Project FLAMEOUT

CONTEXT

Gondwana is a small planet orbiting a star on the outer fringes of our Galaxy. Intergalactic rebels have sabotaged hydrocarbon fuel extraction wells and for several months the wellheads have been burning out of control. Toxic gases and extreme heat near the wells have prevented the Gondwanans from entering the fields of wells to extinguish the infernos. Thick smoke is polluting their atmosphere which is causing global cooling, their heating fuel reserves are becoming dangerously low. They have pleaded for help from all galaxy resources. Chemical engineers have developed an explosive charge that will extinguish the flames providing spherical vessels of the fluid are accurately dropped into the tubular wellheads. Each field contains multiple wellheads, each head produces different levels of hydrocarbon output. Engineering students from Earth have risen to the challenge of developing a system to deliver the correct number of vessels to each wellhead. They will build and demonstrate a proof of concept autonomous system that will precisely deliver the vessels. Wellheads giving higher output require more vessels. Over the last 32 years, engineering students have rendered invaluable assistance with such engineering problems, and on this thirty-third occasion, the Gondwanans again seek help from these budding engineers to demonstrate a solution.

DILEMMA

Toxic smoke and heat are stopping the access of firefighters to hydrocarbon extraction wells that are flaring out of control. Galactic engineers have proposed that an autonomous system to drop vessels of an explosive mixture into the wellhead would extinguish the flames by temporarily removing oxygen. Due to the thick smoke and ash, airborne navigation is not possible and flying systems would be damaged. In many cases the sabotage has left debris across access lanes, creating obstacles to robotic systems. A ground-based autonomous system is required to drop the vessels into the wellheads and return to base before the time-triggered chemical mixture explodes or the heat damages the system.

CHALLENGE

Prototype a proof of concept system that precisely delivers ten vessels (the payload) into four vertical tubes of different heights that simulate the wellheads, Figure 1. Higher tubes are representative of higher output heads, requiring more vessels to be deposited. The autonomous system will start from a safe area, such as an access road, defined by the Start/End zone, Figure 1. The system will be loaded with up to ten vessels by the team and when activated will deliver the appropriate number of vessels into each tube and return to the Start/End zone. The real application temperature in the delivery location is extreme so the time the system spends operating in the active fire zone must be brief. The timed ignition will occur 120 seconds after system activation so the system must have returned within that time or it will be destroyed. The system will be transported to the fields generally by helicopter or truck so there are size and weight restrictions.

Objective
The objective is to design, build and demonstrate a proof of concept scaled prototype transfer system in a laboratory environment. Points will be earned when your autonomous system starts entirely within the Start/End zone and delivers the payload vessels into each of four vertical tubes, Figure 1. The required number of vessels to be deposited in each tube is shown in Figure 1. Further points will be scored when the entire system returns to being fully within the safe Start/End zone in less than 120 seconds, faster systems will be preferred. Preferably all ten vessels will be correctly deposited but fewer will earn points. At the International Final, the ambient temperature during the prototype demonstration SHALL NOT be elevated to simulate the wellhead conditions and there SHALL NOT be smoke.

