

OVERVIEW

Participants design and produce a race-worthy CO₂-powered dragster according to stated specifications, using only specified materials. Special design requirements will be posted for this event on the [TSA website](#) under Competitions/Themes and Problems.

ELIGIBILITY

Two (2) individuals per chapter may participate.

TIME LIMITS

1. The dragster and drawing are submitted at the time and place stated in the conference program.
2. Sixteen (16) qualifying car builders will participate in a five (5)-minute interview.
3. Drawings and cars must be picked up at the specified time at the conclusion of the event.

LEAP

An individual LEAP Response is required for this event and must be submitted at event check-in.

ATTIRE

TSA competition attire is required.

PROCEDURE

PRE-CONFERENCE

1. Participants design and create their dragster while working within the required specifications and considering the current year's theme/problem.

PRELIMINARY ROUND

1. Participants check in the following at the time and place stated in the conference program:
 - The dragster entry
 - A full-size metric drawing of the completed vehicle
 - A hard copy of the LEAP Response with no report cover.
2. Entries are reviewed by judges to determine specification adherence and safety on the track.

3. Safe dragsters race for qualifying time on the same lane of a raceway.
4. The top sixteen (16) qualifying cars, based on time trials, are evaluated against the required specifications for this event.
5. Dragsters that do not meet event regulations are disqualified and lower qualifying cars are moved up until sixteen (16) dragsters meeting specifications are determined.

SEMIFINAL ROUND

1. The top sixteen (16) car builders will report to the track at the posted time for a five (5)-minute interview.
2. The top sixteen (16) cars race in a double-elimination format to earn points for the race portion of the event.
3. Drawing, design, and body finish points are combined with race points to determine the final standings.
4. Following the race, participants pick up their entries from the display area at the time and place stated in the conference program.
5. The LEAP Response will be judged for semifinalists.
6. Ten (10) finalists will be announced during the conference award ceremony.

REGULATIONS AND REQUIREMENTS

- A. Each entry must be submitted at check-in with a full-size metric drawing of the completed vehicle.
 1. A two (2)-view (top and side) working drawing with metric dimensions must be made on 11" x 17" drawing paper.
 2. The drawing must be developed using standard engineering practices and procedures; it may be produced using traditional drafting methods or CAD.
 3. The title block includes only the student's identification number, which is assigned at conference registration and is placed on the entry and drawing during check-in.
- B. The official distance between the start line and the finish line on the race track is twenty (20) meters.
- C. Dragsters that do not meet the following specifications and tolerances are disqualified from the race.

Dragster body		
	MINIMUM	MAXIMUM
1. One (1)-piece, all-wood construction <ul style="list-style-type: none"> a. Two (2) or more like or unlike pieces of wood glued together are not considered one (1)-piece, all-wood construction. b. Any type of lamination will result in disqualification. c. No add-ons, such as body strengtheners, fenders, plastic canopy, exhausts, or air foils may be attached to or enclosed within the vehicle. d. Fiberglass and shrink wrap are considered body strengtheners and cannot be used on the car body for any reason. e. Decals may be used for decoration only; they may not be used to gain an aerodynamic advantage, i.e., decals cannot cover the exterior axle holes or be used to cover open areas of the body. 		
2. Body length	280mm	300mm
3. Body height with wheels		75mm
4. Body mass (completed car without CO ₂)	*(2020) – 50g	80g
* denotes specific school year requirement	*(2021) – 60g	85g
5. Body width at the point the axles pass through the body, front and back	35mm	42mm
6. Vehicle total width (including wheels).	90mm	

Axles/axle holes/wheelbase		
	MINIMUM	MAXIMUM
1. Dragsters must have two (2) axles per car, no more.		
2. Bottom of axle hole or bearing above bottom of car body. (NOTE: This will be only be measured at the side surfaces of the wood car body at the axle hole.)	5mm	10mm
3. Axle hole from front and rear of car	10mm	100mm
4. Wheelbase (axle distance apart at farthest points)	105mm	250mm
5. Bearings, bushings and lubricants may be used.		
6. Glue may only be used to secure bearings to body.		

Spacer washers/clips		
	MINIMUM	MAXIMUM
1. Spacer washers	10	
2. Axle clips	4	
3. Silicone or any other type of glue/adhesive may not be used in place of wheel clips to hold wheels or axles in place.		

