ENGINEERS AUSTRALIA

WARMAN®
Design & Build Competition

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37th Warman Design and Build Competition

Competition rules

WARMAN® Design & Build Competition

37th WARMAN DESIGN & BUILD COMPETITION 2024

ENGINEERS AUSTRALIA

SPONSORED BY WEIR

Project FAMINE

(**F**ind **A**nd **I**ncinerate **N**oxious **E**picotyls)

CONTEXT

Gondwana is a small planet orbiting a star on the outer fringes of the Milky Way. An asteroid has entered their atmosphere and distributed six seed pods of an invasive plant. If the pods rupture and distribute their seeds the Gondwanan agriculture would be devastated, leading to famine. The pods will naturally rupture during the next biannual full moon, so it is imperative the pods are collected and preferably incinerated using an underground facility as soon as possible. Four fur covered pods have settled on the ground and two in trees.

Your task is to **F**ind **A**nd **I**ncinerate **N**oxious Epicotyls (**Project FAMINE**).

The Gondwanans have once again asked for assistance from Earth's student engineers to design a system to deposit the seed pods into the mouth of their incinerator before they distribute their seeds. A scaled down prototype of their design will be manufactured and demonstrated.

Your team of student engineers has been set the task of designing and building a scale, demonstration system which is capable of safely depositing six fur covered pods into the ground mounted incinerator mouth. Over the last 36 years, Earth's engineering students have rendered invaluable assistance with such engineering problems, and we anticipate you will again be successful on this thirty-seventh occasion.

OBJECTIVE

Prototype a reduced scale, proof-of-concept transport system, later referred to as the "system", which will precisely deliver scale representations of the seed pods, from their respective settling zones to the incinerator. Referring to Figure 1, the team will have freedom to position their prototype device at any chosen location within the respective boundaries. The seed pods will be simulated using tennis balls. Size constraints require your system to fit within an imaginary 400 mm sided cube. When activated via a single starting action, your system will autonomously move the pods (in the order of your choice) and deliver them to the incinerator. The maximum allowed time for the operation is 120 seconds.

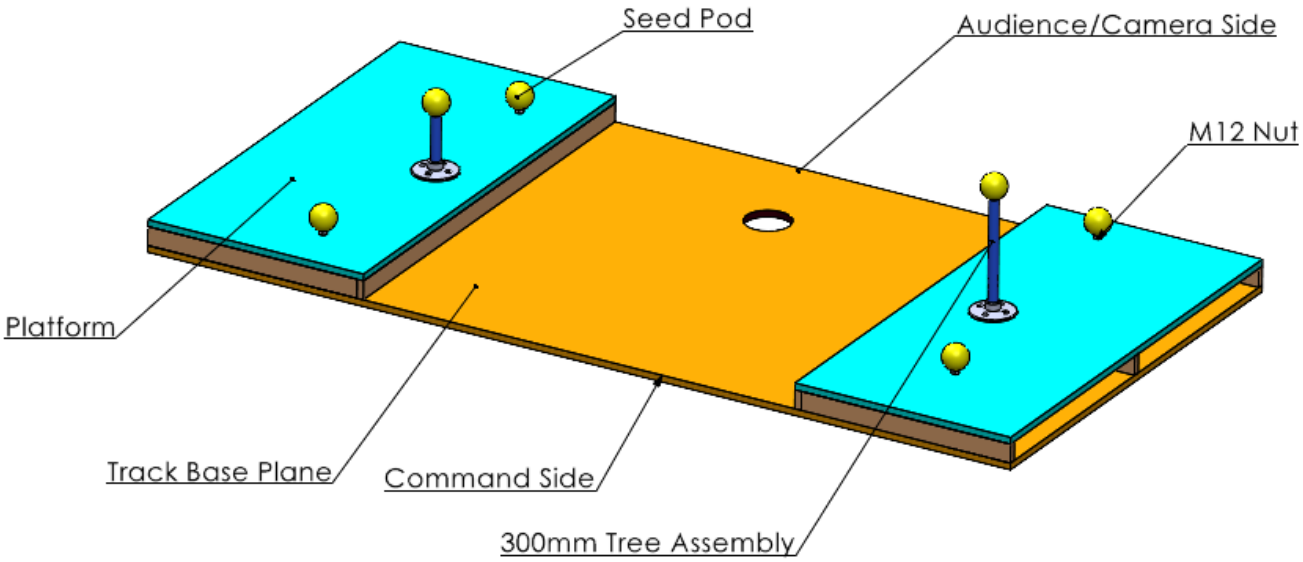

Figure 1. Schematic view of the Competition Track showing the track base plane, platforms, incinerator mouth, two tree assemblies of different height, four M12 pod support nuts, and six seed pods.

