# DRAGSTER DESIGN

## OVERVIEW

Applying leadership and 21st century skills, participants design, produce a working drawing for, and build a $CO_2$-powered dragster according to stated specifications, using only certain materials.

## ELIGIBILITY

Two (2) individuals per chapter may participate.

## TIME LIMITS

The top sixteen (16)-qualifying dragster builders participate in a five (5)-minute car builder interview.

## ATTIRE

TSA competition attire is required for this event.

## PROCEDURE

### PRE-CONFERENCE

A. Participants prepare their documentation and Dragster model according to the regulations.

### PRELIMINARY ROUND

A. Participants report to the time and place stated in the conference program to check in:
   1. the dragster
   2. the drawings
B. Entries are reviewed by judges to determine safety on the track.
C. Safe dragsters race for qualifying time on the same lane of the raceway.
D. The top sixteen (16) qualifying entries, based on the time trials, are evaluated against the criteria for this event.
E. Dragsters that do not meet event regulations are disqualified and lower qualifying cars are moved up until sixteen (16) dragsters that meet specifications are determined.

### SEMINFINAL ROUND

A. The top sixteen (16) dragster builders report to the track at the posted time for a five (5)-minute interview.
B. The top sixteen (16) entries race in a double-elimination format to earn points for the race portion of the event.
C. Drawing, design, and body finish points are combined with race points to determine the final standings.
D. The top ten (10) finalists are announced at the awards ceremony.

## REGULATIONS AND REQUIREMENTS

Students will work to develop their leadership and 21st century skills in the process of preparing for and participating in this TSA competitive event. The development and application of those skills must be evident in their submission, demonstration, and/or communication pertaining to the entry.

### PRELIMINARY ROUND

A. Participants must check the "Special Design Challenge Requirements" section for the current year's design challenge specifications.
B. Drawings:
   1. The two (2)-view (top and side) drawing with metric dimensions is made on drawing paper no larger than 11" x 17" in size.
   2. Drawings are developed using standard engineering practices and procedures.
   3. The drawing may be produced using traditional drafting methods or CAD.
   4. The title block includes only the participant's identification number, which is assigned at registration time and is placed on the entry and drawing during check-in.
C. Dragsters that do not meet the below specifications/ tolerances are disqualified from the race.

## Special Design Challenge Requirements

(2021) Car body design must include at least one vertical fin on the front and rear of the body
(2022) All four wheels must be completely exposed from the body. Use modern NHRA Top Fuel Dragsters as inspiration.

## Dragster body

| | MINIMUM | MAXIMUM |
|---|---|---|
| 1. One (1)-piece, all-wood construction; any type of lamination results in disqualification. No add-ons such as body strengtheners, fenders, plastic canopy, exhausts, or air foils may be attached to or enclosed within the vehicle. Fiberglass and shrink wrap are considered body strengtheners and cannot be used on the car body for any reason. 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. Two (2) or more like or unlike pieces of wood glued together are not considered one (1)-piece, all-wood construction. | | |
| 2. Body length | (2021) 235mm<br>(2022) 280mm | (2021) 245mm<br>(2022) 290mm |
| 3. Body height with wheels | | 75mm |
| 4. Body mass (completed car without $CO_2$) | (2021) 100g<br>(2021) 80g | N/A |
| 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 | 15mm | 100mm |
| 4. Minimum wheelbase (axle distance apart at farthest points) | 105mm | N/A |
| 5. Bearings, bushings and lubricants may be used. | | |
| 6. Glue may be used to secure bearings to body. | | |

## Spacer washers/clips

| | MINIMUM | MAXIMUM |
|---|---|---|
| 1. Spacer washers | | 8 |
| 2. Axle clips | | 8 |
| 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 ($CO_2$ 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. A minimum of 3mm thickness around the entire power plant hole must be maintained on the dragster for safety. The inside of the power plant hole must not be intentionally painted. | | |
| 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 |

| Screw eyes | | |
|---|---|---|
| | MINIMUM | MAXIMUM |
| 1. Dragsters must have two (2) screw eyes (no more) per car that meet tolerances. Screw eyes must not make contact with the racing surface. The track string must pass through both screw eyelets, which are located on the center line of the bottom of the car. Glue may be used to reinforce the screw eyes. It is the responsibility of the car designer/ engineer to see that the screw eye holes are tightly closed to prevent the track string from slipping out. As with all adjustments, this must be done prior to event check-in. | | |
| 2. Inside diameter | 3mm | 5mm |
| 3. Minimum distance apart (at farthest points) | 150mm | N/A |

| Wheels | | |
|---|---|---|
| | MINIMUM | MAXIMUM |
| 1. A dragster must have four (4) wheels, no more.<br>a. Two (2) wheels must meet the requirements in #2 and #3 below.<br>b. The other two (2) wheels must meet the requirements in #4 and #5 below.<br>c. All four (4) wheels must touch the racing surface at the same time.<br>d. All wheels must roll.<br>e. Wheels must be made entirely from plastic.<br>f. Dimensions must be consistent for the full circumference of each wheel.<br>g. Measurement represents the FULL surface contact point where wheel makes contact with the track. | | |
| 2. Front diameter | 32mm | 37mm |
| 3. Front width (at surface contact point) | 1.5mm | 5mm |
| 4. Rear diameter | 35mm | 40mm |
| 5. Rear width (at full, unbroken, surface contact point) | 12mm | 18mm |