Power plant (CO₂ cartridge hole)

	MINIMUM	MAXIMUM
1. The power plant hole must be at the farthest point at the rear of the car and must be drilled parallel to the racing surface to assure proper puncture of the CO ₂ cartridge. <ul style="list-style-type: none"> a. A minimum of 3mm thickness around the entire power plant hole must be maintained on the dragster for safety. b. There should be no paint inside the CO₂ cartridge hole. 		
2. Hole depth	45mm	55mm
3. Safety zone thickness	3mm	
4. Chamber diameter	19mm	20mm
5. Lowest point of chamber diameter to race surface (with wheels)	26mm	40mm

Eye screws

	MINIMUM	MAXIMUM
1. Dragsters must have no more than two (2) eye screws per car that meet tolerances. <ul style="list-style-type: none"> a. Eye screws must not make contact with the racing surface. b. The track string must pass through both eye screws, which are located on the center line of the bottom of the car. c. Glue may be used to reinforce the eye screws. d. It is the responsibility of the car designer/engineer to see that the eye screw holes are tightly closed to prevent the track string from slipping out. e. Any adjustments must be done prior to event check-in. 		
2. Inside diameter	3mm	5mm
3. Distance apart (at farthest points)	150mm	270mm

Wheels

	MINIMUM	MAXIMUM
1. A dragster must have exactly four (4) wheels, each of which separately must meet regulations in items in 2 and 3 below. <ul style="list-style-type: none"> a. All four (4) wheels must touch the racing surface at the same time. b. All wheels must roll. c. Wheels must be made entirely from plastic. d. Dimensions must be consistent for the full circumference of the wheel. 		
2. Wheel diameter	30mm	40mm
3. Wheel width*	2mm	18mm

* Width is determined by the continuous point of contact between the wheel and track or flat surface.

- D. No repair or maintenance is allowed after the entries have been submitted.
1. Any vehicle damaged during the race is evaluated by the event coordinator to determine whether or not the vehicle is allowed to race again.
 2. In the event that the vehicle is damaged by conference personnel, the event coordinator rules as to whether the vehicle may be repaired by the participant entering the vehicle; this is the only reason a participant is allowed to touch his/her vehicle after registration.
 3. Undamaged wheels that come off during the event may be replaced as determined by the event coordinator.
 4. Damaged wheels may not be replaced.
- E. All CO₂ cartridges for the race are provided by national TSA.

SEMIFINAL ROUND

- A. The semifinalist interview must include both team members.
- B. The LEAP Response:
1. Teams document the leadership skills they have developed and demonstrated while working on this event and on a non-competitive event leadership experience.
 2. Find specific LEAP Response regulations in the LEAP Program section of this guide and on the [TSA website](#).

EVALUATION

1. Points earned through car design and appearance
2. Accuracy and quality of the drawing
3. The interview
4. Placement in the double elimination on-site race
5. The content and quality of the LEAP Response

Refer to the official rating form for more information.

STEM INTEGRATION

This event has connections to the STEM areas of Science, Technology, Engineering, and Mathematics.

CAREERS RELATED TO THIS EVENT

This competition has connections to one (1) or more of the careers below:

- Aeronautical engineer
- Automotive designer
- Automotive modeler
- Industrial designer
- Industrial engineer
- Mechanical engineer
- Race car engineer

DRAGSTER

2020 & 2021 OFFICIAL RATING FORM

MIDDLE SCHOOL

Judges: Using minimal (1-4 points), adequate (5-8 points), or exemplary (9-10 points) performance levels as a guideline in the rating form, record the scores earned for the event criteria in the column spaces to the right. The X1 or X2 notation in the criteria column is a multiplier factor for determining the points earned. (Example: an “adequate” score of 7 for an X1 criterion = 7 points; an “adequate” score of 7 for an X2 criterion = 14 points.) A score of zero (0) is acceptable if the minimal performance for any criterion is not met.

Go/No Go Specifications

- Before judging the entry, ensure that the items below are present; indicate presence with a check mark in the box.
- If an item is missing, leave the box next to the item blank and place a check mark in the box labeled ENTRY NOT EVALUATED.
- If a check mark is placed in the ENTRY NOT EVALUATED box, the entry is not to be judged.