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Details follow:

- Competition Guidelines
- Competition Rules
- Frequently Asked Questions
- Further Competition Details
- Spirit of the Competition
- Appendix A – Detailed Drawings of the Competition Track and Relevant Component Details

Document Control:

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Competition Guidelines

Wording: *The language of the guidelines is tiered. Those clauses expressed as "SHALL" are mandatory and failure to comply will attract penalties which in the extreme could lead to a zero RUNscore or disqualification at the International Final. Those expressed as "SHOULD" or "MAY" reflect some level of discretion and choice.*

ELIGIBILITY

G 1. Teams that are eligible to represent their campus in the International Final SHALL consist of students enrolled in the competition year in their first engineering design course/subject/unit in an Australasian (or other countries, by arrangement) mechanical or mechatronics-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, an International Competition Coordinator should be consulted to ensure that other teams are not unreasonably disadvantaged. While students may be required to participate in the Warman competition more than once at their campus level, students SHALL NOT compete at the International Final more than once.

In registering a team, the Campus Organiser attests to the eligibility of the team and teams found to be ineligible at the International Final SHALL NOT be eligible for an award.

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 occur 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. Refer to your campus requirements. Appropriate, protective clothing, footwear, safety glasses or full-face masks SHALL be worn at the International Final.

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 the safe operation and produce risk assessment documentation in order to compete in either the campus heats or at the International Final.

G 5. Appropriate fuses SHALL be used for electrical systems.

G 6. Compressed gas systems MAY be used, but if used, students SHALL gain Campus Organiser approval based on a safety assessment.

Such systems presented at the International Final SHALL be examined against the following principles and in order to run SHALL be found to be acceptable to the International Competition Coordinators.

- 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 International Competition Coordinators prior to arrival at the International Final. The International Competition Coordinators' approval decision SHALL be final after examination of the presented system and documentation at the International Final.

G 7. Systems that are deemed by the officials and judges to be hazardous SHALL NOT be permitted to run. For example, employing any form of combustion SHALL be considered hazardous.

COMPETITION TRACK, EQUIPMENT, AND ENVIRONMENT

G 8. The Competition Track base sheet MAY reuse the 2023 track with minor modifications. It will be fabricated using primarily one sheet of Medium Density Fibreboard (MDF) or equivalent sheet material (MDF SHALL be used at the International Final), with nominal dimensions 2400 x 1200 x 18 mm, arranged as shown in Figure 1 and Appendix A Figure 2 and Drawings. A track supporting frame, not shown, for the sheet MAY be fabricated by any convenient method. The supporting frame SHALL NOT extend beyond the perimeter of the competition track.

NOTE: *MDF sheets as supplied may be slightly larger than the nominal 2400 x 1200 mm dimensions and are generally 2420 x 1210 mm. On request, all dimensions for the 2022 track SHALL be supplied. It is based on sheet sizes of 2400 x 1200 mm. Competition Tracks at the International Final SHALL be trimmed to be 2400 x 1200 mm sheets.*

Raised platforms SHALL be made from Medium Density Fibreboard (MDF) or equivalent sheet material (MDF will be used at the International Final), with nominal dimensions 600 x 1200 x 18 mm, arranged as shown in Figure 1 and Appendix A Figure 2 and Drawings.

G 9. Each platform, refer G8, SHALL have four supports that SHALL be made from 18mm thick Medium Density Fibreboard (MDF) or equivalent material (MDF will be used at the International Final), arranged as shown in Figure 1 and Appendix A Figure 2. The platform and supports SHALL be rigidly attached to the track base with wood screws or similar.

