larger teams may be educationally appropriate at some universities. If an alternative team structure is envisaged, the National Organiser should be consulted to ensure that other teams are not unreasonably disadvantaged.

Safety

G 2. Safety is of paramount importance when participating in this competition. All engineers should know that injury and damage to equipment and the environment occurs when the control of energy (in any form - whether strain, potential, kinetic or thermal) in a system is lost.

G 3. As appropriate, protective clothing, footwear, safety glasses or full face masks should be worn by students working on systems during construction, testing and competitions.

G 4. Students are encouraged to carry out a risk assessment for their system prior to campus testing. Students are encouraged to embrace risk management in their own activities and may need to demonstrate safe operation and produce risk assessment documentation in order to compete in either the campus heat or at the National Final.

G 5. This year the competition relies on the activation of a latch via a pull cord to release a flap gate beneath a storage bin. Campus Organisers should encourage students to consider the sudden release of energy and potential pinch points when completing their risk assessments.

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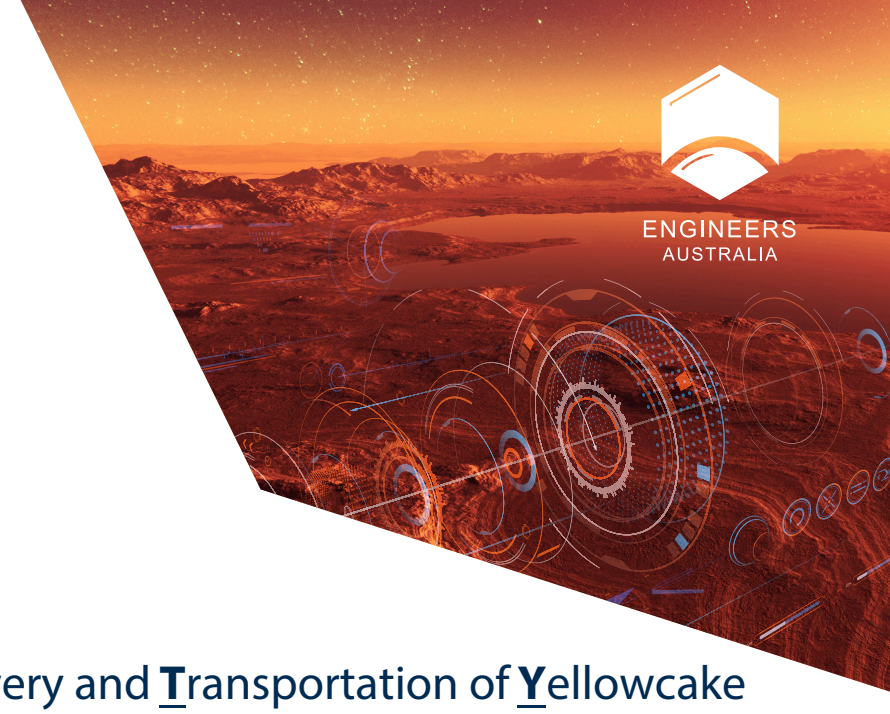

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Safety

G 6. Compressed gas systems may be used but students must gain local coordinator approval based on a safety assessment.

Such systems presented at the National Final will be examined against the following principles and must be acceptable to the National Coordinator.

- Home fabricated pressure system components shall not be used.
- Commercial components shall be used (unions, vessels, cylinders, lines, etc).
- Evidence of proof testing of compressed gas systems shall be provided.

To avoid disappointment, students using compressed gas MAY consult with the National Coordinator prior to arrival at the National Final. The National Coordinator's approval decision will be final after examination of the presented system and documentation at the National Final.

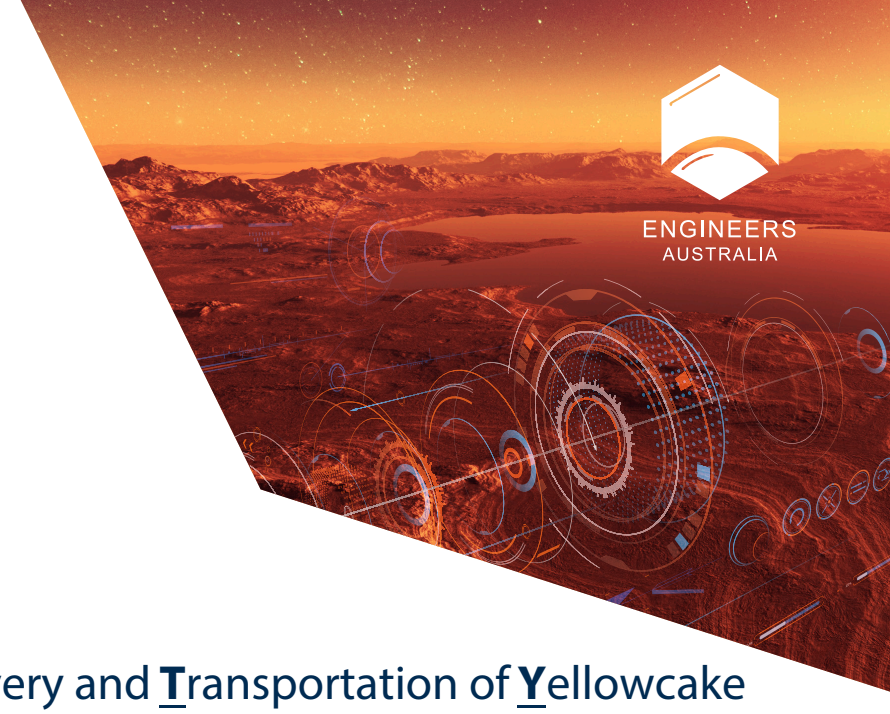
G 7. Systems that are deemed by the officials and judges to be hazardous will not be permitted to run. Employing any form of combustion is considered hazardous.

Competition Track, Equipment and Environment

G 8. The competition track shall be fabricated using primarily two sheets of Medium Density Fibreboard (MDF), each with nominal dimensions 2400 x 1200 x 18 mm, arranged as shown in Figure 1 with detailed drawings included as Appendix A. The supporting frame for these sheets may be fabricated by any convenient method.

NOTE: MDF sheets as supplied are slightly larger than the nominal 2400 x 1200 mm dimensions and are generally 2420 x 1210 mm. All dimensions shown in Appendix A are based on sheet sizes of 2400 x 1200 mm. Competition Tracks at the National Finals shall be constructed from 2400 x 1200 mm sheets in accordance with Appendix A.

G 9. The two MDF sheets and relevant attached features shall be identified respectively as Track Segments 1 and 2 as shown in Figure 1. The attached features shall include; the MDF panels defining the Loading Shed walls, the MDF panel supporting the Run of Mine (ROM) Storage Bin, the 150 mm tall x 150 mm dia PVC pipe forming the ROM Storage Bin, the 90 x 45 mm timber wall across Track Segment 1, the 200 mm tall x 150 mm dia PVC pipe and push on cap forming the Ore Receival Bin, the 400 mm tall x 150 mm dia PVC pipe and push on cap forming the Waste Receival Bin, the DAR 12 x 12 mm timber partially surrounding the Ore Receival Bin, and collectively shall be identified as the Competition Track.



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Competition Track, Equipment and Environment

G 10. The upper surfaces of the two MDF sheets of Track Segments 1 and 2 shall define the competition base plane which is nominally horizontal. The heights of the Track Segments shall be adjusted so that the step between the two track segments does not exceed 2.0 mm.

G 11. The competition base plane shall be no less than 300 mm above the supporting floor at the National Final.

G 12. Track Segments 1 and 2 shall be orientated perpendicular to each other, as shown in Figure 1 and detailed in Appendix A.

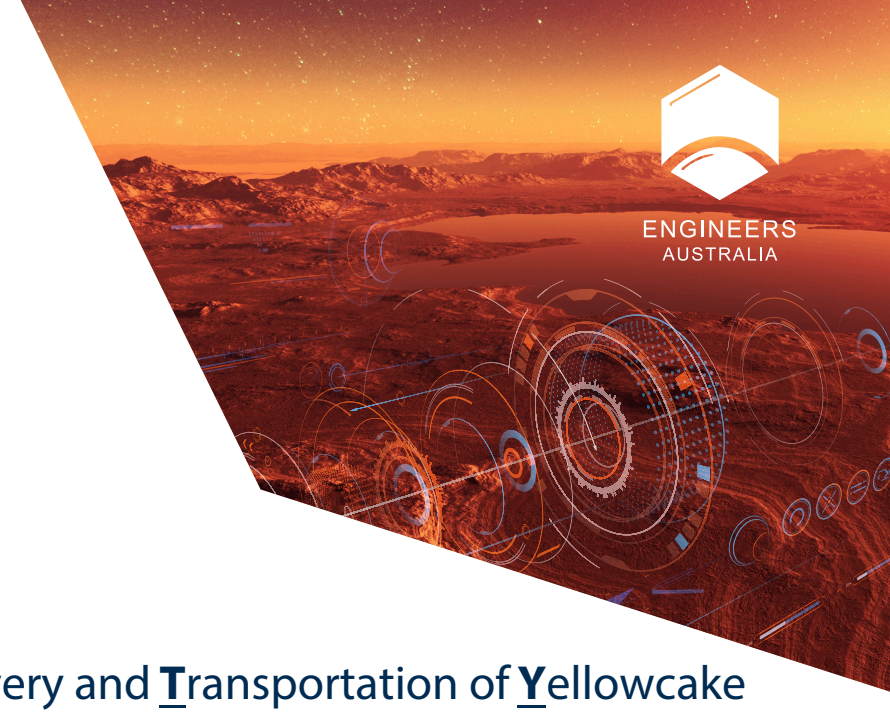
G 13. Track Segment 1 shall contain the Start Zone at one end which is representative of a Run of Mine (ROM) storage and discharge system. The system comprises of a ROM Storage Bin and Loading Shed as shown in Figure 2.

G 14. The ROM Storage Bin shall contain a flap gate at the outlet that is activated by a pull cord that releases a latch as shown in Figure 3. The latch shall be constructed from 18 mm MDF and DAR 12 x 12 mm timber, and hinged as per Figure 3, with a suitable hinge shown in Figure 4. The two flap gates at the outlet of the ROM Storage Bin shall be constructed from 18 mm MDF and piano hinges as shown in Figure 5. The ROM Storage Bin shall be constructed from 150 mm tall x 150 mm dia PVC pipe as shown in Figure 6.

G 15. The Loading Shed shall be constructed from 18 mm MDF and 50 mm angle brackets. Suitable angle brackets are pictured in Figure 7 and detailed in Appendix A.

G 16. A 90 x 45 mm timber wall shall be fixed to Track Segment 1, as shown in Figure 1.

G 17. Track Segment 2 shall contain the 200 mm tall x 150 mm dia PVC pipe forming the Ore Receival Bin as shown in Figure 6. The pipe shall be held in place using a 150 mm PVC push on cap shown in Figure 7 that shall be secured to Track Segment 2. The fit between the pipe and the push on cap shall be sufficient to hold the pipe in place. The overall height of the Ore Receival Bin relative to the competition base plane will be greater than 200 mm due to the thickness of the push on cap.



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Competition Track, Equipment and Environment

G 18. Track Segment 2 shall contain the 400 mm tall x 150 mm dia PVC pipe forming the Waste Receival Bin as shown in Figure 6. The pipe shall be held in place using a 150 mm PVC push on cap shown in Figure 7 that shall be secured to Track Segment 2. The fit between the pipe and the push on cap shall be sufficient to hold the pipe in place. The overall height of the Waste Receival Bin relative to the competition base plane will be greater than 400 mm due to the thickness of the push on cap.

G 19. Track Segment 2 shall contain a partial border that will be formed with strips of DAR 12 x 12 mm timber in one corner as shown in Figure 1 and detailed in Appendix A.

G 20. All exposed surfaces of the MDF and timber shall be brush coated with one coat of Wattyl Water Based Estapol Clear – Satin followed by two coats of Wattyl Estapol Matt.

