DRAGSTER DESIGN

OVERVIEW

Participants design, produce working drawings for, and build a CO2-powered dragster.

PURPOSE

Participants have the opportunity to design and produce a fast CO2-powered dragster according to stated specifications and using only certain materials.

ELIGIBILITY

Participants are limited to two (2) individuals per chapter, one (1) entry per individual.

TIME LIMITS

A. Entries must be started and completed during the current school year.

B. Each dragster and drawing must be submitted at the time and place stated in the conference program.

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

D. Drawings and dragsters must be picked up at the specified time upon the conclusion of the event.

ATTIRE

Competition attire, as described in National TSA Dress Code (www.tsaweb.org/Dress-Code), is required for this event.

PROCEDURE

A. Participants check in their entries at the time and place stated in the conference program.

B. Entries are reviewed by evaluators to determine, among other things, safety on the track.

☑️ Be sure to review the specifications each year, even if you’re a regular participant. This event is modified with each new edition of this guide.
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.

F. The top sixteen (16) dragster builders will report to the track at the posted time for a five (5)-minute interview.

G. The top sixteen (16) entries race in a double-elimination format to earn points for the race portion of the event.

H. Drawing, design, and body finish points are combined with race points to determine the final standings.

It is essential that students and advisors routinely check the TSA website (www.tsaweb.org) for updated information about TSA general rules and competitive events. This information is found on the website under Competitions/Updates and Clarification. When students participate in any TSA competitive event, they are responsible for knowing of updates, changes, or clarification related to that event.

REGULATIONS

A. Each entry must be submitted at check-in with a full-size metric drawing of the completed vehicle. The two (2)-view (top and side) drawing with metric dimensions is made on drawing paper no larger than 11” x 17” in size. Drawings are developed using standard engineering practices and procedures. The drawing may be produced using traditional drafting methods or CAD. The title block includes only the participant’s “entry number,” which is assigned at registration time 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/tolerances are disqualified from the race.
Dragster Design

Dragster body

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-piece, all-wood construction.

**ALERT: Read the regulations closely as there are significant changes to this event from prior years.**

<table>
<thead>
<tr>
<th>MINIMUM</th>
<th>MAXIMUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Body length ............................................................................................... (2015) 200mm ........................................210mm</td>
<td></td>
</tr>
<tr>
<td>........................................................... (2016) 275mm ........................................285mm</td>
<td></td>
</tr>
<tr>
<td>3. Body height with wheels .................................................................................... 75mm</td>
<td></td>
</tr>
<tr>
<td>4. Body mass (completed car without CO2) .......................................................... (2015) 50g ........................................ N/A</td>
<td></td>
</tr>
<tr>
<td>........................................................... (2016) 40g ........................................ N/A</td>
<td></td>
</tr>
<tr>
<td>5 Body width at axles, front and back ................................................................. 35mm ........................................ 42mm</td>
<td></td>
</tr>
<tr>
<td>6. Vehicle total width (including wheels) ............................................................ 90mm</td>
<td></td>
</tr>
</tbody>
</table>

Axles/axle holes/wheelbase

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 measured at the sides of the wood car body, from the bottom of the car directly beneath the axle to the bottom of the axle hole or bearing hole.)
   ........................................................................................................... 5mm ................................. 10mm
3. Axle hole from front and rear of car ............................................................... 9mm ........................................ 100mm
4. Wheelbase (axle distance apart at farthest points) ........................................... 105mm ........................................... 270mm
5. Bearings, bushings and lubricants may be used.
6. Glue may be used to secure bearings to body.
Dragster Design

### Spacer washers/clips
1. Spacer washers
2. Axle clips
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)
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 CO2 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.

<table>
<thead>
<tr>
<th>MINIMUM</th>
<th>MAXIMUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hole depth</td>
<td>45mm</td>
</tr>
<tr>
<td>Safety zone thickness</td>
<td>3mm</td>
</tr>
<tr>
<td>Chamber diameter</td>
<td>19mm</td>
</tr>
<tr>
<td>Lowest point of chamber diameter to race surface (with wheels)</td>
<td>26mm</td>
</tr>
</tbody>
</table>

### Screw eyes
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.

<table>
<thead>
<tr>
<th>MINIMUM</th>
<th>MAXIMUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inside diameter</td>
<td>3mm</td>
</tr>
<tr>
<td>Distance apart (at farthest points)</td>
<td>150mm</td>
</tr>
</tbody>
</table>
Wheels

1. A dragster must have four (4) wheels, no more. Two (2) wheels must meet the requirements in #2 and #3 below. The other two (2) must meet the requirements in #4 and #5 below. All four (4) wheels must touch the racing surface at the same time. All wheels must roll. Wheels must be made entirely from plastic. Dimensions must be consistent for the full circumference of the wheel.