G 10. The two trees SHALL be made from 20 mm galvanised steel pipe (Brasshards 20 x 600 mm Galvanised Pipe, one length is sufficient for both trees). The cut ends of these pipes, which SHALL point upwards and mount the pods, SHALL be chamfered and deburred 1.5 x 45 +/- 0.5 on the inner edge. The two pipes SHALL be attached to the track surface using two round steel threaded flanges (Brasshards Galvanised Round Flange With 20 mm Drill Mall). The total height of the towers from the surface of each platform SHALL be 150 +/-1mm and 300 mm +/- 1 mm respectively. The height SHALL be measured following assembly of the pipe and flange. The vertical axis of these tree assemblies SHALL be located as shown in Figure 1, and in Appendix A Figure 2 with the shorter tree on the left hand side. Flanges should be attached to the track surface using Zenith 12G x 18mm Zinc Plated Self Tapper Pan Head Sheet Metal Screws, refer Photo 1. The screw holes in both flanges should be appropriately chamfered to slightly recess the screw heads.hoto 1. The screw holes in both flanges should be appropriately chamfered to slightly recess the screw heads.

G 11. All screw or fastener recesses on the horizontal surfaces of the competition track SHALL be filled and levelled. If the 2023 track is being recycled the two SHS uprights SHALL be removed or cut off in situ and the cut platform area filled and levelled. The top of the platform MAY be replaced, if preferred.

G 12. The MDF base sheet with relevant features attached, not including the pods or nuts, SHALL be identified as the Competition Track as shown in Figure 1. The features include; two raised platforms at each end, the incinerator mouth and the two pipe/flange assemblies with defined fasteners.

G 13. The upper surface of the base sheet, SHALL define the competition base plane, which is nominally horizontal.

G 14. Permanent marker vivid pen, refer Appendix A and supplied drawing, SHALL define the perimeter of the M12 nuts in their designated positions. The axis of these nuts should coincide with the designated pod location as per the supplied drawings.

G 15. The competition base plane SHALL be no less than 300 mm above the supporting floor at the International Final. The supporting table or frame is not shown in Figure 1. A 120 +/- 5mm diameter circular through hole SHALL be cut into the base plane sheet, in the location shown in the supplied drawings, for the incinerator mouth, see Appendix. This hole must be clear of obstruction for at least 300mm below the competition base plane, to allow for a 10 litre bucket to catch the deposited pods. The bucket edge SHALL not be visible through the 120 mm diameter hole from above. The bucket SHALL be accessible for easy removal and placement. Buckets MAY be cut down to clear support framework. Features MAY be added to this bucket to ease positioning and retrieval.

G 16. All upper surfaces of the track, including the platform supports and edge of the sheets, SHALL be brush or roller coated with one coat of ESTAPOL® Water-Based Xtra Clear – Satin as a sealer followed by two coats of Wattyl ESTAPOL® - Polyurethane Matt (in accordance with Wattyl's recommendations for use with MDF - Refer: Estapol Polyurethane Material Specification and Estapol Water-Based Clear Material Specification. Recycled track surfaces SHALL be lightly sanded and re-coated with two coats of Wattyl ESTAPOL® - Polyurethane Matt. The M12 nut perimeter

position markings MAY be applied with a fine permanent marker before the last coat. At the International Final new or recycled 2023 tracks MAY be used but for recycled tracks the holes SHALL be filled and resurfaced.

G 17. The six balls representing seed pods SHALL be simulated using Wilson Tour Competition Tennis Balls Wilson Tour Competition Balls. (This ball specification was used for the 2023 competition). One standard zinc plated M12 nut per pod SHALL be used to support the four pods directly on the platforms, refer Figure 1. Two balls SHALL be located on the non-threaded, cut and chamfered ends of the 20 mm galvanised pipes. These two balls should be marked with T symbols, using fine permanent marker, to indicate they have come from the trees, for the purposes of scoring

G 18. Teams SHALL accept that the presence of bright lighting and photographic equipment including flash and infrared systems MAY be part of the competition environment.

G 19. Teams SHALL accept that the presence of air conditioning/ventilation induced air movement MAY be part of the competition environment.

G 20. Teams SHALL accept track assembly, components, and the seed pods are made within defined tolerances.

G 21. Campus Organisers MAY 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 International Final.

G 22. At the International Finals, video recording SHALL be used to determine placings if potential podium winning time scores are within 3 seconds.