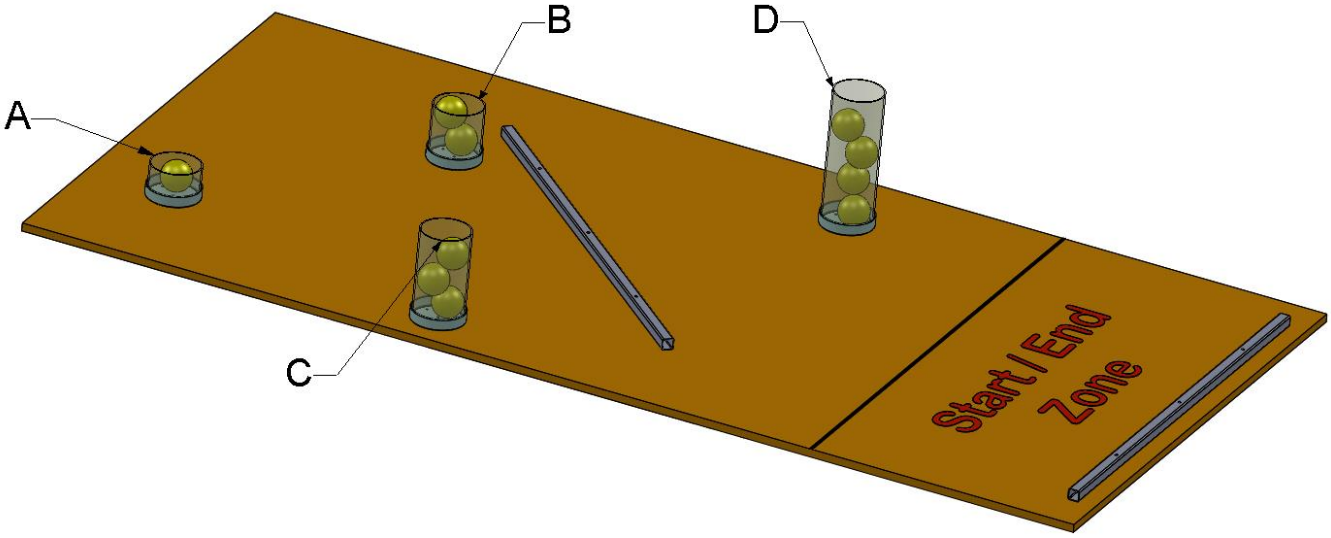

Figure 1. Schematic view of the Competition Track showing well head tube location and the number of payload vessels targetted to be in each tube at the completion of the run. Tubes are transparent for clarity.

International Competition Coordinators:

A/Prof Don Clucas	don.clucas@canterbury.ac.nz	Phone: +64 3 3692212
Prof Craig Wheeler	craig.wheeler@newcastle.edu.au	Phone: +61 2 4033 9037
Dr. Scott Wordley	scott.wordley@monash.edu	Phone: +61 3 9905 3811

International Competition Supervisor:

A/Prof Warren Smith	w.smith@adfa.edu.au	Phone: +61 2 6268 8262

Details follow:

- Competition Guidelines
- Competition Rules
- Frequently Asked Questions
- Further Competition Details
- Spirit of the Competition
- Appendix A - General Assembly and Detailed Drawings of the Competition Track

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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 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.

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 heat 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 SHALL be fabricated using primarily one sheet of Medium Density Fibreboard (MDF), with nominal dimensions 2400 x 1200 x 18 mm, arranged as shown in Figure 1 and detailed drawings in Appendix A. The 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. All dimensions shown in Appendix A are 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 in accordance with Appendix A.*

G 9. The MDF Track Sheet with relevant features attached, not including the ten vessels, SHALL be identified as the Competition Track as shown in Figure 1. The attached features include; the Start/End zone defined by a black vivid pen line and the track edge, four nominal 100mm diameter vertical DVW PVC pipes (OD110xID104) supported by PVC end caps, screws to attach the PVC caps to the Track Sheet, a diagonal obstacle 1000mm length of 25x25x1.6 SHS, a 1000mm length of 25x25x1.6 SHS within the start zone, and six standard M6 bolts with twelve 6 x 18 washers and six nuts to restrain the two SHS lengths. M6 washers SHALL be used top and bottom and bolt heads SHALL be on the upper face. Refer G13 and G14.

G 10. The upper surface of the Track Sheet SHALL define the competition base plane, which is nominally horizontal. Lettering shown on the competition base plane in all figures are for clarity and SHALL NOT be applied to the track.

G 11. 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.

G 12. The Competition Track SHALL contain the Start/End Zone area bounded by the edges of the Track Sheet and a black vivid line across the Track Sheet. The black vivid line SHALL be applied before the track surface sealer, refer G16. Prior to starting, the system SHALL be fully contained within the Start/End zone virtual vertical planes defined by the vivid line and the track edges.

G 13. Within the track Start/End zone, a 25x25 SHS section SHALL be fixed to the Track Sheet using three M6 bolts with washers top and bottom. M6 x 18 Washer Example. Bolt heads SHALL be on the upper surface. The SHS shall be positioned as shown in Figure 1 and Appendix A. It SHALL be made from galvanised <u>unpainted</u> Steel SHS 1000mm in length. 25 x 25 SHS Material Specification

G 14. A 25x25 SHS obstacle SHALL be fitted nominally at 45 degrees to the central plane of the track using three M6 bolts with washers top and bottom, M6 x 18 Washer Example, as shown in Figure 1 and Appendix A. Bolt heads SHALL be on the upper surface. It SHALL be made from galvanised unpainted Steel SHS 1000mm in length. 25 x 25 SHS Material Specification