G 21. The payload used for the competition will be 2 regulation golf balls (yellow in colour), 2 regulation yellow dot squash balls (black in colour) and 2 regulation racquetball balls (blue in colour). The yellow golf balls shall represent the ore. The squash balls and racquetball balls shall represent the waste material. All balls shall be loaded randomly into the ROM Storage Bin prior to the start of the run (see R17).

NOTES:

(1) As defined under the Rules of Golf, a golf ball weighs no more than 1.620 oz (45.93 grams) and has a diameter not less than 1.680 in (42.67 mm). Yellow golf balls shall be used as per G21.

(2) As defined under the Rules of Squash, a squash ball weighs 24.0 ± 1.0 gram and has a diameter of 40.0 ± 0.5 mm. Yellow dot squash balls (black in colour) shall be used as per G21.

(3) As defined under the Rules of Racquetball, a racquetball ball weighs approximately 1.4 oz (39.69 grams) and has a diameter of 2 ¼ in (57.15 mm). Blue racquetball balls shall be used as per G21.

G 22. Teams must accept that the presence of bright lighting and photography including flash and infrared systems are part of the competition environment.

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Figure 1 - Isometric view of competition track

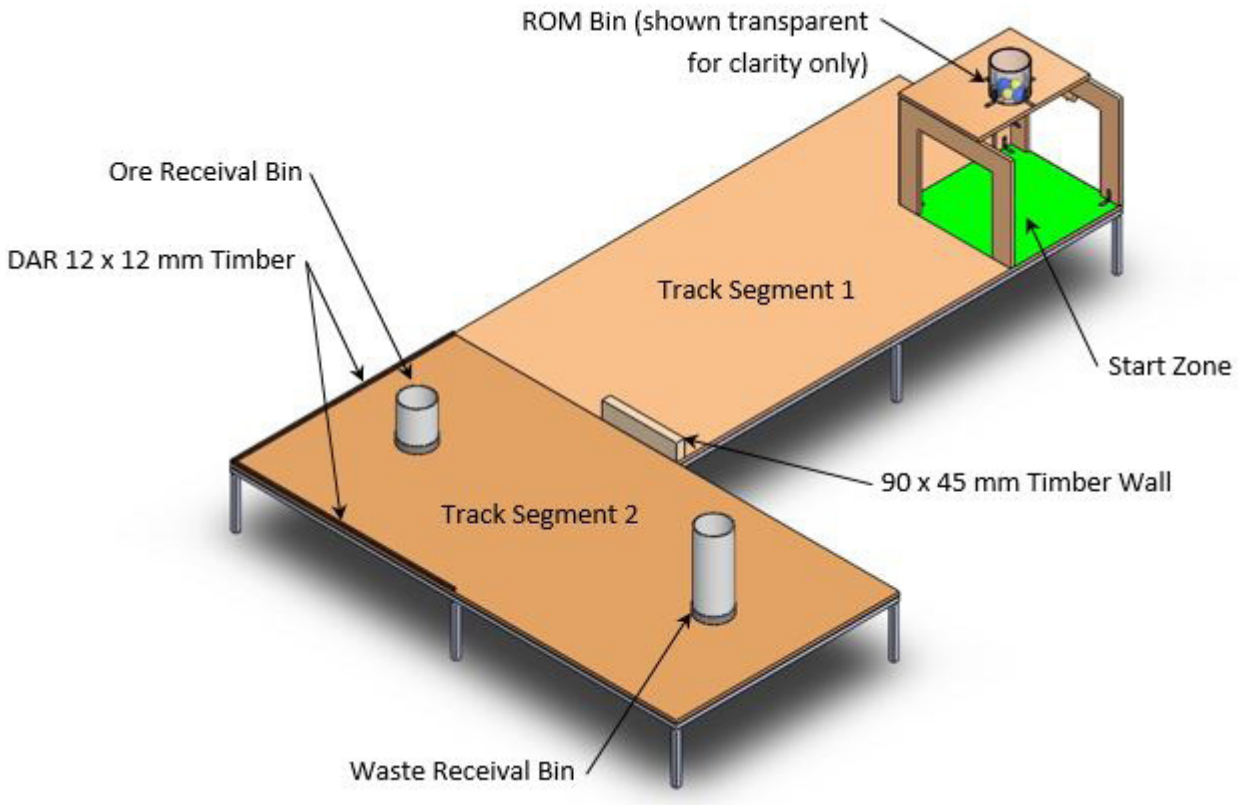

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Figure 2 - Isometric view of start zone

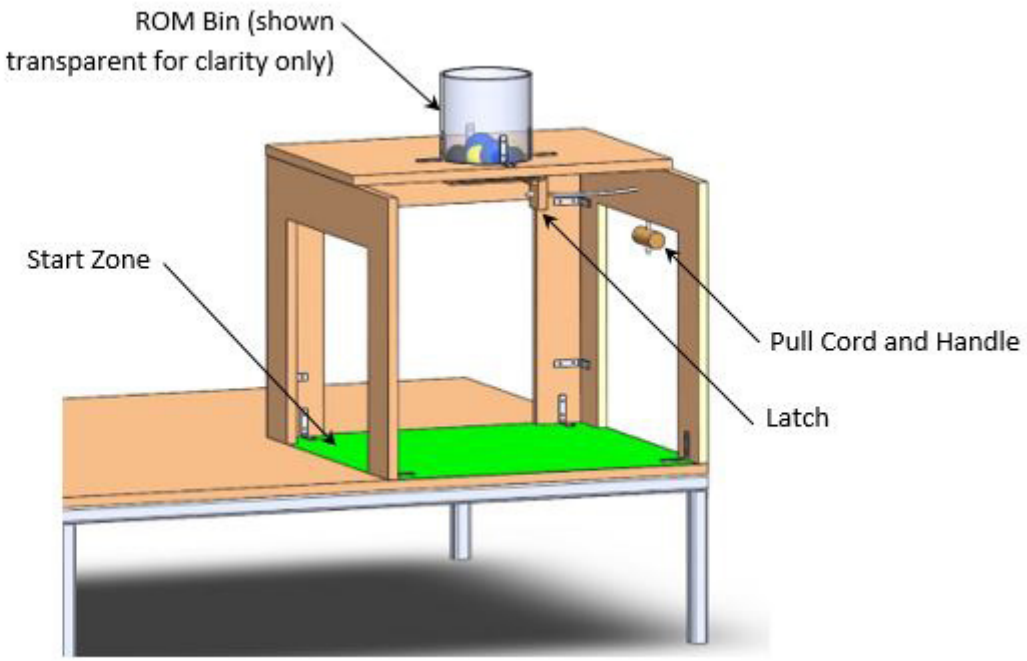
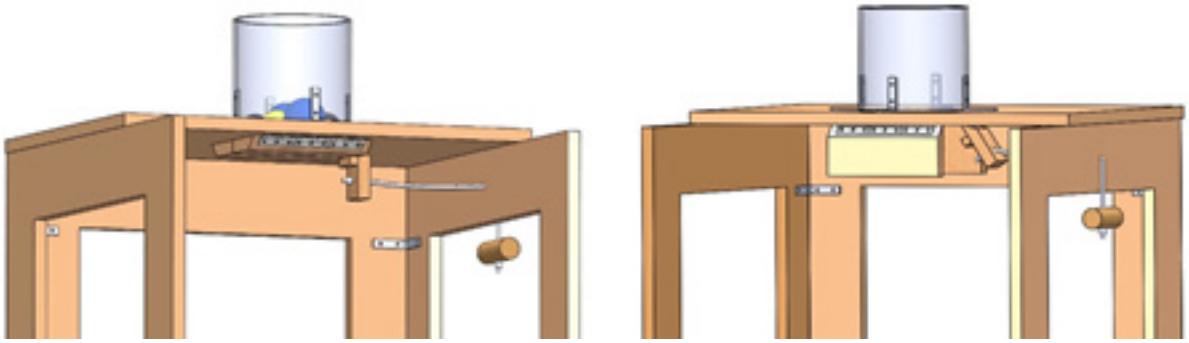


Figure 3 - Detailed View of ROM bin and flap gate



A: GATES CLOSED

B: GATES OPEN

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Figure 4 - Zenith 35mm Zinc Plated Fixed Pin Butt Hinge
(available at Bunnings for $3.20 each)

Figure 5 - Zenith 305mm Nickel Plated Continuous Hinge
(available at Bunnings for $6.95 each)

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Figure 6 - Holman 150mm x 1m PVC DWV Pipe (available at Bunnings for $23.00 each)

Figure 7 - Holman 150mm PVC DWV Push on cap (Available ot Bunnings for $7.90 each)

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Figure 8 - 50mm angle brackets (available at Bunnings for $4.54 pkt of 4)

Figure 9 - Uni Pro 4.6L Painters Bucket - Lid not required
(available ot Bunnings for $6.80 each)

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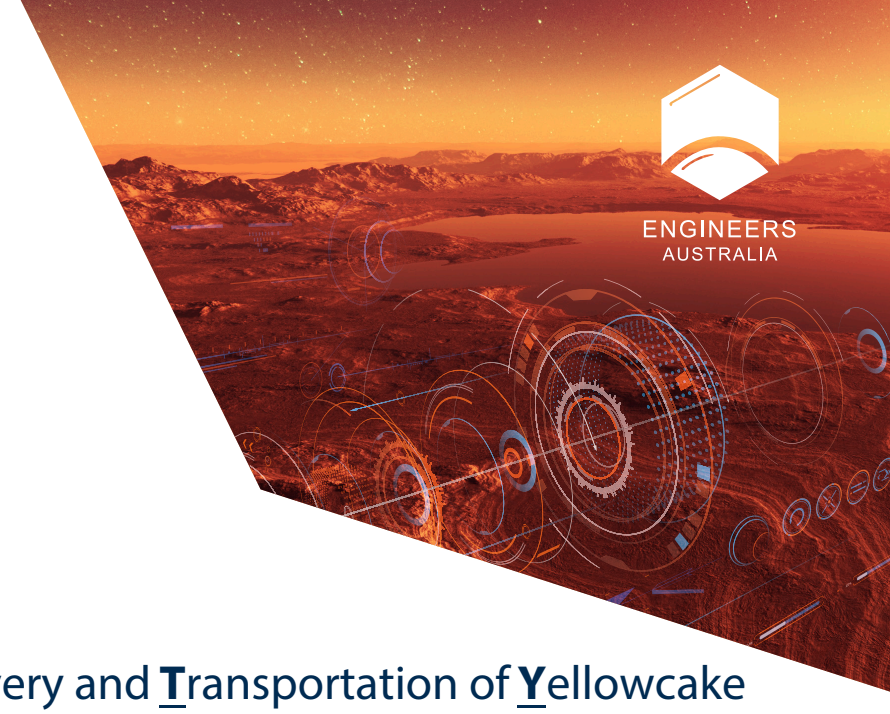

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Proof of concept system

G 23. The system shall collect and deliver the payload on the defined competition track in accordance with the rules.

G 24. The system shall represent essentially a ground based solution.

G 25. The system will be initially positioned in the Start Zone and be fully supported by the base plane of the competition track.

G 26. Campus organisers are free to modify the rules and or competition track for their local competition but the guidelines and rules as stated shall be strictly adhered to at the National Final.