PROOF OF CONCEPT SYSTEM

G 23. The system SHALL cease all operations within 120 seconds. The system MAY use an identifying signal, for example a LED or similar visual or audible signal, to indicate when all electrical and/or mechanical functions have ceased.

G 24. Untethered or tethered flying systems SHALL NOT be used, refer G2. The system or separated components SHALL be fully supported by the competition track at all times.

G 25. Prior to the start signal, the system SHALL contact any horizontal or vertical surface of the competition track. The system SHALL not contact the horizontal surfaces of both the raised end platforms and competition track base plane. The system microelectronics MAY be initialised but SHALL not perform any functions. The overall system SHALL fit within a virtual 400 mm cube with one surface of the cube coincident with the horizontal surface of the competition track base plane or raised platforms. The system SHALL not be in contact with a pod or nut, or a tree. A pod, nut, or tree SHALL not be within the 400 mm virtual cube surfaces. The system MAY sit over the mouth of the incinerator but SHALL not protrude into the mouth of the incinerator.

G 26. To earn points for DISTURBscore, DEPOSITscore, and RUNTIMEscore the system SHALL complete the respective tasks as defined in the scoring formula (see SCORING).

G 27. The system MAY push, launch or throw the pods and the safety of the process SHALL be considered, refer to G2 and G4.

G 28. The system MAY comprise multiple separate systems, or a system that separates into multiple, unconnected sub-systems. The entire system SHALL meet G25 requirements.

G 29. To commence setup, a track official SHALL call the team to the track which will have the pods already on their M12 nuts and trees. On the command of a track official, the setup SHALL begin. The maximum setup time SHALL be 120 seconds. Teams SHALL set-up their system during this time. Setup jigs MAY be used but any items left on the track at the end of setup time SHALL be considered part of the system.

G 30. Team members SHALL NOT block sight of the track from the audience, judging and video camera side of the competition track (see Figure 1) during setup or the run.

COMPETITION RULES

Objective

R 1. Points SHALL be awarded for achieving particular milestones including; the system dislodging pods off their supports, the successful deposit of pods in the incinerator, and the time taken to deposit ALL pods in the incinerator.
R 2. Two conditions SHALL result in a zero RUNscore: The system (or components of the system) being lost off the track (no longer fully supported by the track surface or features). Or the system making contact with any of the external vertical surfaces of the competition track (See R25).

System Design and Fabrication

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

R 4. At the International 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 teams MAY purchase components "off-the-shelf", it is not intended that they purchase systems / major subsystems as solutions directly.

R 5. In keeping with the spirit of the competition, teams SHALL NOT use LEGO Mindstorm® or similar comprehensive kitted systems at the International Final.

R 6. In keeping with the spirit of the competition, teams MAY use Arduino or similar PIC based components.

R 7. In keeping with the spirit of the competition, teams MAY adapt / modify / integrate elements sourced "off-the-shelf".

R 8. Systems using electric battery storage devices SHALL have an appropriately sized fuse connected to one of the battery leads.

Pre-Setup Scrutineering

R 9. As directed, teams MAY attempt two runs.

R 10. The system MAY be modified between runs.

R 11. The mass of the team's system (SYSTEMmass) SHALL be measured and recorded by a track official. The system mass does not include the pods, supporting M12 nuts, or any positioning jigs or setup equipment used by the team but removed from the track before the run start. The SYSTEMmass SHALL NOT be greater than 6 kilograms.

NOTE: *A maximum system mass of 6 kg has been selected to reflect carry on allowances by Jetstar and Virgin airlines so as not to disadvantage interstate and international teams traveling to the International Final who MAY wish to transport their system as carry on. Teams must appropriately satisfy the airline's restrictions/limitations for carry on and/or checked luggage, including restrictions for transporting dangerous goods such as batteries.*

Pre-run System Setup

R 12. The team SHALL then be called to the trackside. The track SHALL have all pods in position on their M12 nuts or trees.

R 13. There SHALL be no contact by team members or their system with the Competition Track before setup time commences as directed by the track officials.

R 14. When ready, an official will signal that the setup SHALL commence. The team SHALL be allowed a maximum of 120 seconds for setup. During this time they are to set up their system on the competition track.

R 15. During setup, the team MAY use additional objects not considered part of the "system" to assist with setup. Any additional objects used SHALL be removed from the competition track at the conclusion of the setup time. The mass of these additional objects SHALL NOT be included in the SYSTEMmass.