G 15. Four delivery target tubes made from 100DN DWV PVC PIPE drain pipe. Refer to this page for an example material: Holman 100mm PVC Pipe. It SHALL be nominally OD110 x ID 104 and SHALL be positioned on the track at the locations shown in Figure 1 and Appendix A by gluing into 100mm PVC push-on caps screwed to the track sheet. Example PVC Cement. Refer to this page for an example push-on cap: Holman Push-On Cap. The cut length of the tubes SHALL be: A=70, B=120, C=200, D=300 with tolerances of +/-5mm. The tubes SHALL be fully inserted into the cap that is screwed to the track using seven wood screws per cap. The centre screw hole in the four push caps SHALL align with the four location pilot holes shown in Appendix A. The tubes SHALL be nominally vertical.

Note: There are other manufacturers of the 100mm PVC push caps and pipe that MAY be used. The Holman brand will be used on the International Final tracks.

G 16. The surface of the track sheet 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 SHOULD be lightly sanded and re-coated with two coats of Wattyl ESTAPOL® - Polyurethane Matt. The black vivid line defining the Start/End zone SHALL be applied prior to the final coat.

G 17. The ten payloads (vessels) SHOULD be Wilson Tour Competition Tennis Balls Wilson Tour Competition Balls. Up to ten balls SHALL be loaded into/onto the system by the team during the two minutes setup time.

Note: There are various suppliers of tennis balls and various grades. The Wilson Tour Competition balls SHALL be used at the International Final.

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.

PROOF OF CONCEPT SYSTEM

G 20. The system, initially located fully within the start zone and no more than 500 x 500 x 500 (w x d x h), SHOULD deliver **TEN** payload vessels and return to be fully to the right hand side of a virtual vertical plane projected from the vivid black line, Figure 1, within 120 seconds. The system MAY overhang the edges of the competition track. The system does not need to comply with the 500 x 500 x 500mm constraint upon its return to the Start/End zone at the conclusion of the run.

G 21. The system SHALL cease operation within 120 seconds.

G 22. The system SHALL represent essentially a ground-based solution. Untethered flying systems SHALL NOT be used, refer G2.

G 23. The system SHALL be initially positioned in the Start/End zone and be fully supported by the competition track. The system MAY contact the 25x25 SHS within the Start/End zone.

G 24.   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.

COMPETITION RULES

R 1. A payload vessel refers to **ONE** of **TEN** balls being transferred from the Start/End zone to a delivery target tube A, B, C or D. Points SHALL be awarded for delivering payload vessels into the delivery target tubes. Bonus points SHALL be awarded when the system delivers at least one payload vessel and returns to be fully to the right side, Figure 1, of a virtual vertical plane projected from the black vivid line. In the end state, the system MAY hang over/extend beyond the competition track edges of the Start/End zone but SHALL NOT be in contact with surfaces below the competition track base plane.

SYSTEM MATERIALS AND MANUFACTURE

R 2. Students SHALL manufacture and fabricate their "proof of concept prototype" system themselves using commonly available materials, components and methods.

NOTE: *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 students MAY purchase components "off-the-shelf", it is not intended that they purchase systems / major subsystems as solutions directly.*

R 3. In keeping with the spirit of the competition, teams SHALL NOT use LEGO ® Mindstorms ® or similar comprehensive kitted systems at the International Final.

R 4. In keeping with the spirit of the competition, teams MAY use Arduino or similar PIC based components.

R 5. In keeping with the spirit of the competition, teams MAY adapt / modify / integrate elements sourced "off-the-shelf".

R 6. Systems using electric battery storage devices SHALL have an appropriately sized fuse connected to one of the battery leads.

COMPETITION PROCEDURE

R 7. The mass of the team's system (SYSTEMmass) SHALL be measured by an official. The system mass, not including payload and device positioning equipment, 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.*

R 8. The team SHALL then be called to the trackside.

R 9. There SHALL be no contact by team members or their system with the Competition Track before setup commences.

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/End Zone.

R 11. 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 during setup. The mass of these additional objects SHALL NOT be included in the SYSTEMmass.

R 12. During setup, physical 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 surfaces bounded by the perimeter of the Start/End zone. Contact with the track edges of the Start/End zone is permitted. Refer to Figure 1 and Appendix A.