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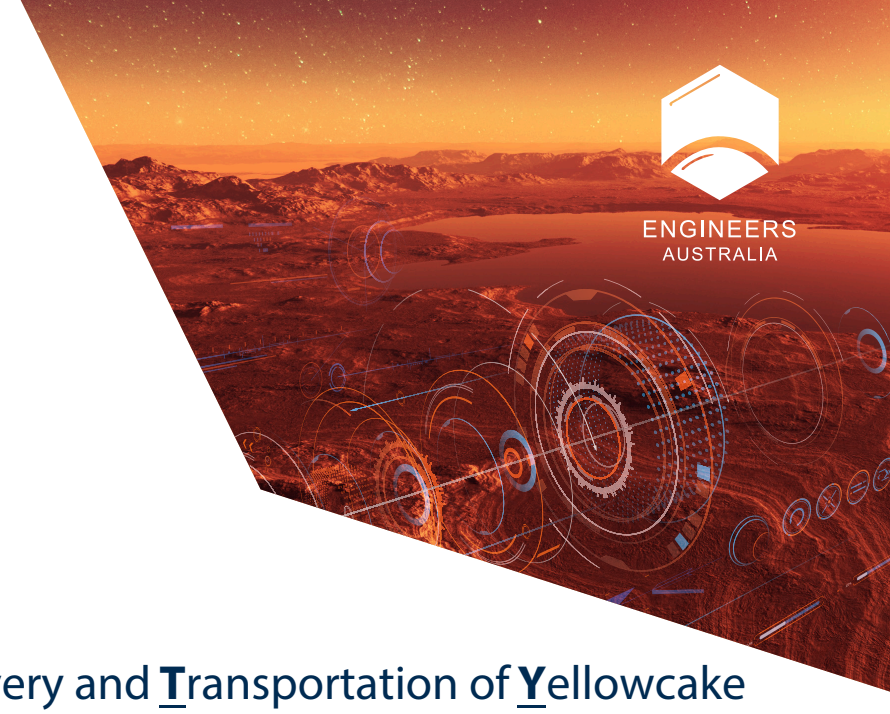

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Competition Rules

Rule wording

R 1. The language of the rules is tiered. Those clauses expressed as "SHALL" are mandatory and failure to comply will attract penalties which in the extreme could lead to disqualification at the National Final. Those expressed as "SHOULD" or "MAY" reflect some level of discretion and choice.

R 2. The payload refers to the golf balls representing the ore, and the squash and racquetball balls representing the waste material. Individually, the golf balls, racquetball balls and squash balls SHALL be known as payload elements.

Materials and Manufacture

R 3. Students SHALL manufacture and fabricate their "proof of concept" system themselves using commonly available materials, components and methods.

NOTE: At the National Final Campus Organisers may be required to confirm that the system presented has been appropriately manufactured in keeping with the spirit of the competition. While students may purchase components "off-the-shelf", it is not intended that they purchase systems / major subsystems as solutions directly.

R 4. In keeping with the spirit of the competition, teams SHALL NOT use LEGO Mindstorm or similar comprehensive kitted systems at the National Final.

R 5. In keeping with the spirit of the competition, teams MAY use Arduino or similar PIC based components.

R 6. In keeping with the spirit of the competition, teams MAY adapt / modify / integrate elements sourced "off-the-shelf".

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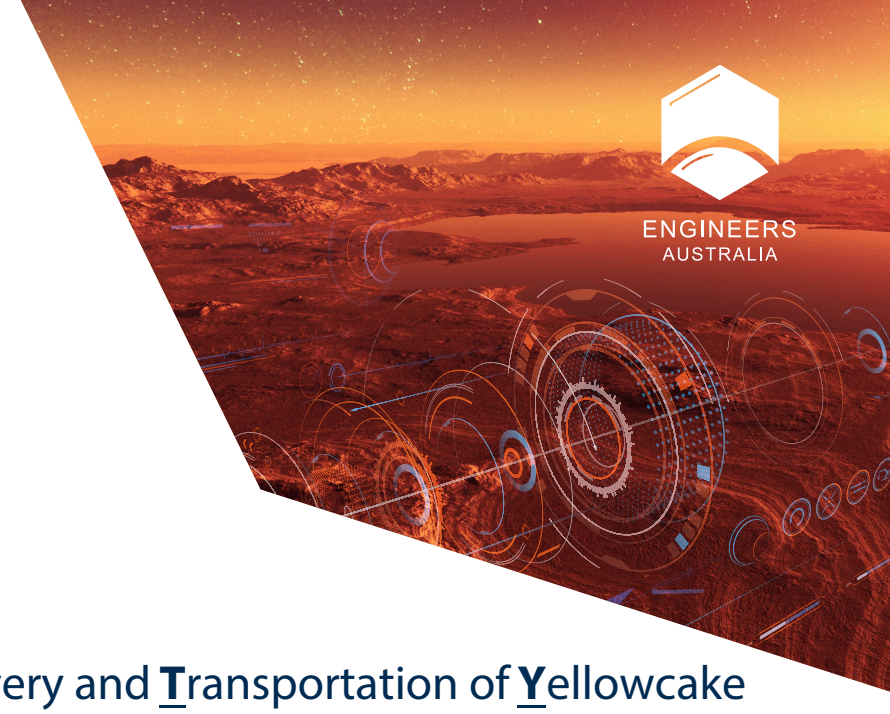

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Procedure

R 7. The mass of the team's system SHALL be measured by an official. The system mass (i.e. without payload) SHALL NOT be greater than 6 kilograms.

NOTE: A maximum system mass of 6 kg has been selected to reflect new carry on allowances by Jetstar and Virgin airlines so as not to disadvantage interstate and international teams travelling to the National Finals who MAY wish to transport their system as carry on. Teams must appropriately satisfy the airlines restrictions/limitations for carry on and/or checked luggage, including restrictions for transporting batteries.

R 8. The team SHALL then be called to the track side.

R 9. Contact by team members or their system with the competition track before setup commences is prohibited.

R 10. When ready an official will signal that the setup SHALL commence. The team SHALL be allowed a maximum of 120 seconds for setup. In this time they are to set up their system in the Start Zone.

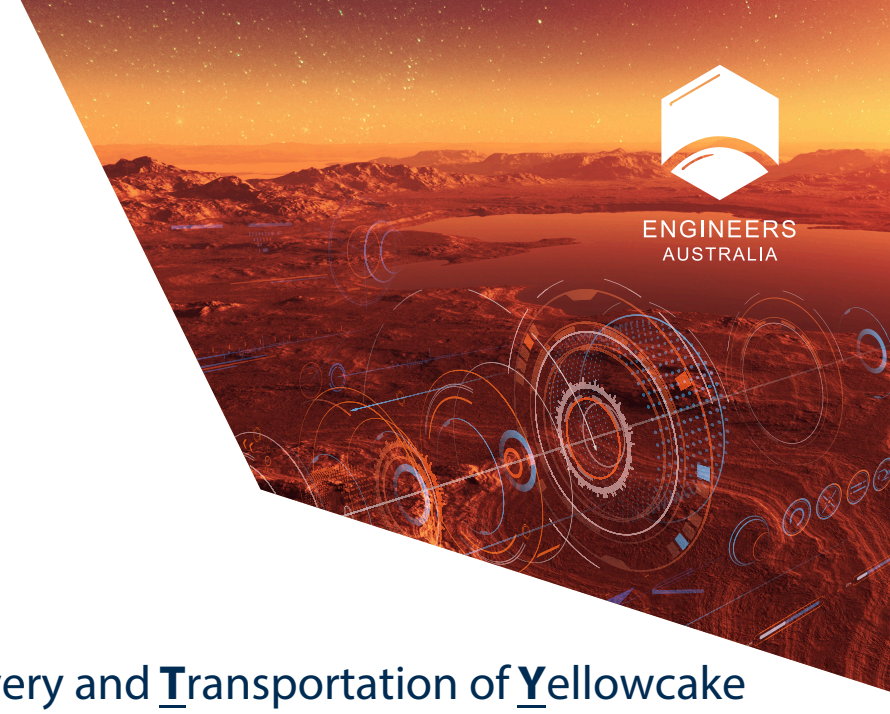
R 11. During setup, the team MAY use additional objects not considered part of the "system" to assist with setup.

R 12. During setup, contact SHALL NOT be made by team members, their system, or any additional objects used to assist with setup, with any portion of the competition track other than the internal faces of the Loading Shed. The internal surfaces of the Loading Shed includes the internal faces of the MDF front and side walls, internal face of the MDF supporting the ROM Bin, the 50 mm angle brackets, inside edges of the three 400 mm square openings, and the competition base plane bounded by the external faces of the front and side walls.

R 13. The Team SHALL indicate to the appropriate "official" when their setup is complete.

R 14. After setup, and prior to running, everything placed and left on the competition track SHALL be considered to be part of the system.

R 15. After setup, and prior to running, the system SHALL be subject to volume constraints. The system SHALL be wholly contained within the start zone as defined by the size of the Loading Shed, i.e.; the height and projected plane of the external faces of the front and side walls, and the edges of Track Segment 1. The volume and positioning conditions SHALL be physically checked by an official.



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Procedure

R 16. After set up and prior to running, the system SHALL NOT be held or supported or contacted by anything other than the competition base plane and must be ready to start. The system SHALL NOT be in contact with or be restrained by the walls of the Loading Shed. The system SHALL NOT be restrained by personal contact by team members. Systems SHALL be capable of remaining in the set up condition indefinitely.

R 17. An "official" SHALL load the payload (2 golf balls, 2 squash balls and 2 racquetball balls) from a suitable container (like that shown in Figure 9), with all balls mixed together by hand in the container and poured into the ROM Storage Bin so the payload is randomly arranged.

R 18. On instruction and by a signal from the "official starter" the run SHALL commence.

R 19. The run SHALL finish within 100 seconds. This will be judged by an "official".

R 20. The system SHALL be started by a team member pulling the pull cord handle to release the payload, followed if necessary by a single action that does not impart motion or energy to the system. The later SHALL be known as a dual action start.

R 21. No further system set up SHALL occur after the release of the payload.

R 22. After performing the single, or dual action start, team members SHALL NOT control or touch the system in any way during the run. Wireless control is specifically prohibited. Any interference by team members SHALL result in a zero score for the run. If team members choose to intervene to protect a system that is malfunctioning, a zero score for the run SHALL be recorded.

R 23. During the run the system SHALL NOT come into contact with anything below the competition base plane (defined in G10).

R 24. At the completion of the run, the system SHALL cease translation on the competition track and remain in this state indefinitely relative to the competition base plane. Mechanisms and items within the system MAY continue to move but no further functions can be executed.

R 25. The team MAY indicate to the timekeepers when they declare their run to be complete. However, the time keepers SHALL make the final judgment as to when the system ceases translation and all functions have ceased and the recorded time MAY exceed the team's declaration.

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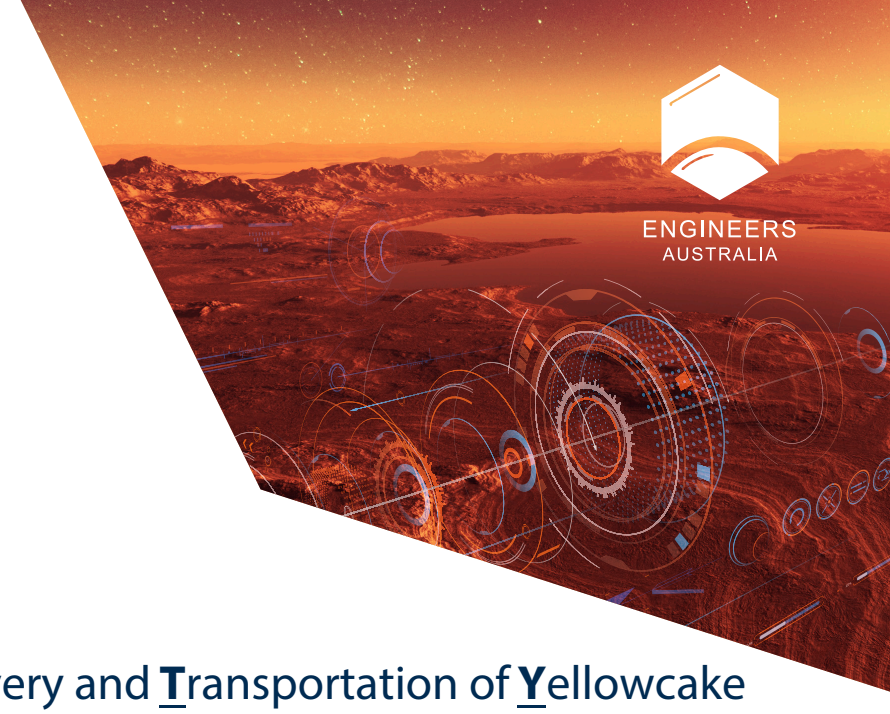

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Procedure

R 26. To ensure that judging has been completed teams SHALL NOT retrieve their system or assist in gathering other items until directed by an official.