R 16. After setup, the plan projection of the system SHALL lie fully contained within and supported by any surface(s) within the competition track boundaries, including the raised platforms. The system SHALL NOT be in contact with any of the pods or the M12 Nuts or the trees. The system SHALL not protrude into the mouth of the incinerator.

R 17. The installed system SHALL be fully contained within a virtual cube with 400mm sides. One face of this cube SHALL be coincident with a horizontal track surface. The installed system SHALL also be contained inside the competition track boundary. The system size and location SHALL be checked using large square gauges and C shaped gauges with a 400mm square internal cavity. Parts of this virtual cube MAY overhang the plan projection of the outer track perimeter, even if components of the system do not.

R 18. The Team SHALL indicate to the appropriate competition official when their setup is complete.

R 19. After setup, and prior to running, everything placed and left on the competition track, except the pods and M12 nuts, SHALL be considered to be part of the system.

R 20. After the setup and during the run, view of the incinerator mouth SHALL NOT be blocked. This is to allow video recording of when the last pod passes through the upper lip of the track base. Video camera(s) and audience view SHALL be toward the incinerator side of the competition track.

R 21. Officials SHALL inspect the team's setup of their system, using the gauges, rulers and large square edges. If the setup is found to be in violation of any of the system starting location and size, or if contact with, or movement of the pods or M12 nuts is detected, at the discretion of the competition officials, the system and pods MAY ONE TIME ONLY for each run be removed from the track and the setup process IMMEDIATELY repeated. If after the second setup the system is again in violation of the setup rules a zero RUNscore SHALL be recorded.

Run Process and Timing

R 22. On instruction by a clapper board type signal from a track official the run SHALL commence. The start SHALL be counted 3-2-1-clap at nominally one-second intervals.

R 23. The system SHALL be started by a single team member, using a single hand, via a single action, that does not impart any motion or energy to the system. Attaching wires, fitting electrical terminals, or fitting plugs SHALL NOT be considered a single action. Teams should install a reliable and easily accessible switch or mechanical trigger to ensure safe and reliable starting.

R 24. If the team member accidentally or prematurely starts the system, at the discretion of the competition officials, the system MAY ONE TIME ONLY for each run be removed from the track and IMMEDIATELY reset and started again after repeating the setup procedure. Rules R2 to R21 SHALL be adhered to. This rule SHALL NOT be used to extend the setup time.

R 25. After performing the single action start, team members SHALL NOT control or touch the system in any way during the run. Wireless control by one or more team members SHALL NOT be used. Team members SHALL NOT interfere with the system. The team SHALL wait for a track official's approval to touch the system after the run has started. If team members choose to intervene to protect a system that is malfunctioning, a zero RUNscore SHALL be recorded. In the case that a system is driving off the track a team member MAY catch it and protect it from damage, noting that a zero RUNscore SHALL be recorded.

R 26. During and at the end of the run, the system MAY contact the horizontal surfaces of both platforms, the base plane of the track, the trees and flange mounts, the M12 nuts, the inner vertical surfaces at each end of the platforms, and the inner 18 mm lip of the circular incinerator hole.

R 27. The system SHALL NOT contact any of the external vertical faces of the track, or any track or ground surface below the base plane, or the underside horizontal surface surrounding the incinerator hole, or the bucket. Any such contact SHALL result in a zero RUNscore being recorded.

R 28. During or at the end of the run the system and pods MAY extend or pass beyond the edges of the perimeter of the competition track.

R 29. The run SHALL be designed to finish within 120 seconds. For timing, the run SHALL be deemed to be complete when all functions of the system have ceased. An LED or similar visual or audible signal MAY be used to indicate when the micro controller program has ended.

R 30. At the completion of the run, all parts of the system SHALL cease controlled or powered translation or rotation, and remain in this state indefinitely relative to the competition base plane. Mechanisms and items within the system MAY continue to move (i.e. to swing, sway or vibrate) but no further functions may be executed.

R 31. The team or system MAY indicate to the timekeepers when they declare their run to be complete. However, the track officials 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 or system's declaration.

R 32. To ensure that judging has been completed, teams SHALL NOT retrieve their system or assist in gathering other items until directed by a track official.