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- Car is present
 - Technical drawing is present
 - Car is safe to race
 - Completed LEAP Response is present
 - ENTRY NOT EVALUATED

DRAGSTER CONSTRUCTION (50 points)				Record scores in the column spaces below.
CRITERIA	Minimal performance	Adequate performance	Exemplary performance	
	1-4 points	5-8 points	9-10 points	
Dragster body production quality (X1)	Dragster exhibits poor production quality; little or no attention to detail is evident; surface is crude and rough.	Dragster shows evidence of proper production techniques; dragster is adequate but needs improvement.	Excellent production techniques are displayed in the dragster; obvious attention to detail and quality is evident.	
Body paint/finish (X1)	Surface preparation is inadequate; body is unprimed, with poorly applied final finish.	Dragster body is painted and finished but not in a quality way; body is dull and sticky.	Dragster body finish is exemplary; body is smooth, shiny, and exhibits quality.	
Vehicle assembly (X1)	Dragster exhibits poor or sloppy assembly of parts (loose wheels, eye screws are not level, and/or they are loose, etc.).	Dragster is well assembled, and adequately meets standards.	Dragster is properly assembled, with obvious evidence of attention to detail.	
Drawing scale and dimensioning (X1)	Drawing is present, but it is not to scale; dimensions are missing, or dimensioning is poorly done.	Drawing is acceptable, true to scale, and it is a close representation of the vehicle; some dimensions are missing.	Drawing is exemplary, exact, and includes all pertinent dimensions.	
Drawing completion and quality (X1)	Drawing work is sloppy, missing parts, and lacking quality.	Drawing is complete; quality is average.	Drawing is complete, precise, and of exceptional quality.	
DRAGSTER CONSTRUCTION SUBTOTAL (50 points)				

Record scores
in the column
spaces below.

INTERVIEW (20 points)			
CRITERIA	Minimal performance	Adequate performance	Exemplary performance
	1-4 points	5-8 points	9-10 points
Car builder interview (X2)	The student shows very limited knowledge of (and has difficulty articulating) how the car was produced or decisions made during the production; the student exhibits a basic understanding of design elements and functionality, and the rationale is inconsistent or absent.	The student demonstrates some knowledge of the dragster production and has adequate knowledge of some processes or reasoning behind the vehicle design.	The student shows competence and knowledge related to the design and production of the vehicle; the student is able to articulate “reasoning” behind the decisions made.
INTERVIEW SUBTOTAL (20 points)			

PRELIMINARY SUBTOTAL (70 points)

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LEAP RESPONSE (7 points)			
CRITERIA	Minimal performance	Adequate performance	Exemplary performance
LEAP Response (10% of total event points)	The individual's efforts are not clearly communicated, lack detail, and/or are unconvincing; few, if any, attempts are made to identify and/or incorporate the SLC Practices and Behaviors.	The individual's efforts are adequately communicated, include some detail, are clear, and/or are generally convincing; identification and/or incorporation of the SLC Practices and Behaviors is adequate.	The individual's efforts are clearly communicated, fully-detailed, and convincing; identification and/or incorporation of the SLC Practices and Behaviors is excellent.
LEAP RESPONSE SUBTOTAL (7 points)			

RACE (60 points)							
1st	2nd	3rd	4th	5th & 6th	7th & 8th	9th-12th	13th – 16th
60 Points	55 Points	50 Points	45 Points	40 Points	35 Points	30 Points	25 Points
RACE SUBTOTAL (60 points)							

Rules violations (a deduction of 20% of the total possible points for the above sections) must be initialed by the judge, coordinator, and manager of the event. Record the deduction in the space to the right.

Indicate the rule violated: _____

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SEMIFINAL SUBTOTAL (67 points)

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To arrive at the TOTAL score, add any subtotals and subtract rules violation points, as necessary. TOTAL (137 points)
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Comments:

I certify these results to be true and accurate to the best of my knowledge.

JUDGE

Printed name: _____ Signature: _____

DRAGSTER

EVENT COORDINATOR INSTRUCTIONS

PERSONNEL

- A. Event coordinator
- B. Judges:
 - 1. Preliminary round, two (2) or more
 - 2. Semifinal round, two (2) or more
- C. Recorder for double elimination chart, one (1)
- D. Assistants, two (2)