R 27. The system SHALL NOT damage or contaminate the competition track. Teams presenting a system that damages or is deemed to have potential to damage the track may be disqualified from the competition.

EXPLANATORY NOTE: A component of the system left simply on the competition track does not constitute contamination.

R 28. As directed, teams MAY attempt two runs.

R 29. The system MAY be modified between runs but the mass, volume and time constraints must be satisfied for a run to achieve a valid non-zero score.

R 30. Violations of procedural rules SHALL result in a zero run score being recorded.

R 31. The judges' decisions on all matters pertaining to the competition SHALL be final.

Scoring

R 32. Better systems will achieve the objectives of collecting and depositing the payload in the least time, whilst adhering to volume and positioning constraints.

R 33. The run score SHALL be calculated using the formulas on the following two pages:

$$RUNscore = COLLECTscore + TRANSPORTscore + DEPOSITscore + TIMEscore$$

Calculated to one decimal place, where at the end of the run:

$$COLLECTscore = 2.5 \times NUM\_BALLS\_COLLECTED \times START$$

Where:

NUM_BALLS_COLLECTED = 0, 1, ..., 6

START = 1 if the ball drop initiates the start of the system and the system (and any balls collected) fully leaves the Start Zone

= 0.5 if a dual action start of the system is necessary (see R20) and the system (and any balls collected) fully leaves the Start Zone

= 0 otherwise

See R34 for the definition of "collected" and R20 for the definition of the start of the system

$$TRANSPORTscore = \sum_{i=1}^{6} BALL\_ENDSTATE(i)$$

Where:

i = 1 to 6; representing the total number of balls collected (payload elements)

BALL_ENDSTATE(i) = 2.5 if ball is in either receival bin, or the ball is controlled by the system and the system is fully on or above, or entirely supported by Track Segment 2 at the end of the run

= 1 if ball is controlled by the system and the system is fully or partially on or above Track Segment 1, but outside of the Start Zone at the end of the run

= 0 otherwise

See R35 for the definition of "controlled"

$$DEPOSITscore = \sum_{i=1}^{6} BALL\_DEL(i)$$

Where:

BALL_DEL(i) = 10 for each yellow golf ball that is controlled and Deposited into the Ore Receival Bin

= 10 for each squash ball and each racquetball ball that is controlled and deposited into the Waste Receival Bin

= -5 for each yellow golf ball that is deposited into the Waste Receival Bin

= -2.5 for each squash ball or racquetball ball that is deposited into the Ore Receival Bin

= 0 otherwise

See R36 for the definition of "deposited"

$$TIMEscore = 10 - RUNTIME/10$$

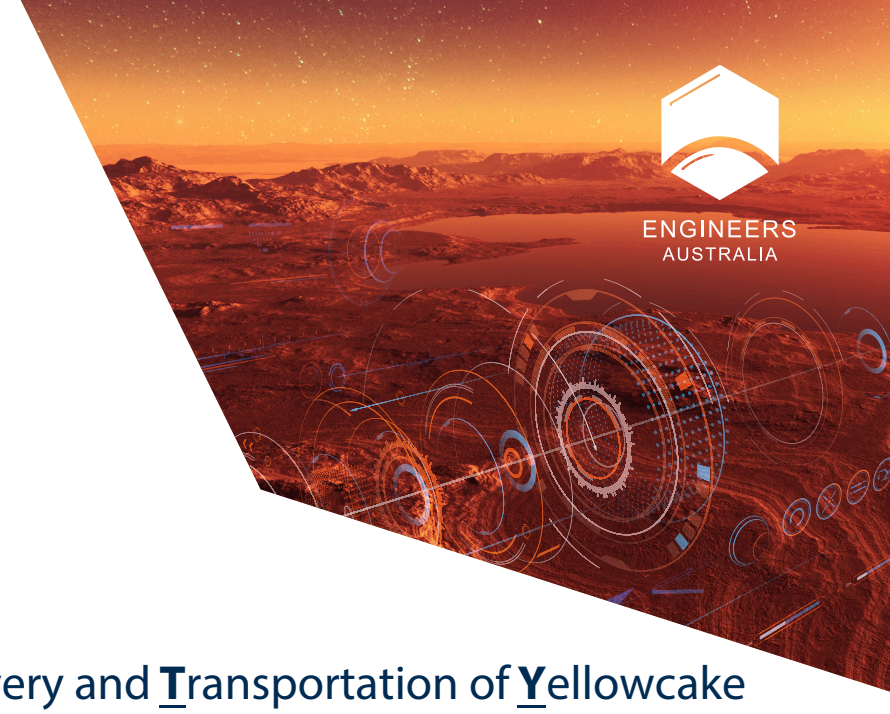
Where:

RUNTIME = Time for complete run rounded up to the nearest whole second (e.g. 15.2s becomes 16s) if system fully on or above, or entirely supported by Track Segment 2

= 100 otherwise

The following data shall also be recorded for each run:

MASS = Net mass of system in grams



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Scoring

R 34. For a payload element to be considered "collected" after discharging from the ROM Storage Bin it shall be fully discharged from the bin, and in contact with or contained by the system until the system fully leaves the Start Zone.

R 35. For a payload element to be considered "controlled" by the system it shall be in contact with, or contained by the system, up until the ball is discharged into a receival bin or until the run is complete.

R 36. For a payload element to be considered fully "deposited" by the system it shall be fully contained within a receival bin (as defined by the top surface of the 150 mm PVC pipe) at the end of the run.

R 37. For a payload element to be considered fully outside the Start Zone, it SHALL be wholly outside the Loading Shed, as observed by a plan view projection from the external faces of the front and side wall at the end of the run.

R 38. The RUNTIME for the run SHALL be measured by officials as the time from the start command being given, to the system ceasing both translation on the competition track and gross motion above the competition base plane, and being able to remain in this state indefinitely relative to the competition track. Mechanisms and items in the system may continue to move but no further functions can be executed. The payload may continue to move within the Ore and Waste Receival Bins.

R 39. Each team MAY attempt two runs. The Competition Score shall be the higher RUNscore achieved from either run plus half the RUNscore achieved from the other run. The highest Competition Score shall be declared the winner. The system may be modified between runs but the mass, volume and time constraints must be satisfied for a run to achieve a non-zero run score.

R 40. If equal Competition Scores are recorded by teams, teams tied SHALL be ranked based on the RUNTIME recorded for their higher scoring run, with faster devices preferred. Time will similarly define other minor placings as necessary. If teams remain tied, teams tied SHALL be ranked based on the MASS recorded for their higher scoring run, with lighter devices preferred.

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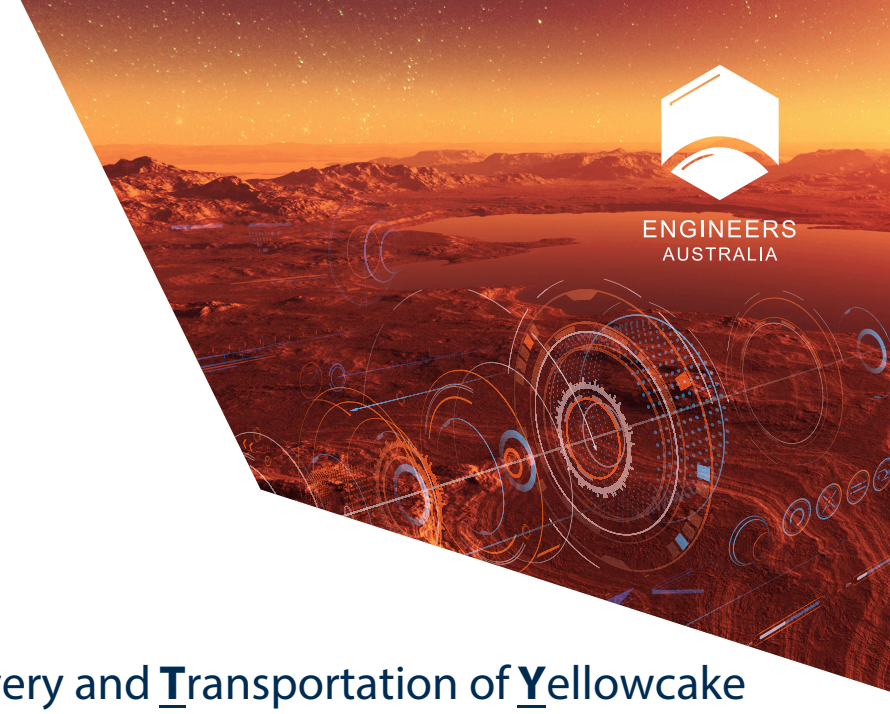

Project "THIRTY"

The Highly Ingenious Recovery and Transportation of Yellowcake

Frequently asked questions

1. Does the system have to stay in contact with the competition track at all times?

Yes. The scenario is for essentially a ground based system (see G24). The guidelines and rules do define what can be legally contacted (see G25, R23, etc).

2. Can part of a system be "discarded" off the competition track without penalty?

No. If the system, or part of the system, is discarded off the competition track this would lead to a zero run score (R23).

3. Can part of the system or payload overhang the extremities of the competition track without penalty when negotiating track segments 1 and 2?

Yes. The system can lie partly outside the track at completion of the run and not be penalised provided volume and positioning constraints of the system are met prior to running (see R15 and R16).

4. When is a system deemed to be stationary at the completion of the run?

The stop instant will be interpreted as the later of when all the contact points between the system and the competition site come to rest and when the functions being performed are observed to have ceased. It must be clear that the system could remain in the end state indefinitely. The payload may continue to move within the Ore and Waste Receival Bins.

5. Autonomous – does this mean that the system on the competition track cannot receive input or instructions from a Subsystem off the track (such as a computer)? Or does it mean that the system on the competition track can receive input from a Subsystem off the track (such as a computer) but that Subsystem (computer) cannot be manipulated by a team member during the run?
An example of the second would be if the system was controlled by motors that ran to a pre-programmed route transmitted from the computer.

Autonomous in this competition implies every control system for the system is to be part of the system on the competition track and fit within the start volumes. No remote-to-the-track control systems of any sort can be used (manual or pre-programmed, hard wired or wireless). Such configurations would be considered to be part of the system and violate position and volume constraints (see R16 and R22).

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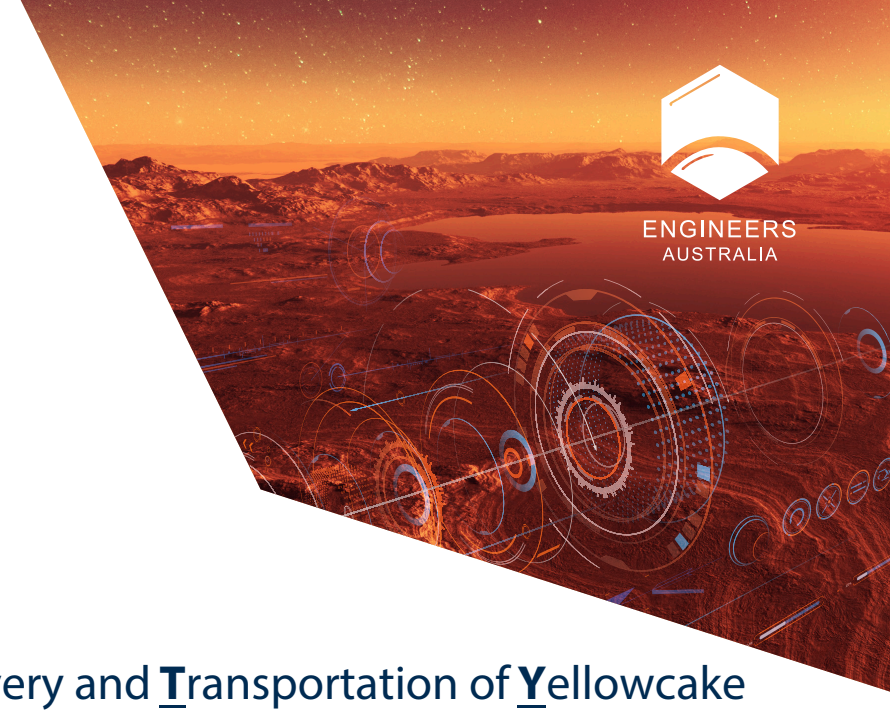

Project "THIRTY"

The Highly Ingenious Recovery and Transportation of Yellowcake

Frequently asked questions

6. Are programmable chips allowed?

Yes. You can use a programmable chip, but there is to be no remote communication during the run. However, LEGO Mindstorm or similarly kitted systems are not allowed (see R3).