<table>
<thead>
<tr>
<th>MINIMUM</th>
<th>MAXIMUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Front diameter ........................................................ 30mm ..................37mm</td>
<td></td>
</tr>
<tr>
<td>3. Front width (at surface contact point) .................... 1.5mm ......................5mm</td>
<td></td>
</tr>
<tr>
<td>4. Rear diameter ......................................................... 30mm ..................40mm</td>
<td></td>
</tr>
<tr>
<td>5. Rear width (at surface contact point) .................... 12mm ......................18mm</td>
<td></td>
</tr>
</tbody>
</table>

D. No repair or maintenance is allowed after the entries have been registered. Any entry damaged during the race is evaluated by the event coordinator to determine whether or not the vehicle is allowed to race again. In the event that the vehicle is damaged by the conference personnel, the event coordinator rules as to whether 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. Undamaged wheels that come off during the event may be replaced as determined by the event coordinator. Damaged wheels may not be replaced.

E. All CO2 cartridges for the race are provided by national TSA.

EVALUATION

Evaluation is based on points earned through car design and appearance, accuracy, and quality of the drawing, as well as points earned through the wind tunnel test and placement in the double elimination on-site race.
STEM INTEGRATION

This event aligns with the STEM educational standards noted below. Please refer to the STEM Integration section of this guide for more information.

Science, Technology, Engineering, Mathematics

COMMON CORE STATE STANDARDS (CCSS) INTEGRATION

Please refer to the Common Core State Standards (CCSS) Integration section of this guide for more information.

PRIMARY LEADERSHIP SKILLS

Leadership skills promoted in this event:

- CREATIVE THINKING — Students produce creative ideas based on specifications. Suggested leadership lessons: Creative Techniques and HAT To Be Creative
- EVALUATION — Students evaluate their entry using time trials, testing and rebuilding. Suggested leadership lessons: Silence Is Golden and Your Dream Car
- PROBLEM SOLVING — Students fix/adjust their entry after evaluation. Suggested leadership lessons: Effective Brainstorming and Problem Solving Steps

Additional leadership skills promoted in this event: decision making, organization

TSA AND CAREERS

This competition connects to one or more of the career areas featured in the TSA AND CAREERS section of this guide. Use The 16 Career Clusters chart and the TSA Competitions and The 16 Career Clusters grid as resources for information about careers.

CAREERS RELATED TO THIS EVENT

Automotive designer
Automotive modeler
Industrial designer
Industrial engineer
Race car engineer
DRAGSTER DESIGN

EVENT COORDINATOR INSTRUCTIONS

PERSONNEL

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

MATERIALS

A. Coordinators box, containing:
   1. Event guidelines, one (1) copy for the coordinator and for each evaluator
   2. Official rating forms
   3. List of entries with finalist report
   4. List of evaluators/assistants
   5. Time trial record sheet
   6. Qualifier interview time slot sheet
   7. Double elimination bracket chart
   8. Results envelope
B. CO2 cartridges
C. Go/No-go gauges for all evaluators
D. Metric scientific scales (triple beam balance or digital)
F. Race track set, including a starting gate and finish gate with digital timer and winning lane indicator
G. Padding for the finish gate
H. One (1) or more test cars
I. Race brackets for placement of the semifinalists
J. Tables for the display of cars and for evaluation
K. Table at the starting line, for arranging and holding cars prior to the races
L. Table at the finish gate for the placement of cars after the races and to hold eliminated cars
M. Table for the official timekeeper

N. 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.

O. Provide for a display of time trial and race brackets.

P. Ultraviolet ink and light to mark cars and check for cars that have been previously entered.

RESPONSIBILITIES

A. Upon arrival at the conference, report to the CRC room and check the contents of the coordinator’s notebook. Review the event guidelines and check to see that enough evaluators/assistants have been scheduled.

B. Inspect the area(s) in which the event is being held for appropriate set-up, including room size, chairs, tables, outlets, etc. Notify the event manager of any potential problems.

C. Check in the entries at the time stated in the conference program. Anyone reporting who is not on the entry list may check in only after official notification is received from the CRC chairperson. Late entries are considered on a case-by-case basis and only when the lateness is caused by events beyond the participant’s control. Requirements for attire do NOT apply during check-in.

D. Place an entry number on each entry. Position entries for evaluation and viewing. Secure the entries in a designated area.

E. One (1) hour before the event is scheduled to begin, meet with your evaluators/assistants to review time limits, procedures, and regulations. If questions arise that cannot be answered, speak to the event manager before the event begins.

F. Assist the evaluators during the evaluation of the design, drawing, and construction categories. Participants do NOT have to be present at this time.

G. After testing all race-worthy cars in the time trial, evaluators verify that the top sixteen (16) semifinalists meet all specifications. Only raceable cars, as determined by the evaluators, are allowed to compete in the semifinalist category. Cars that are damaged or broken during the qualifying round are deemed non-raceable and are not allowed to run in a semifinalist position. Eliminated entries not meeting specifications are removed. Lower qualifying cars are moved up until sixteen (16) legal cars are determined.
H. Each car is timed in the same lane. Cars are timed only once. It is important that each car be positioned as well as possible in the starting gate. If, in the opinion of the evaluators, a car misfires or a timing error occurs, the race may be rerun.