MATERIALS

- A. Coordinator's packet, containing:
 - 1. Event guidelines, one (1) copy for the coordinator and each judge
 - 2. TSA Event Coordinator Report
 - 3. List of judges/assistants
 - 4. Stick-on labels for identifying entries (three [3] per entry; one [1] each for the car, plans, and LEAP documents)
 - 5. Time trial record sheet
 - 6. Qualifier Interview Time Slot sheet
 - 7. Double elimination bracket chart
 - 8. Results envelope with coordinator forms
- B. CO₂ cartridges
- C. Go/No-Go gauges for all judges
- D. Metric scientific scales (triple beam balance or digital)
- E. Mono-filament fishing line (50lb) for track (4 pre-tied, 2 on track, and 2 reserve)
- F. Race track set, including a starting gate and a finish gate with digital timer and winning lane indicator
- G. Padding for the finish gate
- H. One (1) or more test cars
 - I. Tables for the display of cars and for evaluation
 - J. Table at the starting line for arranging and holding cars prior to the races
 - K. Table at the finish gate for the placement of cars after the races and to hold eliminated cars
 - L. Table for the official time keeper

- M. When using a computer controlled track, provide the proper computer for the software being used, all necessary connections, and a printer (placed on the official time keeper's table)
- N. A method for displaying the time trial and race brackets

RESPONSIBILITIES

AT THE CONFERENCE

- 1. Attend the mandatory coordinator's meeting at the designated time and location.
- 2. Report to the CRC room and check the contents of the coordinator's packet.
- 3. Review the event guidelines and check to see that enough personnel have been scheduled.
- 4. Inspect the area(s) in which the event is to be held for appropriate set-up, including room size, chairs, tables, outlets, etc. Notify the event manager of any potential problems.

CHECK-IN

- 1. Participants report to the time and place stated in the conference program and check in:
 - The dragster entry
 - Full-size metric drawing of the completed vehicle
 - A hard copy of the LEAP response with no report cover.
- 2. Late entries are considered on a case-by-case basis and only when the lateness is caused by events beyond the participant's control.
- 3. In order to compete, participants must be on the entry list or must have approval of the CRC.
- 4. Requirements for attire do NOT apply during check-in, only on the first day of the conference.
- 5. Check to see that each entry drawing includes the participant's identification number in the upper right-hand corner of the paper.
- 6. Position each entry (dragster and drawing) for evaluation and viewing.
- 7. Secure the entries in the designated area.

PRELIMINARY ROUND

1. At least one (1) hour before the event is scheduled to begin, meet with judges/assistants to review time limits, procedures, and regulations. If questions arise that cannot be answered, speak to the event manager before the event begins.
2. Assist judges with evaluation of the design, drawing, and construction categories.
3. Decisions about rules violations must be discussed and verified with the judges, event coordinator, and the CRC manager to determine either:
 - To deduct twenty percent (20%) of the total possible points in this round
 - To disqualify the entry

The event coordinator, judges and CRC manager must all initial either of the violations on the rating form.

4. Begin the time trials at the scheduled time.
 - a. Every race-worthy car should be tested.
 - b. Students do not have to be present.
 - c. Public viewing is allowed.
5. Position a judge at the starting gate to ensure that all cars are positioned in the starting gate correctly.
6. Position another judge at the finish line.
7. If there is a misfire or if a time is not properly recorded, a rerun may be ordered at the discretion of the event coordinator.
8. Record preliminary times on a time trial record sheet.

9. Place each car in the double elimination race bracket (see next page for sample) according to the rank of its qualifying time.
10. Judges verify that the top sixteen (16) qualifying cars meet Regulation D specifications.
11. Entries that do not meet specifications are removed.
12. Cars that are damaged or broken during the qualifying round are deemed non-raceable and also are removed.
13. Only raceable cars, as determined by the judges, are allowed to compete for the semifinalist category.
14. Lower qualifying cars are moved up until there are sixteen (16) legal semifinalists.
15. Submit the semifinalist results to the CRC room.

SEMIFINAL ROUND

1. Begin the semifinals at the scheduled time.
2. Car builders will report to the track at the posted time for a five (5)-minute interview.
3. Only the sixteen (16) qualifying cars are raced.
4. Students do not have to be present.
5. Public viewing is allowed.
6. Discuss rule violations (e.g. 20% deduction, disqualification) and have all relevant parties initial the rating form.
7. Judges should use qualifying times to break any ties among the sixteen (16) qualifying cars.
8. Submit the finalist results and all related forms in the results envelope to the CRC room.
9. If necessary, manage security and the removal of materials from the event area.

RACE BRACKET FOR 16-CAR DOUBLE ELIMINATION

Double Elimination Tournament Chart Seeded 16 player Field