7. What is the allowable voltage and power of any employed electrical systems?

There are no restrictions this year but it clearly needs to be safe.

8. Can off-the-shelf items be used?

Commonly available components such as toy and machine parts are able to be used. The spirit of the competition is that students manufacture and fabricate their system themselves, meaning that professionals are not engaged to do it for them. It is possible for some assistance to be obtained (e.g.; for a weld) but this should be minimal or where possible be done by the students themselves. The production of major components should not be outsourced.

9. Is there a requirement on the end state of the system at the completion of the run?

No. However R38 defines the state of the system that satisfies a completed run.

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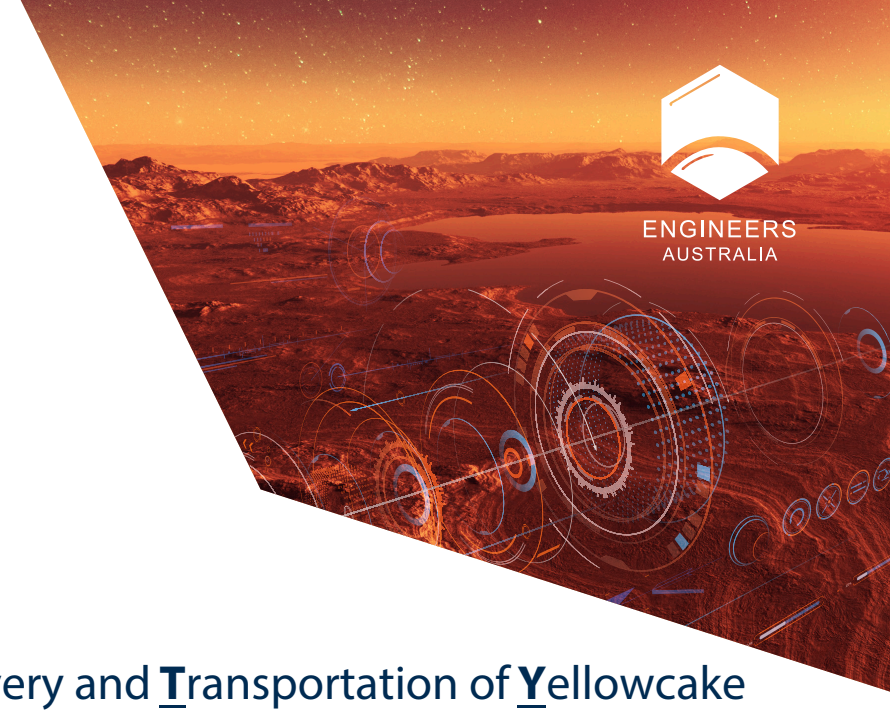

Project "THIRTY"

The Highly Ingenious Recovery and Transportation of Yellowcake

Further Competition details

National Final

It is planned that the Warman National Final will be held in late September to mid-October 2017 in Sydney at a location to be determined.

Prizes for Campus Winners and National Podium Places will be awarded at the National Final. A National Final "Judges' Prize" and an NCED "Design Prize" may also be awarded.

The planned format will have students gathering on Friday morning in Sydney. Lunch, followed by a tour of Weir Minerals Ltd will follow. Scrutineering and additional judging will be conducted on Saturday and there will be briefings, presentations and practice sessions held on Saturday. The actual running of the Final and the National Final Dinner will be on Sunday.

A team registration form will be available – please submit it to Engineers Australia (EA) as early as possible. Travel arrangements are coordinated by EA. Team details are required early August at the latest (unless otherwise advised).

Teams registering and accepting the invitation and sponsorship to participate at the Final also accept that their names and photographs and video of them can be used for publicity purposes by both EA and Weir Minerals. All team members and attending campus organisers will be required to sign an appropriate authority in relation to this use.

In meeting costs, the competition sponsorship has in past years funded two students per team. It is hoped that this will be possible again in 2017. Depending on funding, it is hoped that Campus organisers will also be funded. Campuses will be billed for additional students and for other people for whom arrangements are made whether or not they actually attend the Warman weekend.

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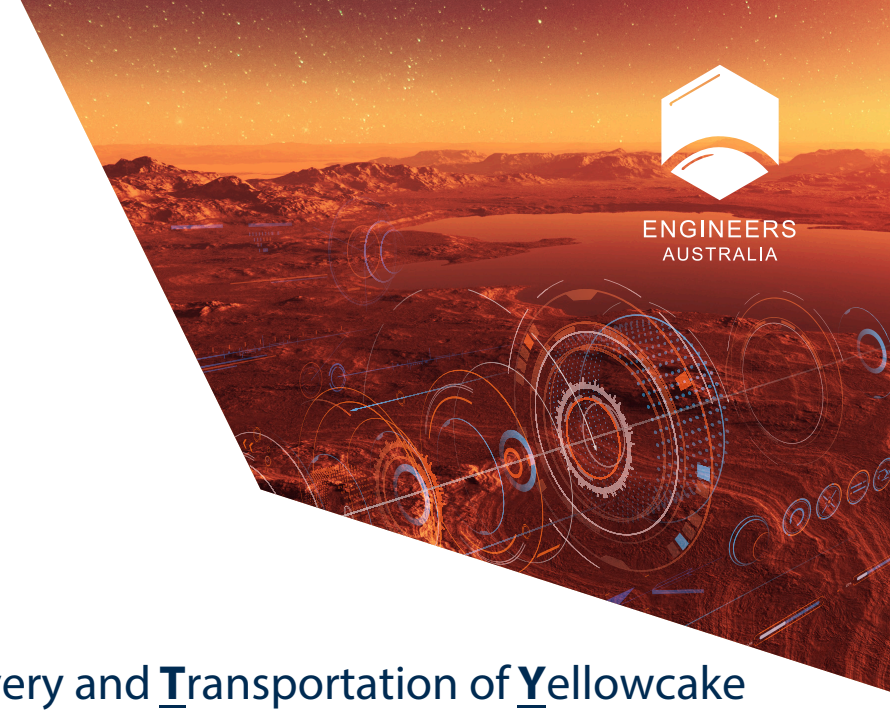

Project "THIRTY"

The Highly Ingenious Recovery and Transportation of Yellowcake

Further Competition details

Spirit of the Competition

Although the rules may look rigid you will find that they have been written in a way which allows, and in fact encourages, creative and innovative solutions. This is not always the case in real-world engineering projects. In this project and competition, the rules are there because we have tried to be very clear on points which will be important when student groups come together for the National Final. For this reason, it is essential to work with your campus organiser from an early stage, and for the campus organiser to verify decisions with the National Organisers so that everyone has the same understanding of the meaning of the rules.

If you think you see a loophole, clear it with your campus organiser before you rely on it in competition. Even if it is accepted at the local level, you might be in for a shock at the national level where the interpretation might be different. Provision will be made for confidentiality, so your idea will not be passed on to other students.

It is highly recommended that all students communicate with their campus organiser and that if a ruling is required by the National Organisers, this is sought by the campus organiser. Students SHOULD NOT contact the National Organisers directly for an individual ruling.

The competition tracks, both at the Campus Competitions and the National Final, will be made with reasonable care but because it is a real engineering object it may well be "wrong" in various small ways. For example the competition base plane might have a slight longitudinal slope. Your team is expected to consider these possibilities in your design, and develop a system that can function even if the competition track has slight imperfections and inaccuracies. In other words, you are not allowed to blame failure of your system on some minor imperfection with the competition track.

A Final Comment on safety

Please be aware that in 2003 during a campus competition, a student was lucky to escape serious eye injury when a Subsystem went off unexpectedly. While Campus organisers run their own competitions independently, they are strongly encouraged to consider all aspects of safety in relation to the conduct of their competition.

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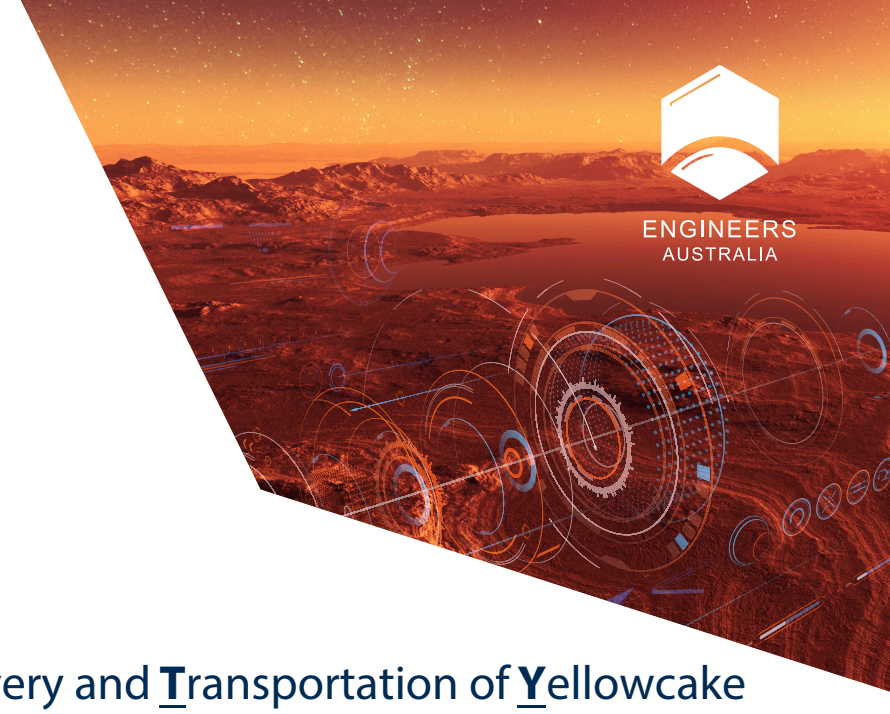


Project "THIRTY"

The Highly Ingenious Recovery and Transportation of Yellowcake

Appendix A - General Arrangement and detailed Drawings of Competition Track

Pages to follow:

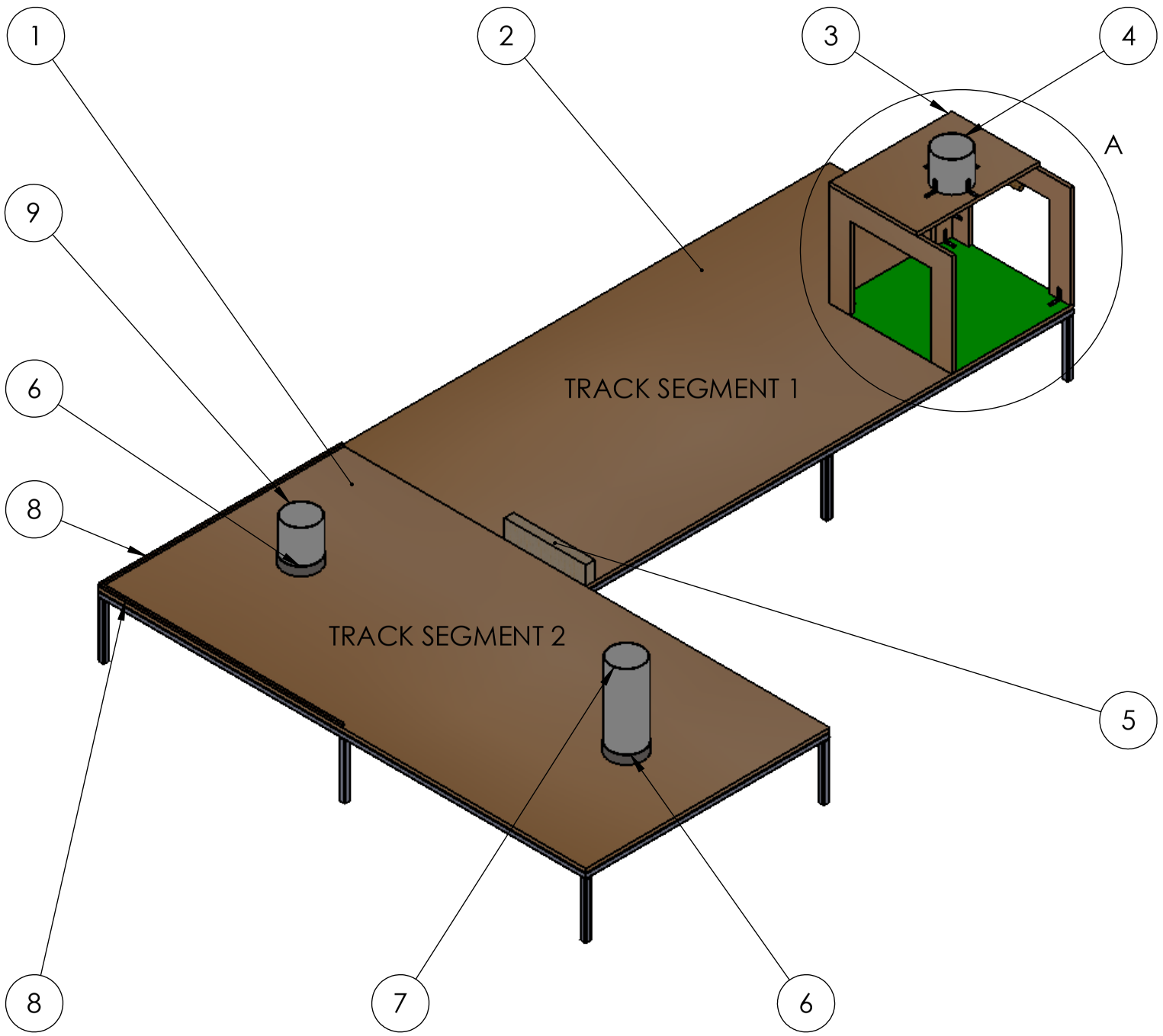
Sheet 1 - General Arrangment View

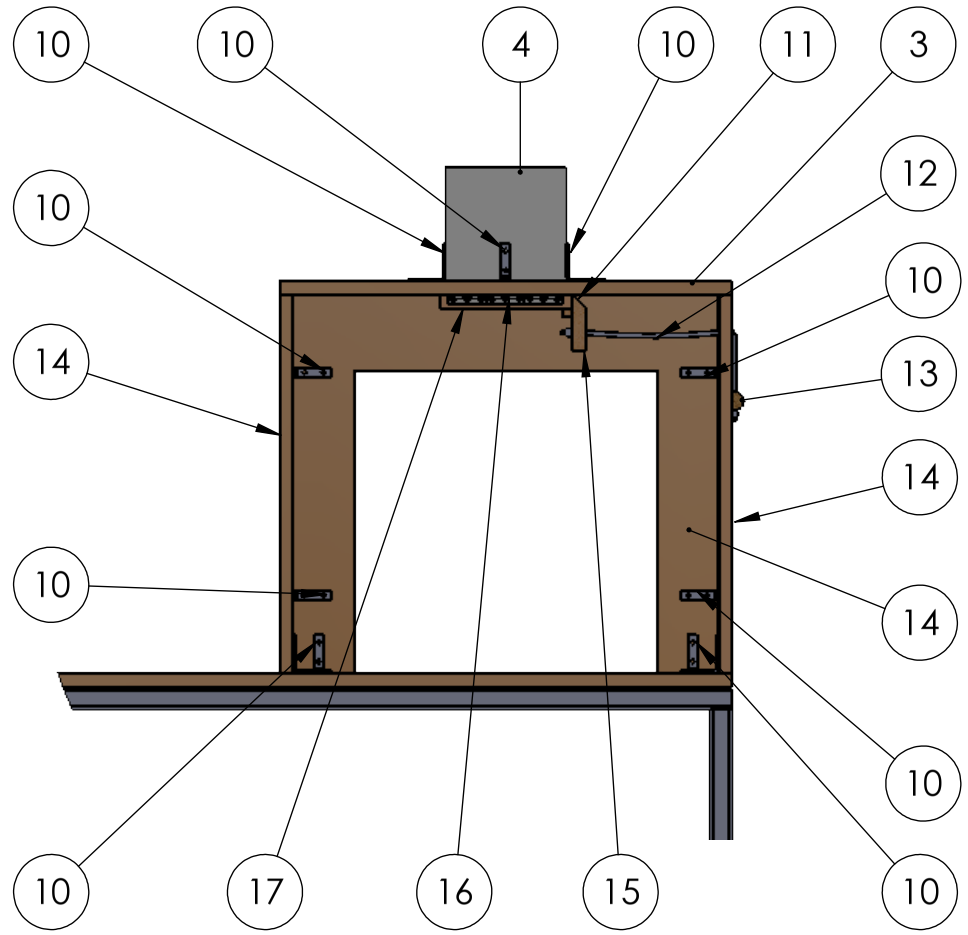
Sheet 2 - Track Details

Sheet 3 - Detailed Section

Sheet 4 - Miscellaneous Items

ITEM	QTY	DESCRIPTION	MATERIAL
1	1	TRACK SEGMENT 2	1200x2400x18 MDF SHEET
2	1	TRACK SEGMENT 1	1200x2400x18 MDF SHEET
3	1	SHED ROOF	430x600x18 MDF (SEE SHEET 3)
4	1	ROM STORAGE BIN	150MM PVC DWV PIPE (SEE SHEET 4)
5	1	TIMBER WALL	90x45 TIMBER (SEE SHEET 2)
6	2	PIPE END CAP	150MM PVC DWV PUSH ON CAP
7	1	WASTE RECEIVAL BIN	150MM PVC DWV PIPE (SEE SHEET 4)
8	2	TIMBER EDGE	DAR 12x12MM TIMBER
9	1	ORE RECEIVAL BIN	150MM PVC DWV PIPE (SEE SHEET 4)
10	12	BRACKET	50x50 ANGLE BRACKETS
11	1	LATCH HINGE	35MM FIXED PIN BUTT HINGE
12	1	PULL CORD	4MMx300MM PVC POLY FIBRE ROPE
13	1	HANDLE	25MM TIMBER DOWEL (SEE SHEET 4)
14	3	SHED WALLS	600x500x18 MDF (SEE SHEET 3)
15	1	LATCH	SEE SHEET 4
16	2	FLAP GATE HINGE	305MM CONTINUOUS HINGE
17	2	FLAP GATE	75x175x18 MDF (SEE SHEET 4)





DETAIL A
SCALE 1 : 10

DEBUR ALL SHARP EDGES
ALL ROUNDS ARE R1mm UNLESS OTHERWISE STATED

REV	DESCRIPTION	BY	DATE	APPV'D
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TOLERANCES
DECIMALS
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ANGLES
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TITLE: 2017 WARMAN COMPETITION - GENERAL ARRANGEMENT

PROJECT NO:	APPV'D	C.WHEELER		10/02/2017	DRAWING NO: 001
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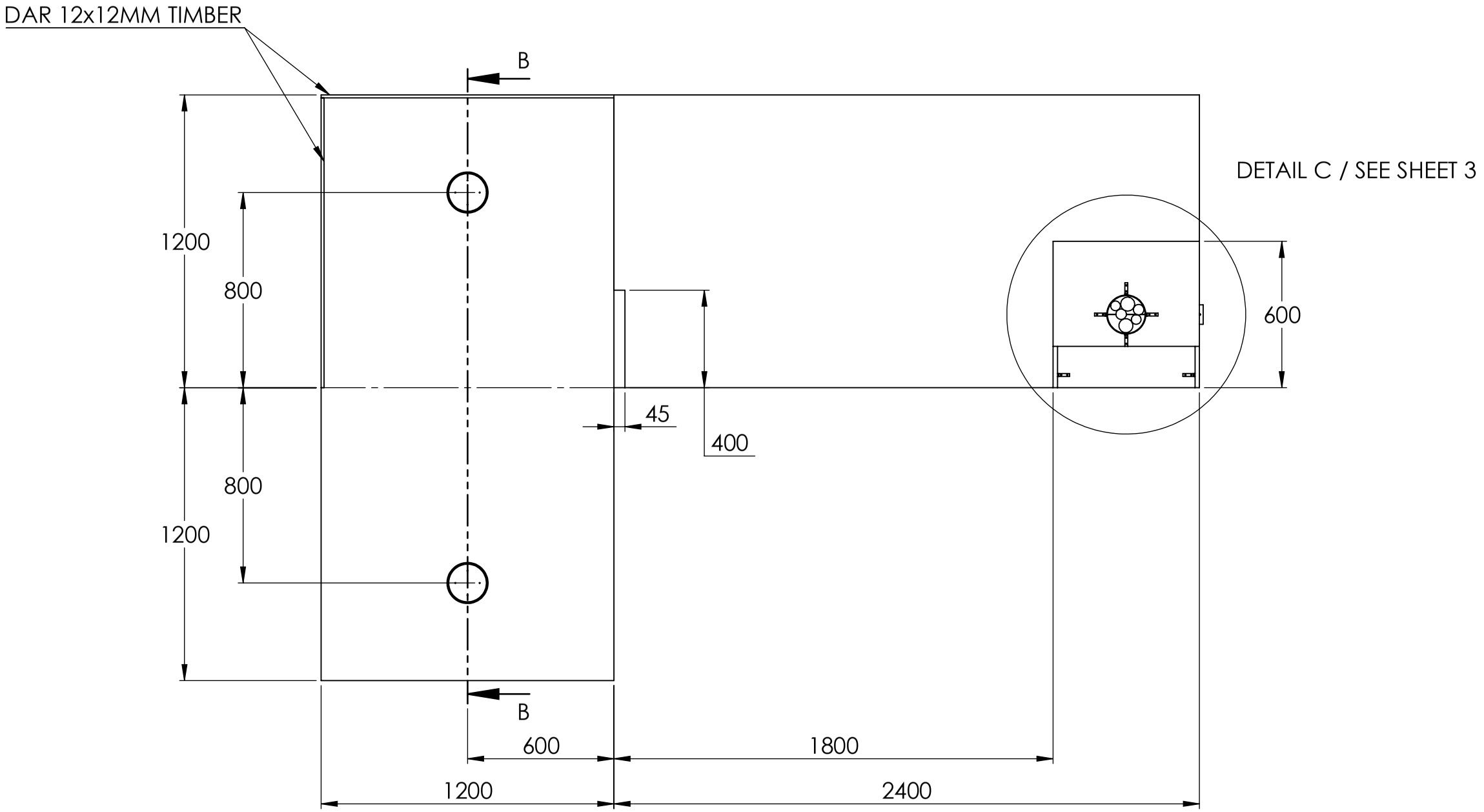
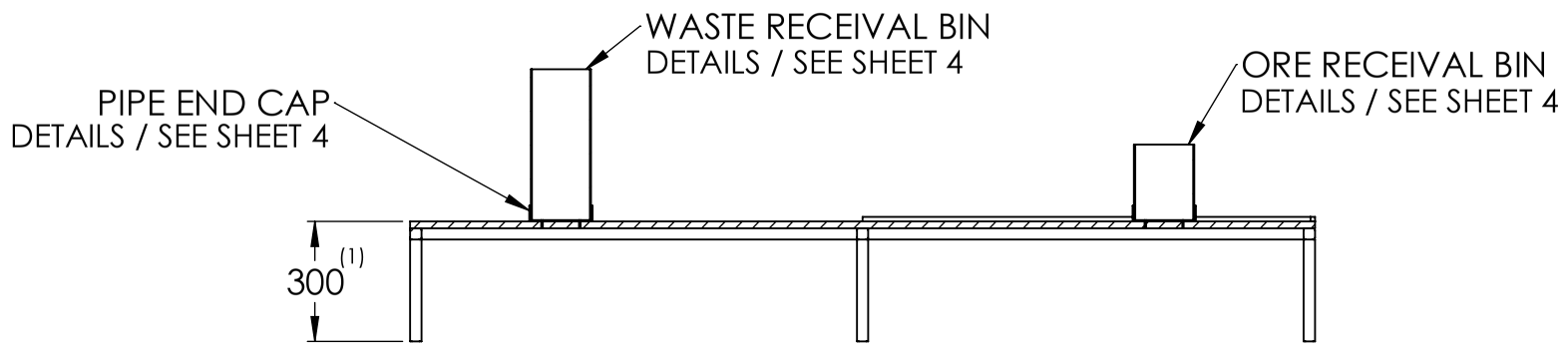
MATERIAL: AS SPECIFIED	DRAWN	M.CARR		10/02/2017	SCALE: 1:20
QUANTITY: 1		NAME	SIGNATURE	DATE	SHEET: 1 OF 4 / SIZE: A3





SECTION B-B

NOTE: (1)THIS DIMENSION WILL BE GREATER THAN OR EQUAL TO 300MM AT THE NATIONAL FINAL.