R 33. RUNtime SHALL be recorded when the last pod fully passes below the track base plane. The time SHALL be rounded up to the nearest half second.

Run Scoring

R 34. The relevant DISTURBscore SHALL be awarded for any pods that are no longer supported by the M12 nuts or the trees. Pods MAY be left on track, cleared off the track, or retained by the system. Movement or relocation of a pod that is still fully supported by an M12 nut or tree at the conclusion of the run SHALL NOT count toward the DISTURBscore. By Design, pods on the trees SHALL NOT be dislodged by deliberate impact between the system and the tree.

R 35. The DISTURBscore for each of the four Pods supported by M12 nuts on the base plane SHALL be 5 points.

R 36. The DISTURBscore for each of the two Pods supported by the trees (and marked with T symbols) SHALL be 10 points.

R 37. The relevant DEPOSITscore SHALL be awarded for pods which are deposited into the incinerator hole, and are completely below the plane made by the circular opening. The pod SHALL NOT be supported by the system.

R 38. The DEPOSITscore for each of the four pods supported by M12 nuts on the base plane SHALL be 15 points.

R 39. The DEPOSITscore for each of the two pods supported by the trees (and marked with T symbols) SHALL be 30 points.

R 40. At the conclusion of the run, pods MAY be left in their positions, lost or discarded off the track, or retained within the system, however these SHALL NOT earn a DEPOSITscore.

R 41. IF all six pods are successfully deposited (maximum DISTURBscores and DEPOSITscores) then the run SHALL attract a RUNTIMEscore, based on the time taken to complete the run (the RUNTIME).

R 42. Each team's overall COMPETITIONscore SHALL be calculated based on their maximum RUNscore plus 50% of their minimum RUNscore.

R 43. If two or more teams have equal COMPETITIONscores the competition placing SHALL be determined by the SYSTEMmass of these teams. The lower SYSTEMmass SHALL be preferred and will be calculated based on the average recorded SYSTEMmass from both runs.

Conditions Determining Zero RUNscores

R 44. If at any time during the run, or at its conclusion, any part of the system is lost or discarded off the track, a zero RUNscore SHALL be recorded.

R 45. The setup or run SHALL NOT contaminate or damage the pods or track. Teams presenting a system that damages or is deemed to have the potential to damage the competition track or pods MAY be disqualified from the competition. IF damage or contamination is deemed to have occurred to the track or pods a zero RUNscore MAY be awarded at the discretion of the competition officials.

R 46. Violations of procedural rules SHALL result in a zero RUNscore being recorded.

R 47. The competition organisers' decisions on all matters pertaining to the competition SHALL be final.

SCORING

The COMPETITIONscore SHALL be calculated using the following:

COMPETITIONscore = Max RUNscore + Min RUNscore/2

$$RUNscore = [DISTURBscore + DEPOSITscore + RUNtimescore]$$

DISTURBscore: 5 points for each Pod initially supported by M12 nuts

10 points for each Pod initially supported by trees (marked with T symbols).

DEPOSITscore: 15 for each Pod deposited, which is initially supported by an M12 nut.

30 for each Pod deposited, initially supported by trees (marked with T symbols)

The following scoring is contingent upon the run achieving full DISTURB and DEPOSITscores:

RUNtimescore: RUNtime = time in seconds for a run that correctly deposits all pods. Points are calculated based on the RUNtime and according to the following formula:

$RUNtimescore = (120 - RUNtime)\ x\ 0.5$ *with a minimum RUNtimescore=0*

Notes: *RUNtime is measured from the 'Start Clap' command until the last Pod has been deposited.*

The system MAY sway but there SHALL NOT be translational motion relative to the competition track.

RUNtime SHALL be rounded up to the nearest half-second. For example, 15.2s becomes 15.5s and 15.7s becomes 16s

SYSTEMmass = the net mass, in grams, of the system. Excludes the vessels, nuts and setup tools.

Example score calculation:

The system disturbs three nut supported pods and two tree supported pods, and deposits three pods (supported by nuts).

5+5+5 +10 +10 +15+15+15 = 80

The system moves and deposits all pods in 20 seconds.

