

The Ultimate Disc (PILOT Event)

LEVEL:	Grades 9/10 and 11/12
TYPE OF CONTEST:	Team
COMPOSITION OF TEAM:	2 - 3 students per team
NUMBER OF TEAMS:	Preliminary – Determined by your MESA Center Regional – Determined by the Regional hosts
SPONSOR:	Luis Topete, Director, San Diego State University MSP Jeanette Espino, Director, Imperial Valley MSP

OVERVIEW: Design and build a lightweight and durable concrete disc meant to fly in the air. **Students must develop and test various prototypes to determine the most efficient design to achieve flight and stay within project specifications. Students will achieve functionality and efficiency by considering structural design and aerodynamic principles.**

Participation logistics, limits, and competition facilities may vary by host site. Advisors and students are responsible for verifying this information with their center directors. Additionally, project must be the original work of the students. Judges may ask questions for verification.

MATERIALS:

- Portland Cement - Type 1 NOTE: Cement takes at least 18 hours to fully dry.
 - Recommended: Portland Cement (Type 1) is considered the glue required to create concrete. While various products will state to be cement mix, please note that portland cement is required for this competition. Link provided will direct you to Sakrete brand but any brand stating portland cement (type 1) can be used.

<https://www.lowes.com/pd/Sakrete-Portland-94-lb-Type-I-II-Cement/4747085>

Any other cement mixes will not be allowed.

- Carbon and fiberglass mesh
- No restriction on the choice of aggregates (e.g., sand, rocks, etc.)
 - Keep in mind aggregates cannot be hazardous (ie. sharp items, glass)
- Molds to create disc of any form may be used

- No Reinforcement can be exposed at the time of registration
- No coatings that increase the hardness of the disc or create a shell around the disc can be used. (ie. plastic, rubber, glue)

GENERAL RULES:

- 1) Disc must be labeled with team members’ names, grade level, school, and MESA Center. There will be a 10% penalty in the overall score for failing to properly label. Use a sharpie/marker or engrave to label project; any other labeling method (i.e. use of pen/pencil, stickers, adhesives) will result with the labeling penalty of 10%.
- 2) Must be at least 8 in. x 8 in. x ½ in. and no larger than 12 in. x 12 in. x 2 in. to compete.
- 3) Disc must be solid (i.e. must hold shape and must be dry) when registering project.
- 4) One (1) disc per team will be allowed to be registered.
- 5) The weight of the disc must be no more than 3 pounds.
- 6) Creative paint jobs encouraged.

JUDGING:

- 1) Performance: Teams must consider the following competition areas and their scoring breakdown. Maximum total score is out of 100 points.
 - a) Creativity/ Engineering | 10 points
 - i) Scores are based on aesthetics, uniformity, surface texture, finish and paint job.
 - b) Weight Efficiency | 20 points
 - i) Scores for this component will be weighted according to the lightest disc.
 - ii) Formula:

$$WE \text{ (Weight Efficiency)} = WL \text{ (Weight of lightest Disc)} / (\text{Weight of your Disc}) \times 20$$

Example:

$$\begin{aligned} &\text{Weight of lightest Disc: 1.5 lbs} \\ &\text{Weight of your Disc: 2.3 lbs} \\ &1.5/2.3 \times 20 = .6522 \times 20 = 13.04 \text{ points} \end{aligned}$$

- c) Durability | 20 points
 - i) Scores for this section will compare weight of disc when registered and after both throws have been completed. With durability in mind, discs that lose little to no weight after throws will be awarded the most points in this section. Discs that result weighing less than 2/3 of its original weight (weight collected at registration) will receive a zero (0) for this section.
 - ii) In the event that the disc breaks into several pieces, it will be up to **the competitors discretion** to pick one piece for the final weigh in.
 - iii) Formula:

$$DT \text{ (Durability Total)} = WA \text{ (Weight After Tasks)} / WR \text{ (Weight at Registration)} \times 20 \text{ max points}$$

$$\begin{aligned} \text{Disc \#1 | } DT &= (2.4 \text{ lbs} / 2.8 \text{ lbs}) \times 20 \text{ points} = 0.857 \times 20 \text{ points} = 17.14 \text{ points} \\ \text{Disc \#2 | } DT &= (1.68 \text{ lbs} / 2.5 \text{ lbs}) \times 20 \text{ pints} = 0.672 \times 20 \text{ points} = 13.44 \text{ points} \\ \text{Disc \#3 | } DT &= (1.30 \text{ lbs} / 2 \text{ lbs}) \times 20 \text{ points} = 0 \text{ points}^{**} \\ & \quad *[\text{Disc's weight is less than } 2/3 \text{ of original weight}]^* \end{aligned}$$