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TITLE: 2017 WARMAN COMPETITION - TRACK DETAILS

PROJECT NO:	APPV'D	C.WHEELER		10/02/2017	DRAWING NO: 001
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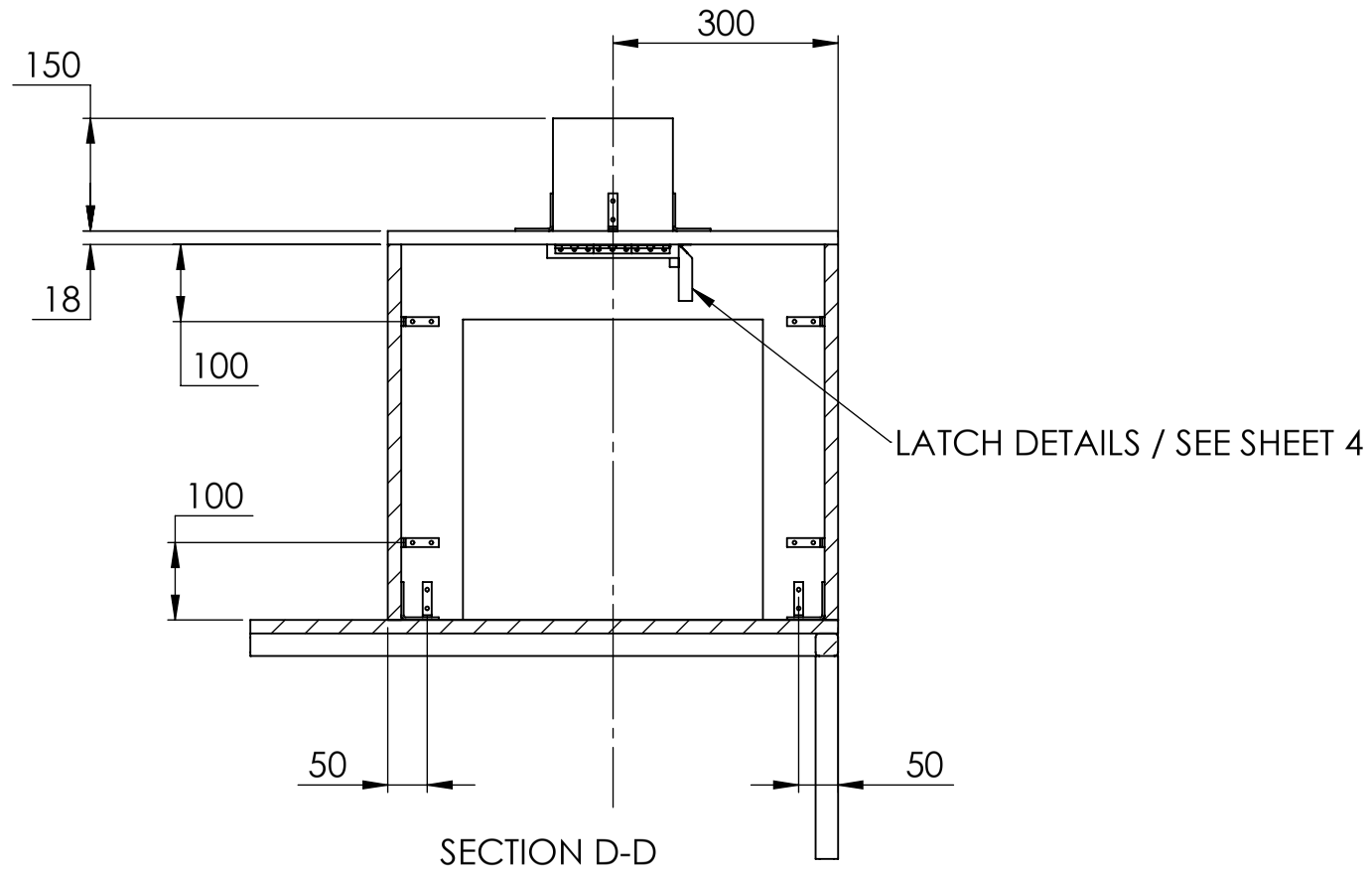
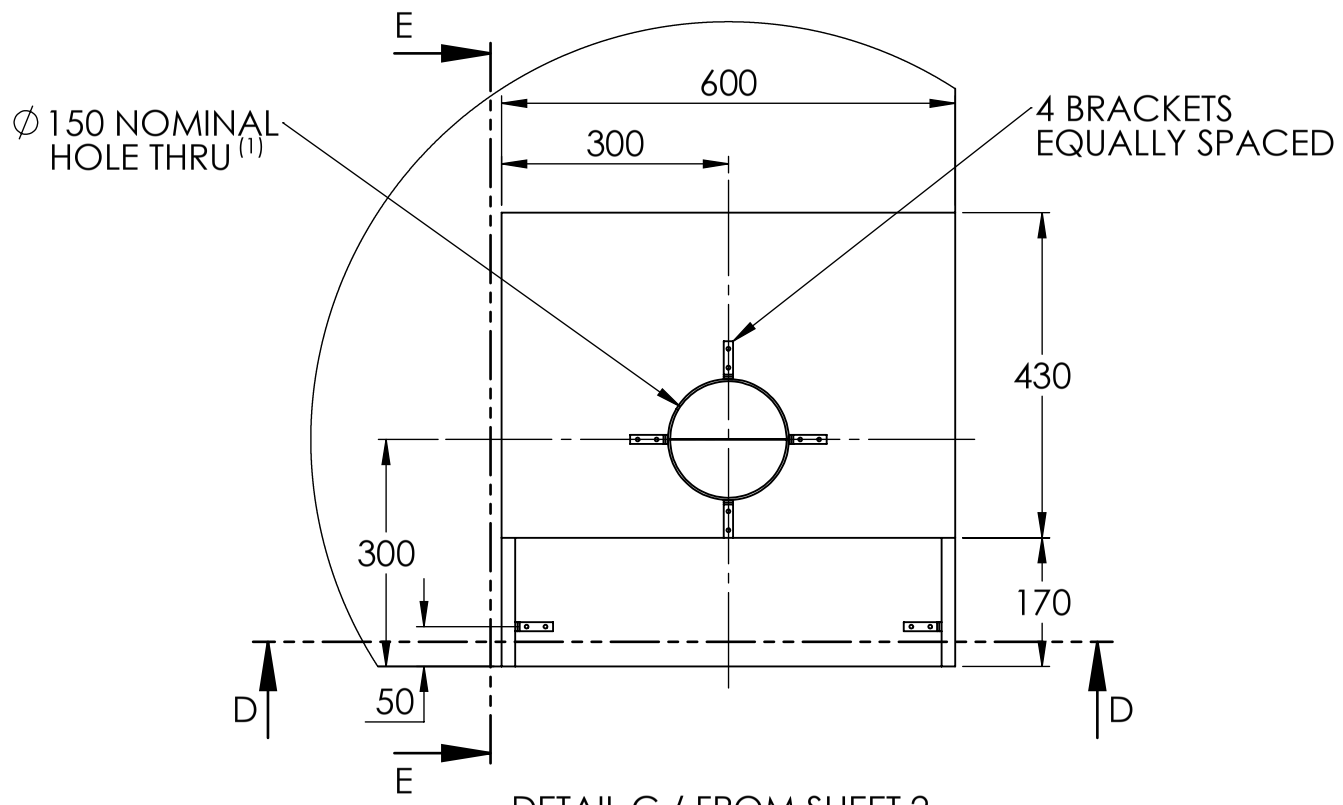
MATERIAL: AS SPECIFIED	DRAWN	M.CARR		10/02/2017	SCALE: 1:20
QUANTITY: 1		NAME	SIGNATURE	DATE	SHEET: 2 OF 4 / SIZE: A3

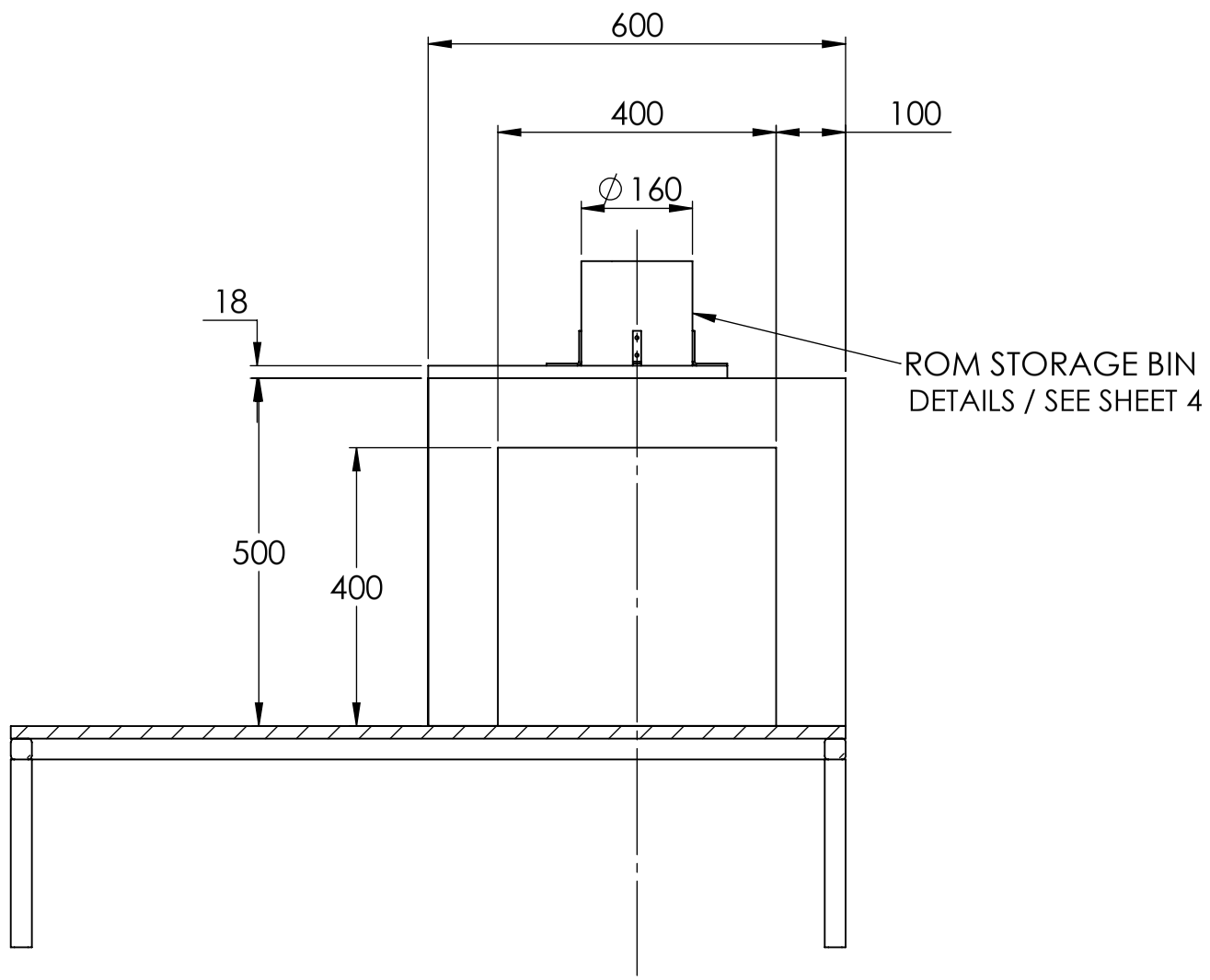
NOTE: (1)HOLE THROUGH MDF TO BE EQUAL TO OR GREATER THAN ID OF 150MM PVC PIPE.