R 13. During the setup, the team SHALL load up to **TEN** payload vessels into/onto their system. Vessels not loaded SHALL be retained by the track officials.

R 14. The Team SHALL indicate to the appropriate "official" when their setup is complete.

R 15. After setup, and prior to running, everything placed and left on the competition track SHALL be considered to be part of the system.

R 16. After setup, and prior to running, the system SHALL be subject to volume constraints. The system and payload vessels SHALL be wholly within a virtual cube of 500 x 500 x 500 (w x d x h) and wholly within the Start/End zone vertical planes of the vivid black line and the track edges. The lower face of the virtual cube SHALL be coincident with the competition track base plane. The volume and positioning conditions SHALL be physically checked by an official. The system MAY have multiple unconnected components but the combination of components SHALL satisfy this rule.

R 17. After setup and prior to running, the system SHALL be held or supported only by the competition track base plane and/or the Start/End zone SHS and must be ready to start. The system SHALL NOT be restrained by personal contact by team members. The system SHALL be capable of remaining in the setup condition for at least 240 seconds prior to starting. Electronics MAY be powered up.

R 18. On instruction by a clapper board type signal from the "official starter," the run SHALL commence. The start SHALL be counted 3-2-1-clap at nominally one-second intervals.

R 19. The system SHALL be started using a single action of a team member that does not impart motion or energy to the system. Attaching wires or fitting electrical terminals or fitting plugs SHALL NOT be used. If a surface of the system or payload vessel fails to move beyond the virtual vertical plane of the black vivid line or the team member prematurely starts the system, by the instruction of the official starter the system MAY be one time immediately reset and started again after 120 seconds setup time. Rules R9 to R18 SHALL be adhered to.

R 20. The run SHALL be designed to finish within 120 seconds.

R 21. After performing the single 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 RUNscore. If team members choose to intervene to protect a system that is malfunctioning, a zero RUNscore SHALL be recorded.

R 22. During the run, the system SHALL NOT come into contact with anything below the competition base plane including the track vertical edges, refer G9. This SHALL NOT apply to payload vessels. The system MAY contact the Competition Track comprising the track, either of the steel SHS assemblies and the vertical tube assemblies.

R 23. The system or payload MAY hang over / extend beyond the edges of the perimeter of the Competition Track during the run.

R 24. At the completion of the run, all parts of 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 SHALL be executed.

R 25. The team or system MAY indicate to the timekeepers when they declare their run to be complete. However, the timekeepers 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 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. The run SHALL NOT contaminate or damage the payload vessels. Teams presenting a system that damages or is deemed to have the potential to damage the competition track or payload vessels MAY be disqualified from the competition.

R 28. Each target tube requires a different quantity of payload vessels as defined in R40 and shown in Figure 1. Payload vessels deposited that exceed the specified quantity for a tube SHALL NOT receive a DEPOSITscore. For example, if 4 payload vessels are deposited in tube C, which requires 3 payload vessels, the recorded DEPOSITscore is 3.

R 29. Payload vessels still in contact with the system and/or not fully deposited SHALL NOT receive a DEPOSITscore. For example, a payload vessel with a holder detached from the system and in contact with a payload vessel at the end of the run SHALL NOT constitute a deposited vessel. A detached vessel holder, for example, remains part of the system when considering the RETURNscore.

R 30. For the RETURNscore bonus at least one payload vessel SHALL be correctly deposited, the entire system and any payload vessels still held by the system SHALL be fully to the right side, Figure 1, of the virtual vertical plane of the black vivid line and the RUNtime SHALL be less than 120 seconds.

R 31. One or more components of the system left on the competition track SHALL NOT constitute contamination. Systems that leave parts on the competition track outside the Start/End zone SHALL NOT receive the RETURNscore bonus. System parts SHALL NOT contact delivered payload vessels, refer R29.

R 32. As directed, teams MAY attempt two runs.

R 33. 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. SYSTEMmass SHALL be recorded before each run.

R 34. Violations of procedural rules SHALL result in a zero RUNscore being recorded.

R 35. The judges' decisions on all matters pertaining to the competition SHALL be final.

SCORING

R 36. Within 120 seconds the system SHALL cease all operations. Payload vessels deposited after 120 seconds SHALL NOT receive a DEPOSITscore. Systems that have not fully returned to the Start/End zone within 120 seconds SHALL NOT receive the RETURNscore.