- d) Accuracy | 30 points
 - i) Teams will have one (1) chance to throw their concrete disc to a target **25 feet** away from the testing zone. Task is to have the disc land closes to the target's bullseye.
 - ii) Teams must keep in mind the disc throwing process and testing zone detailed below.
 - iii) Judges will measure from the center of the target to the closes edge of the disc once the disc has come to a complete stop (See visual attached).
 - e) Distance | 20 points
 - i) Teams will have one (1) chance to throw their concrete disc with the goal to throw the furthest distance away from the testing zone.
 - ii) Teams must keep in mind the disc throwing process and testing zone detailed below.
 - iii) Judges will measure from the baseline at the testing zone to the closes edge of the disc once the disc has come to a complete stop. The distance will be perpendicular to the baseline (See visual attached).
- 2) When throwing the concrete disc, teams must keep the following process in mind:
- a) One (1) foot must be planted in the testing zone (2ft x 2ft) at all times (i.e. no moving, no spinning, etc. of designated foot). The team member may not pass the baseline indicated in the testing zone when throwing the concrete disc. Arms (up to the elbow) crossing the baseline will be acceptable/allowable.
 - b) Throwing of disc must be backhanded.
 - c) Only one member of the team can be in testing zone during judging. A different team member can be designated for each throwing competition task.
- 3) Team will be called up to collect disc and will have 30 seconds to prepare throw. Team will notify judge once "Ready". This will indicate that the team has determined how they will throw and how they will place their foot in testing zone. The judge will state when to "Go!" and will provide teams up to 30 seconds to throw or they will forfeit their throw.

AWARDS:

- Awards will be given per grade level: 9th/10th grade and 11th/12th grade.
- Medals will be awarded for 1st, 2nd, and 3rd place based on Overall Score.
- Ribbons will be awarded for Creativity and Engineering Design.
- Students who win 1st place in each grade level in Overall will move onto Regional Competition

ATTACHMENTS/APPENDIX:

- Competition Area Specifications
- Competition Performance Score Sheet
- Mix Table Form
- Sample Mix Tables

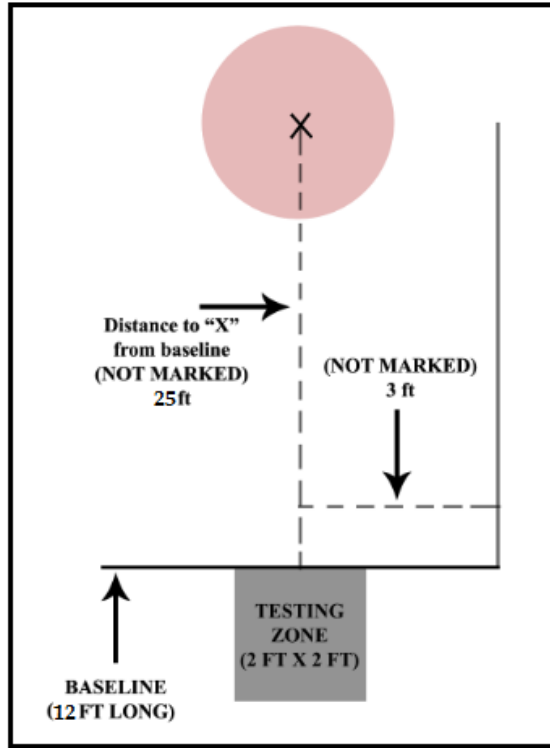
SAFETY NOTE:

The use of the portland cement mix must be done with the supervision of an adult/a teacher. All members must wear gloves, safety glasses, and dust masks when handling cement in its powdered form and during the mixing process. Once the mix has dried and has become concrete, the use of a dust mask will be required if the team members will be sanding their disc to remove excess material, smoothing out the disc, etc. Additionally, because of the nature of the cement/concrete, the use of long sleeve shirts and closed-toe shoes is also required.