SECTION D-D



DETAIL C / FROM SHEET 2



SECTION E-E

DEBUR ALL SHARP EDGES
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ANGLES
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TITLE: 2017 WARMAN COMPETITION - DETAILED SECTION

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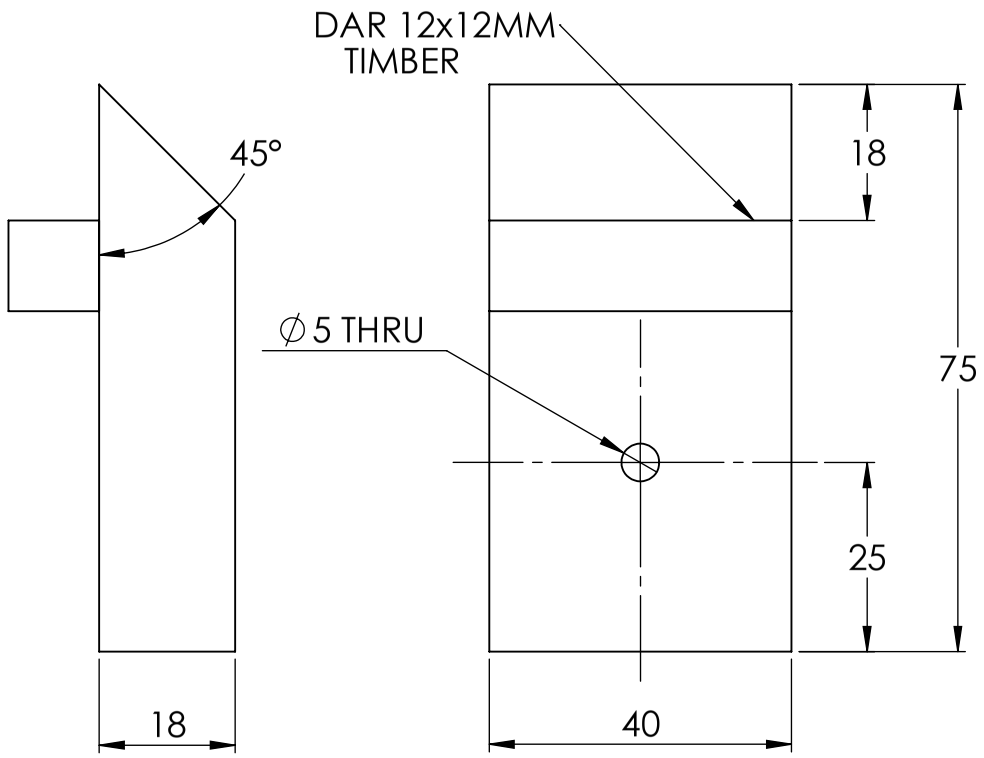
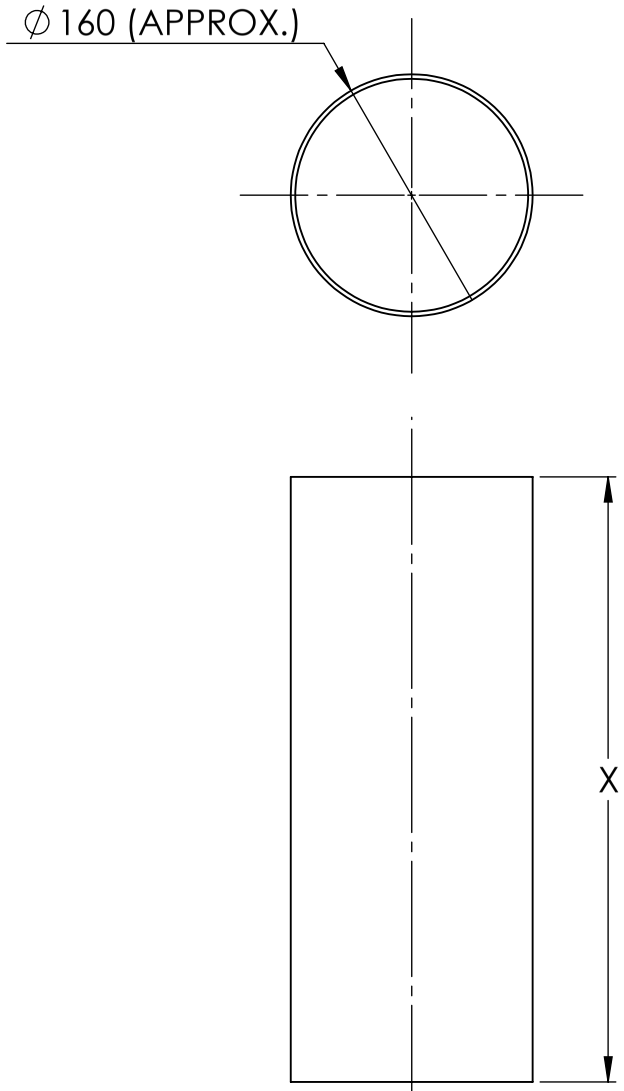
MATERIAL: AS SPECIFIED	DRAWN	M.CARR		10/02/2017	SCALE: 1:10
QUANTITY: 1		NAME	SIGNATURE	DATE	SHEET: 3 OF 4 / SIZE: A3

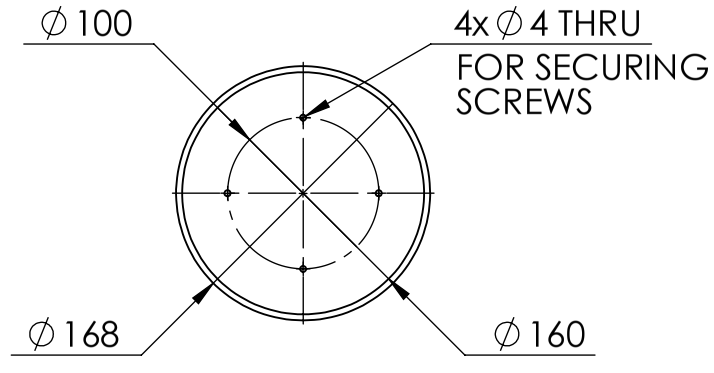
ITEM	QTY	MATERIAL
LATCH	1	18MM MDF SHEET
FLAP GATE	2	18MM MDF SHEET
HANDLE	1	25MM TIMBER DOWEL
ROM STORAGE BIN	1	150MM PVC DWV PIPE
ORE RECEIVAL BIN	1	150MM PVC DWV PIPE
WASTE RECEIVAL BIN	1	150MM PVC DWV PIPE
PIPE END CAP	2	150MM PVC DWV PUSH ON CAP



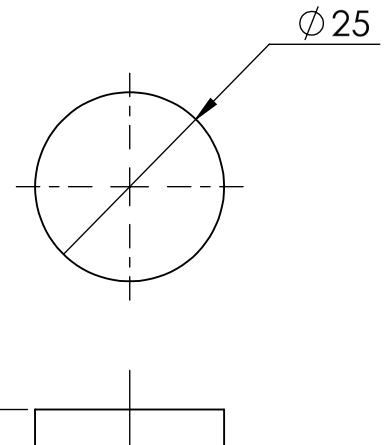
LATCH

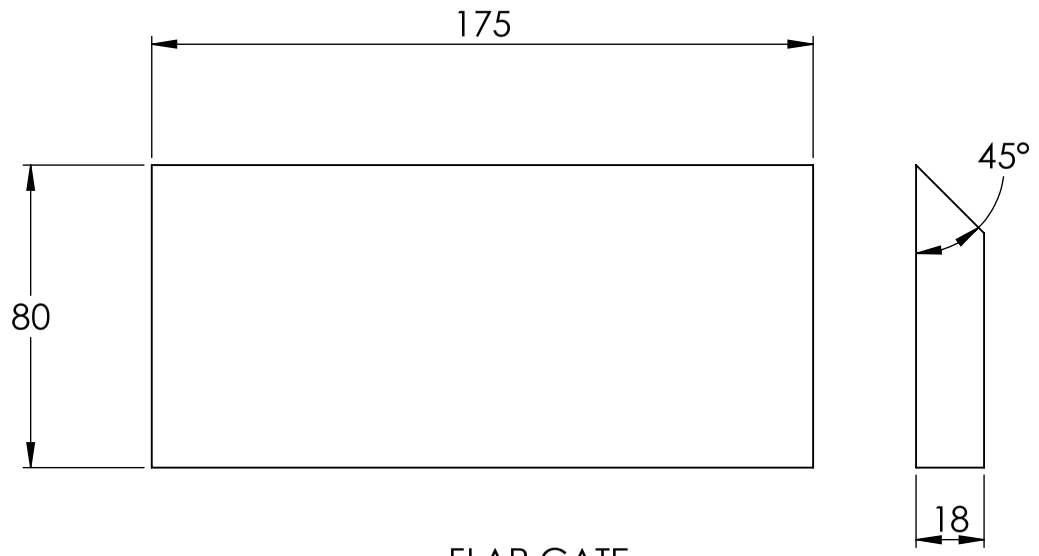


150MM PVC PIPE
SCALE 1: 5



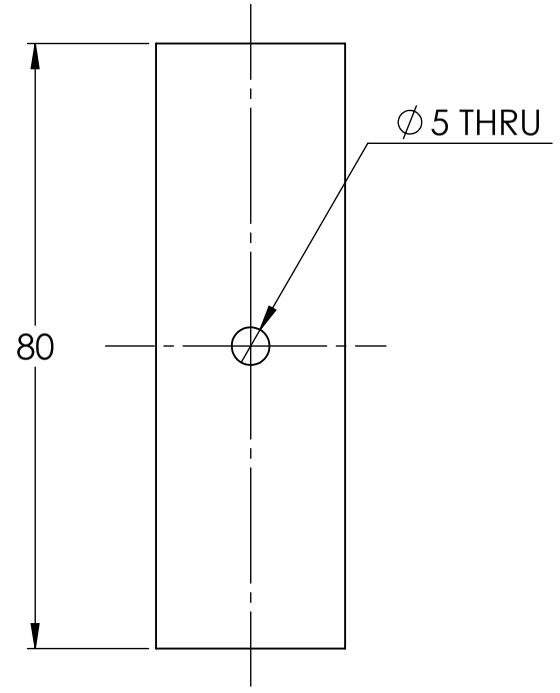
PIPE END CAP
SCALE 1: 5





FLAP GATE
SCALE 1: 2

ITEM	LENGTH "X"
ROM STORAGE BIN	150MM
ORE RECEIVAL BIN	200MM
WASTE RECEIVAL BIN	400MM



HANDLE

DEBUR ALL SHARP EDGES
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ANGLES
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TITLE: 2017 WARMAN COMPETITION - MISCELLANEOUS ITEMS

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QUANTITY: 1		NAME	SIGNATURE	DATE	SHEET: 4 OF 4 / SIZE: A3