### SEMINFINAL ROUND

A. The Race:

1. The official distance between the start line and the finish line on the race track is twenty (20) meters.
2. No repair or maintenance is allowed after the entries have been registered.
3. Any entry damaged during the race is evaluated by the event coordinator to determine whether or not the vehicle is allowed to race again.
4. In the event that the vehicle is damaged by conference personnel, the event coordinator rules as to whether or not the vehicle may be repaired by the student entering the vehicle. This is the only reason a student is allowed to touch his/her vehicle after registration.
5. Cars that lose wheels, bearings, screw-eyes will not continue to race.
6. Damaged wheels may not be replaced.
7. All $CO_2$ cartridges for the race are provided by national TSA.

## EVALUATION

A. The dragster

B. The drawings

C. Placement in the double elimination on-site race

D. The interview

Refer to the official rating form for more information.

## STEM INTEGRATION

This event aligns with the STEM (Science, Technology, Engineering, and Mathematics) educational standards.

## LEADERSHIP AND 21ST CENTURY SKILLS DEVELOPMENT

This event provides opportunity for students to build and develop leadership and 21st century skills including but not limited to:

- Communication
- Collaboration/Social Skills
- Initiative
- Problem Solving/Risk Taking
- Critical Thinking
- Perseverance/Grit
- Creativity
- Relationship Building/Teamwork
- Dependability/Integrity
- Flexibility/Adaptability

## CAREERS RELATED TO THIS EVENT

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

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

Participant/Team ID# _____

# DRAGSTER DESIGN

## 2021 & 2022 OFFICIAL RATING FORM

## HIGH 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.

☐ Car is present
☐ Technical drawing is present
☐ Car is safe to race
☐ ENTRY NOT EVALUATED

| **DRAGSTER CONSTRUCTION** (50 points) | | | | |
|---|---|---|---|---|
| **CRITERIA** | Minimal performance | Adequate performance | Exemplary performance | Record scores in the column spaces below. |
| | 1-4 points | 5-8 points | 9-10 points | |
| **Dragster Body Production Quality** (X1) | Dragster exhibits poor production quality, with a crude and rough surface and little or no attention to detail. | Dragster shows evidence of proper production techniques; it is adequate but may need improvement. | Dragster displays excellent production techniques, with obvious attention to detail and quality. | |
| **Body Paint/Finish** (X1) | Surface preparation is inadequate; the body is unprimed, with poorly applied final finish. | Dragster body is painted and finished adequately. | 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) | The drawing is present, but is not to scale; dimensions are missing, or dimensioning is poorly done. | The drawing is acceptable and to scale; it is a close representation of the vehicle, but some dimensions may be missing. | The drawing is exemplary, exact, and includes all pertinent dimensions. | |
| **Drawing Completion and Quality** (X1) | The drawing is sloppy, missing parts, and lacking quality. | The drawing is complete, and the quality is adequate. | The drawing is complete and precise, and of exceptional quality. | |
| | | | **DRAGSTER CONSTRUCTION SUBTOTAL** (50 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: _____

**PRELIMINARY SUBTOTAL** (50 points)

| SEMIFINAL INTERVIEW (20 points) | | | | Record scores in the column spaces below. |
|---|---|---|---|---|
| **CRITERIA** | Minimal performance | Adequate performance | Exemplary performance | |
| | 1-4 points | 5-8 points | 9-10 points | |
| **Car Builder Interview** (X2) | The participant demonstrates limited knowledge and has difficulty articulating the design process; there are signs of lack of involvement in the video production or processes; leadership and/or 21st century skills are not evident. | The participant demonstrates adequate knowledge of the production and design processes; leadership and/or 21st century skills are somewhat evident. | The participant demonstrates competence and knowledge related to the design and production of the dragster and articulates the "reasoning" behind the decisions made; leadership and/or 21st century skills are clearly evident. | |
| | | | **SEMIFINAL INTERVIEW SUBTOTAL** (20 points) | |

| RACE (55 points) | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1st | 2nd | 3rd | 4th | 5th & 6th | 7th & 8th | 9th-12th | 13th – 16th |
| 55 Points | 50 Points | 45 Points | 40 Points | 35 Points | 30 Points | 25 Points | 15 Points |
| | | | | | | **RACE SUBTOTAL** (55 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: _____