R 37. Better systems will achieve the objective of depositing the correct number of payload vessels in each delivery target tube and the system fully returning into the Start/End zone within 120 seconds, whilst adhering to procedural, volume and positioning constraints.

R 38. At the International Finals, video recording SHALL be used if potential podium winning time scores are within 5 seconds.

R 39. If two or more teams have equal COMPETITIONscores the team competition placing SHALL be determined by the SYSTEMmass of the run achieving the highest RUNscore. The lower SYSTEMmass will be preferred.

R 40. The COMPETITIONscore SHALL be calculated using the following:

$$RUNscore = (DEPOSITscoreA + DEPOSITscoreB + DEPOSITscoreC + DEPOSITscore\ D)x10 + RETURNscore\ + (120 - RUNtime)\ x\ 0.5$$

DEPOSITscore = Number of deposited payload vessels up to the maximum defined below. Deposited vessels SHALL not be in contact with the system.

DEPOSITscoreA: zero or one payload vessel (0, 1)

DEPOSITscoreB: zero to two payload vessels (0, 1, 2)

DEPOSITscoreC: zero to three payload vessels (0, 1, 2, 3)

DEPOSITscoreD: zero to four payload vessels (0, 1, 2, 3, 4)

Vessels deposited that exceed the maximum defined above are a wasted resource and SHALL receive no DEPOSITscore.

Vessels not deposited that are still held by the system or are dropped are wasted resource and SHALL receive no DEPOSITscore.

RETURNscore = 20 for the system fully to the right, Figure 1, of a virtual vertical plane projected from the black vivid line AND at least one payload vessel has been deposited, Refer R1.

RUNtime = time in seconds for runs that correctly deposit all ten vessels within 120 seconds AND fully return to the Start/End zone as defined in R30.

Otherwise = 120

Notes: RUNtime measured from the 'Start Clap' command until the system has stopped 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 placed onto the track, excluding payload and setup tools, which achieved the highest RUNscore.

COMPETITIONscore = Max RUNscore + Min RUNscore/2

Note: Teams are allowed to make two (2) scoring attempts (nominally one in Round 1 and one in Round 2)

Frequently Asked Questions

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

Yes. The scenario requires a ground-based system (see G22). The guidelines and rules do define what can be legally contacted. Payload vessels MAY NOT be in contact with the system or competition track at all times.

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 RUNscore (R22). Parts of the system MAY be left on the Competition Track. The entire system SHALL return to the Start/End zone to receive the RETURNscore. Payload vessels MAY be discarded off the track without penalty or disqualification.

3. Can part of the system overhang the extremities of the competition track without penalty when negotiating the track?

Yes, (see R23). The system can exist in space beyond the projected extremities of the plan of the track during the run. It MAY also overhang the extremity of the Start/End zone beyond the virtual vertical plane generated by the vivid line at the end of the run Refer R30. Contact between the system and anything below the track base plane is not permitted at any time.

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 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) – see R21. Such configurations would be considered to be part of the system and violate position and volume constraints (see R16).

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 ® Mindstorms ® or similarly kitted systems are not allowed (see R4 and R5).

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. Refer G2.

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. To receive the RETURNscore, can the system be larger than 500 x 500 x 500 and in multiple pieces when the run is completed?

Yes, but the entire system must to the right of the vertical plane of the black line. The system MAY have multiple unconnected parts when the run is completed.

Further Competition Details

INTERNATIONAL FINAL

It is planned that the Warman International Final will be held on Saturday 17 and Sunday 18 October 2020 in Sydney at the Australian National Maritime Museum. However, the competition activities will run from Friday to Sunday.

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

The planned format will have students gathering on the morning of Day 1 in Sydney. Lunch, followed by a tour of Weir Minerals Ltd will follow. Briefings, practice sessions, scrutineering and design judging will be conducted on Day 2. The actual running of the International Final and the Awards Ceremony will be on Day 3.

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 in 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 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 will cover two students and one campus organiser from all participating Universities. 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.

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, both at the Campus Competitions 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 organiser’s 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 - General Arrangement and Detailed Drawings of Competition Track

Sheet 1 – Drawing 1 of 4. General Assembly

Sheet 2 – Drawing 2 of 4. Competition Track MDF Sheet

Sheet 3 – Drawing 3 of 4. 25x25 SHS

Sheet 4 – Drawing 4 of 4. 100mm PVC End CAP Drilling Details