*5+5+5+5+10+10+(15*4)+(30*2)+((120-20)*0.5) = 210*

FREQUENTLY ASKED QUESTIONS

1. **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 RUNscore (R44)

2. **Can part of the system overhang the extremities of the competition track without penalty when negotiating the track?**
   Yes, (see R28). After the run commences and at the conclusion of the run, the system or pods MAY extend beyond the edges of the perimeter of the Competition Track. Contact between the system and anything below the track base plane is not permitted at any time.

3. **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 that fits within the start volume. No remote-to-the-track control systems of any sort can be used (manual or pre-programmed, hard-wired or wireless).

4. **Are programmable chips or microcontrollers allowed?**
   Yes. You can use a programmable chip or microcontrollers (R6), but there is to be no remote communication during the run. However, LEGO ® Mindstorms ® or similarly comprehensively kitted systems are not allowed (see R3, R4, R5).

5. **What is the allowable voltage and power of any employed electrical systems?**
   There are no restrictions this year but it needs to be risk assessed as safe. Refer G4 and R8.

6. **Can off-the-shelf items be used?**
   Commonly available components such as toy and machine parts are able to be used, however full kits or systems such as LEGO ® Mindstorms ® are not allowed. 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.

Further Competition Details

INTERNATIONAL COMPETITION FINAL
We are working on the international competition dates and event format and more information will be posted to teams and competition organisers as soon as it is available.

Competition sponsors Weir Minerals Australia will offer the following prizes and cash awards for participants in the International Final.

Overall Winning Team: **AUD$3,000**
Second Place Team: **AUD$2,000**
Third Place Team: **AUD$1,000**

Weir Minerals' Prize: **AUD$400**
NCED Best Design Prize: **AUD$400**

Campus Champion Prize **AUD$200**
(awarded to all competitors in the International Final)

SPIRIT OF THE COMPETITION
Although the rules may look rigid you will find that they have been written in a way that 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 International 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 International Competition Coordinators 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 the competition. Even if it is accepted at the local level, you might be in for a shock at the International Final 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 International Competition Coordinators, this is sought by the Campus Organiser. Students SHOULD NOT contact the International Competition Coordinators directly for an individual ruling.

The competition tracks, at the Campus Competitions, State/Country semi-finals and the International 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.

Personal Protective Equipment, PPE, required for the competition is determined by campus organisers for the campus heats. For the International final, it will be the International Final organisers.

*All participants **SHALL** use appropriate PPE during the building and development of their system. Refer to campus organisers for campus requirements.*

Appendix A –

- **Figure 1 –** *2024 Project FAMINE* Track layout
- **Photo 1 -** *Tree assembly, with Flange, Threaded Tube and Screws*
- **Photo 2 -** *U*se of an M12 nut to support a pod.
- **Track Drawing 1 -** *Dimensioned Drawing of 2024 Competition Track*

Appendix A:

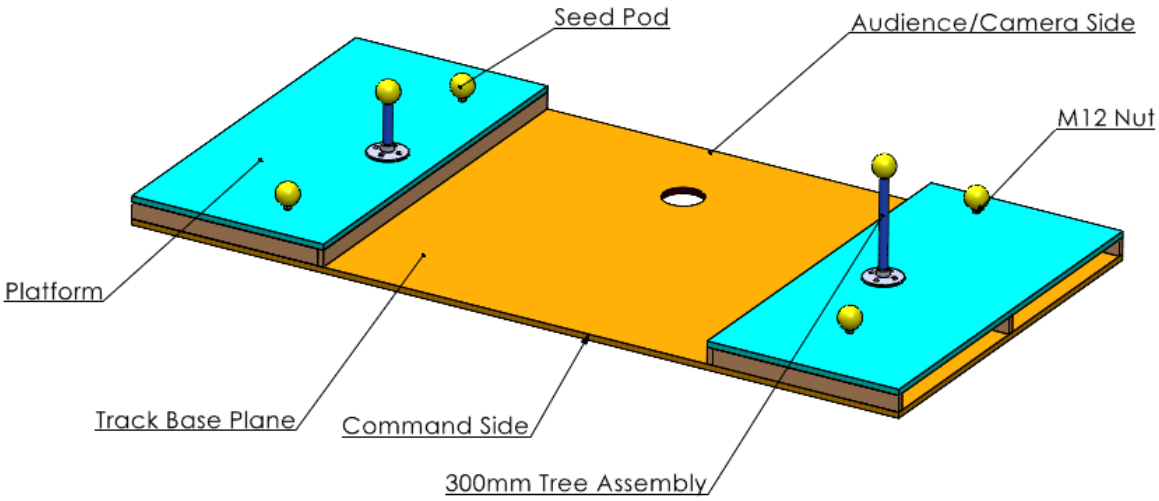
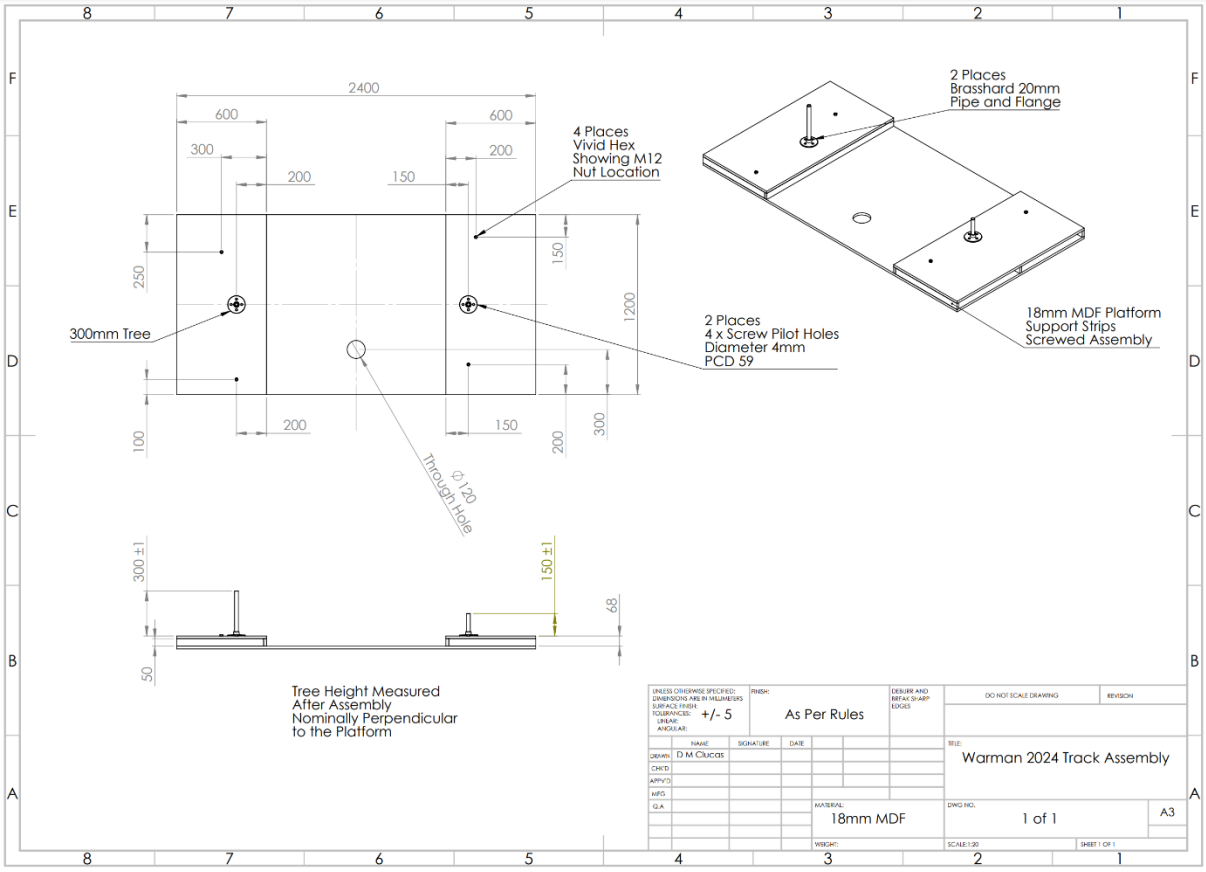


Figure 1.

Figure 1: Schematic view of the Competition Track showing the track base plane, platforms, incinerator mouth, two tree assemblies of different height, four M12 pod support nuts, and six seed pods.

Photo 1. Tree assembly, with Flange, Threaded Tube and Screws (in chamfered screw holes)

*Photo 2. U*se of an M12 nut to support a pod.



Track Drawing 1 – Dimensioned Drawing of 2024 Competition Track