**To arrive at the TOTAL score, add any subtotals and subtract rules violation points, as necessary.** **TOTAL (125 points)**

Comments:

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

JUDGE

Printed name: _____ Signature: _____

# DRAGSTER DESIGN
# EVENT COORDINATOR INSTRUCTIONS

## PERSONNEL

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

## MATERIALS

A. Coordinator's packet and box, containing:
   1. Event guidelines, one (1) copy for the coordinator and for each judge
   2. TSA Event Coordinator Report
   3. List of judges/assistants
   4. Time trial record sheet
   5. Qualifier interview time slot sheet
   6. Double elimination bracket chart
   7. Stick-on labels for entries, as needed
   8. Results envelope
B. $CO_2$ cartridges
C. Metric scientific scales (triple beam balance or digital)
D. Mono-filament fishing line (suggest between 30 and 50 pound); four (4) pre-tied: two (2) on track and two (2) reserve, for the track
E. Race track set, including a starting gate and a finish gate, with a digital timer and winning lane indicator
F. Padding for the finish gate
G. Extra vehicles to test and demonstrate the track
H. Race brackets for placement of the semifinalists
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 timekeeper
M. When using a computer controlled track, provide the proper computer for the software being used, all necessary connections, and a printer. This equipment is placed on the official timekeeper's table.
N. Provide for a display of time trials and race brackets.
O. Ultraviolet ink and light to mark cars and check for cars that have been previously entered.

## RESPONSIBLITIES

### AT THE CONFERENCE

A. Attend the mandatory coordinator's meeting at the designated time and location.
B. Report to the CRC room and check the contents of the coordinator's packet.
C. Review the event guidelines and check to see that enough personnel have been scheduled.
D. Inspect the area(s) in which the event is to be held for appropriate set-up, including room size, tables, chairs, etc. Notify the event manager of any potential problems.
E. At least one (1) hour before the event is to begin, meet with judges and assistants to review time limits, procedures, regulations, evaluation, and all other details related to the event. If questions arise that cannot be answered, speak to the event manager before the event begins.

### EVENT CHECK-IN

A. Participants report to the time and place stated in the conference program and check in:
   1. The dragster entry
   2. Full-size metric drawing of the completed vehicle
B. Late entries are considered on a case-by-case basis and only when the lateness is caused by events beyond the participant's control.
C. In order to compete, participants must be on the entry list or must have approval of the CRC.
D. Requirements for attire do NOT apply during check-in, only on the first day of the conference.
E. Check to see that each entry drawing includes the participant's identification number in the upper right-hand corner of the paper.
F. Position each entry (dragster and drawing) for evaluation and viewing.
G. Secure the entries in the designated area.

## PRELIMINARY ROUND

A. Assist judges with evaluation of the design, drawing, and construction categories.

B. Decisions about rules violations must be discussed and verified with the judges, event coordinator, and CRC manager to determine either:

   1. To deduct twenty percent (20%) of the total possible points in this round or
   2. To disqualify the entry

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

C. Begin the time trials at the scheduled time.

   1. Every race-worthy car should be tested.
   2. Students do not have to be present.
   3. Public viewing is allowed.
   4. Each car is timed in the same lane.
   5. Cars are timed only once.
   6. It is important that each car be positioned as well as possible in the starting gate.

D. Position a judge at the starting gate to ensure that all cars are positioned in the starting gate correctly.

E. Position another judge at the finish line.

F. 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.

G. Record preliminary times on a time trial record sheet.

H. Place each car in the double elimination race bracket (see sample) according to the rank of its qualifying time.

I. Judges verify that the top sixteen (16) qualifying cars meet Regulation C specifications.

J. Entries that do not meet specifications are removed.

K. Cars that are damaged or broken during the qualifying round are deemed non-raceable and also are removed.

L. Only raceable cars, as determined by the judges, are allowed to compete for the semifinalist category.

M. Lower qualifying cars are moved up until there are sixteen (16) legal semifinalists.

N. Review and submit the semifinalist results and all related forms in the results envelope to the CRC room.

## SEMIFINAL ROUND

A. Post the top sixteen (16) cars with interviews times.

B. Car builders report to the track at the posted time for a five (5)-minute car builder interview.

C. Conduct interviews with the qualifying top sixteen (16) car builders.

D. Begin the semifinals at the scheduled time.

E. Run the semifinalist race. A sample double-elimination bracket follows.

F. Only the sixteen (16) qualifying cars are raced.

G. Students do not have to be present.

H. Public viewing is allowed.

I. Discuss rule violations (e.g. 20% deduction, disqualification) and have all relevant parties initial the rating form.

J. Judges use qualifying times to break any ties among the sixteen (16) qualifying cars.

K. Submit the finalist results and all related forms in the results envelope to the CRC room.

L. If necessary, manage the security and removal of materials from the event area.