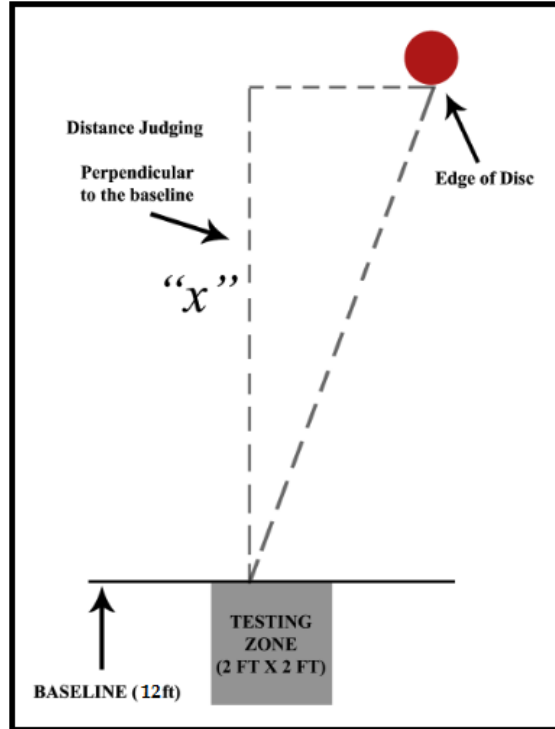
MESA Advisors, Staff, Admin and Judges are recommended to remove participants from this competition if team members do not keep safety as their #1 priority during the creation, testing, and competition of this project.

Competition Area Specifications:

Accuracy



Distance



Performance Scoresheet:

JUDGING CATEGORIES		POINTS																											
A	<p>CREATIVITY/ ENGINEERING: Each category is 2 points each.</p> <table border="1"> <thead> <tr> <th>Category</th> <th>2 - Excellent</th> <th>1 - Present</th> <th>0 - Missing</th> </tr> </thead> <tbody> <tr> <td>Aesthetics</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Uniformity</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Surface texture</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Finish</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Paint job</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Subtotal</td> <td></td> <td></td> </tr> </tbody> </table>	Category	2 - Excellent	1 - Present	0 - Missing	Aesthetics				Uniformity				Surface texture				Finish				Paint job				Subtotal			_____/10
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	Finish																												
	Paint job																												
Subtotal																													
B	<p>WEIGHT EFFICIENCY: Use the following formula Points for Weight Category = $\left[\frac{\text{Weight of Lightest Frisbee}}{\text{Weight of your Frisbee}} \right] \times 20$ = [_____/_____] x 20 = _____</p>	_____/20																											
C	<p>DURABILITY: To receive a score for durability, final weight after the 1st launch must be greater than two-thirds (⅔) of your Disc's initial weight. Use the following formula to calculate durability Points for Durability Category = $\frac{\text{Weight After Tasks}}{\text{Weight at Registration}} \times 20$ = [_____/_____] x 20 = _____</p>	_____/20																											
D	<p>ACCURACY: Teams will have one (1) chance to throw their concrete disc to a target 25 feet away from the testing zone. The objective is to land as closest as possible to the target. Use the following formula to calculate the accuracy of landing Points for Accuracy Category = $\left[\frac{\text{Shortest Distance to Target}}{\text{Your Distance to Target}} \right] \times 30$ = [_____/_____] x 30 = _____</p>	_____/30																											
E	<p>DISTANCE: Use the following formula to calculate the accuracy of landing Points for Distance Category = $\left[\frac{\text{Your Team Total Distance}}{\text{Highest Team Distance}} \right] \times 20$ = [_____/_____] x 20 = _____</p>	_____/20																											
SUBTOTAL		_____/100																											
<p>If there is an Improper Labeling penalty, then subtract 10% from the subtotal score</p>		- _____ (10%)																											
TOTAL		_____/100																											

Mix Table Form:

These tables may be used to record your disc’s weight and materials. Submission of the mix table will not be required due to this being a pilot project. However, it will be required for MESA Day 2020.

Prototype #1

Material	Weight
Example: Portland Cement	.25 lbs
Total Weight	

Prototype #2

Material	Weight
Total Weight	