I. The operator’s preliminary times are recorded on the time trial record sheet. Each vehicle is ranked according to fastest time first, second fastest time second, and so on. The top sixteen (16) cars that meet specifications are run in the semifinals. A sample double-elimination bracket appears after this section.

J. Position one evaluator at the starting gate to check to see that all cars are positioned as well as possible in the starting gate. If the evaluator feels there is any sort of a misfire, a rerun can be ordered. Position one (1) evaluator at the finish gate to rule on the finish of a race in case of failure of the finish lights or a very close finish. If the evaluator feels there is any sort of timing error, a rerun may be ordered.

K. Post the top sixteen (16) cars with interviews times; car builders will report to the track at the posted time for a five (5)-minute interview.

L. Conduct five (5)-minute interviews with the qualifying top sixteen (16) car builders.

M. Mark cars that have been raced with ultraviolet ink.

N. For participants who violate the rules, the decision either to deduct 20% of the total possible points or to disqualify the entry must be discussed and verified with the evaluators, event coordinator, and a CRC manager; all must initial either of these actions on the rating form.

O. Secure the evaluators’ signatures on their rating forms. Evaluators discuss and break any ties.

P. Complete and submit the finalist report, which includes a ranking of the ten (10) finalists, and all related forms in the results envelope to the CRC room.

Q. Manage security and the removal of materials from the area.
Double Elimination Brackets
1st Place: Winner of 30 or 31
2nd Place: Loser of 30 or 31
3rd Place: Loser of 29
**DRAGSTER DESIGN**

2015 & 2016 OFFICIAL RATING FORM

**Dragster Construction (50 points)**

<table>
<thead>
<tr>
<th>CRITERIA</th>
<th>Minimal performance 1-4 points</th>
<th>Adequate performance 5-8 points</th>
<th>Exemplary performance 9-10 points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dragster body production quality</td>
<td>Dragster exhibits poor production quality, with a crude and rough surface and little or no attention to detail.</td>
<td>Dragster shows evidence of proper production techniques; it is adequate but may need improvement.</td>
<td>Dragster displays excellent production techniques, with obvious attention to detail and quality.</td>
</tr>
<tr>
<td>(X1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body paint/finish</td>
<td>Surface preparation is inadequate; the body is unprimed, with poorly applied final finish.</td>
<td>Dragster body is painted and finished adequately.</td>
<td>Dragster body finish is exemplary; body is smooth, shiny and exhibits quality.</td>
</tr>
<tr>
<td>(X1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vehicle assembly</td>
<td>Dragster exhibits poor or sloppy assembly of parts (wheels are loose, screw eyes are loose and/or not level, etc.).</td>
<td>Dragster is well assembled, with adequate or some attention to detail.</td>
<td>Dragster is properly assembled, with obvious evidence of attention to detail.</td>
</tr>
<tr>
<td>(X1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drawing scale and dimensioning</td>
<td>The drawing is present but is not to scale; dimensions are missing, or dimensioning is poorly done.</td>
<td>The drawing is acceptable and to scale; it is a close representation of the vehicle, but some dimensions may be missing.</td>
<td>The drawing is exemplary, exact, and includes all pertinent dimensions.</td>
</tr>
<tr>
<td>(X1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drawing completion and quality</td>
<td>Drawing work is sloppy, missing parts and lacking quality.</td>
<td>The drawing is complete, and the quality is average.</td>
<td>The drawing is complete and precise, and of exceptional quality.</td>
</tr>
<tr>
<td>(X1)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Interview (20 points)**

<table>
<thead>
<tr>
<th>CRITERIA</th>
<th>Minimal performance 1-4 points</th>
<th>Adequate performance 5-8 points</th>
<th>Exemplary performance 9-10 points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car builder interview (X2)</td>
<td>The student shows very limited knowledge of and has difficulty articulating how the car was produced or decisions made during the production. There are signs of the student not being involved in the dragster production.</td>
<td>The student demonstrates some knowledge of the dragster production and has adequate knowledge of some processes or reasoning behind the vehicle design.</td>
<td>The student shows competence and knowledge related to the design and production of the vehicle. The student is able to articulate &quot;reasoning&quot; behind the decisions made.</td>
</tr>
</tbody>
</table>

**SUBTOTAL (50 points)**

**SUBTOTAL (20 points)**
# Dragster Design

## DRAGSTER DESIGN (continued)

### Race (55 points)

<table>
<thead>
<tr>
<th>1st</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
<th>5th &amp; 6th</th>
<th>7th &amp; 8th</th>
<th>9th - 12th</th>
<th>13th – 16th</th>
</tr>
</thead>
<tbody>
<tr>
<td>55 points</td>
<td>50 points</td>
<td>45 points</td>
<td>40 points</td>
<td>35 points</td>
<td>30 points</td>
<td>25 points</td>
<td>15 points</td>
</tr>
</tbody>
</table>

**SUBTOTAL (55 points)**

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

**Indicate the rule violated:** __________

(To arrive at TOTAL score, add any subtotals and subtract rules violation points, as necessary. Check your math twice!) **TOTAL (125 points)**

**Comments:**

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

**Evaluator**

Printed name: ____________________________  Signature: ____________________________