

Dynamite Duel!

BEST 1997 Design Contest

THE RULES

20 September, 1997

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1.0 Objective

The objective is to design and build a remotely controlled device to pick up sticks of "dynamite" outside an old mine and place them into a bucket. Games will be played one on one and the winner will be the team with the heaviest bucket at the end of the two minute game.

The playing field is square, 24 feet on a side. The outside boundary of the field is defined by 4x4 timbers. There are two drivers' platforms at one end of the field. At the other end are two ramps up to an elevated platform where the buckets and weighing mechanism are located. The ramps are 4' wide and 8' long, rising 3' to the level of the platform. The surface of the ramps and the surface of the platform are covered with carpet.

Also on the playing field are 50 sticks of "dynamite". These are constructed from 12" sections of ^{3/4" from last years field (they will check)} diameter, class 200 PVC pipe capped with standard end caps. 30 sticks are light, being filled only with air and a little sand, and weigh 6 ± 1 ounces. 20 sticks are heavy, being about half filled with lead pellets, and weigh 30 ± 1 ounces. All 50 sticks are identical in appearance and any stick may be picked up by either team.

Before the start of each match 4 heavy sticks are located inside the mine while the remaining 16 heavy sticks and all 30 light sticks are located inside a "TNT" box near the center of the field. The sticks inside the mine are in pairs, set back 2 feet from the entrance and 1 foot on either side of the mine centerline (see drawings for clarification).

Before the start of a match your machine must be touching both the back wall of the playing field and the inside edge of your drivers' platform. It may face any direction. Your driver and one spotter will be on the drivers' platform.

At the start of the match the side of the "TNT" box facing the machines will open and the 46 sticks of "dynamite" inside will spill out onto the field. The two teams compete to pick up as much "dynamite" by weight as possible and to put it into their bucket. Only "dynamite" may be placed into either bucket, no kit material is allowed. Covers over either bucket are not allowed. Although the driver and spotter are inside the field boundaries, they are not allowed to touch the "dynamite" or either machine, nor may they step off the platform. If you wish to discriminate between the heavy and light sticks they must be weighed by your machine.

At the end of each match the team having the heaviest bucket, as indicated by the scales on the platform, is the winner. Should the scales balance (equally weighted buckets), the winner will be the team having the fewest sticks in their bucket. *addition to work!*

Matches are two minutes long. During the match you may drive your machine anywhere you wish except up on either drivers' platform. You may pick up as many or as few sticks as you wish and may place them into either (or neither) bucket. You may attempt to remove sticks from either bucket or to defend either bucket from your opponent's machine. Sticks which leave the field or are placed on the drivers' platforms are out of play. During the game machines

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may push or pull on either bucket, but at the end of the game any machine touching either bucket will be moved and the buckets allowed to hang free to determine the winner.

Team members shall remain off the field until the referees have finished determining the score for each match.

2.0 Evaluation

There will be two phases to the contest, a preliminary (seeding) competition and a double elimination playoff. During the seeding competition the machines will be divided into up to four pools. Machines will play all the machines in their pool, scoring 1 point for each win and 0 points for each draw or loss. After the preliminary competition all machines will advance to the playoffs. Playoff seeding will be determined by the ranking of the machines within their pools.

In the playoffs, the winner of each match will advance, while the loser will either drop to the challengers' bracket (if it is their first loss) or be eliminated (if it is their second loss). Byes may be in used in the preliminary competition or the playoffs up to the semi finals as needed.

Ties (after the first tie-breaker given above) will be allowed in the seeding competition; in the case of a tie both teams will be credited with a loss.

Ties will not be allowed in the playoffs; additional tie-breakers will be used. If the tie cannot be resolved using the tie-breaker mentioned above, we will look to see which team had the higher seeding score. Should the seeding scores be the same, we will check to see if the two teams involved played each other earlier in the playoffs (or, secondarily, in the seeding) and take whichever team won that match. If the tie is still unresolved, the winner will be the team having the most sticks on their half of the raised platform (the level section under the buckets; sticks on the ramps and sticks in the machines count for naught). A coin toss will be used if all else fails.

The coin toss will not be used after the quarter finals begin. In the case of a tie, the match will be replayed.

Once we are down to two teams (the finals), play will continue until one team has accumulated 3 losses; the other team will be the winner. Remember that the team entering the finals from the Challengers' bracket already has one loss, while the team entering the finals from the Champions' bracket has no losses.

3.0 Constraints

Materials

With the **following** exceptions, each machine must be constructed entirely from materials provided in the kit (including all fasteners used):

- Lubricants may be used for lubrication only.
- Paint and stickers or decals may be added.

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- Non-functional decorations (excluding strobe lights) are permitted. Non-functional means that it does not aid the machine in performing the game. If you can remove it (and you may be asked to) and your machine behaves the same, it is probably non-functional.
- You may solder electrical wires using your own solder. You may not do structural soldering, welding, or brazing.
- Springs and plastic may be heated and reformed.

Energy Sources

The energy used by the devices in the competition must come solely from:

- Electrical energy derived from the single onboard battery pack.
- Storage achieved by the deformation of the springs provided in the kit.
- A change in the altitude of the center of gravity of any part of the machine.
- Stretched rubber from the bicycle tube, provided the band is attached to the machine such that it will not fly off if broken.

Size

At the start of each match the machine must fit, unconstrained, in a 24 inch by 24 inch by 24 inch cube.

Weight

The weight of the machine may not exceed 24 pounds.

4.0 Details

Safety

Due to the nature of the event, in which electrical equipment and tools are used, safety may not and will not be compromised.

1. Safety first.
2. Any machine which appears to be a safety hazard will be disqualified by the referees.
3. Power supply, batteries, charger, and control system may not be tampered with.
4. If a projectile is used, it must have a frontal area greater than 10 square inches (blocks excepted). Items that detach from your machine and remain on the playing surface or simply fall to the surface are not considered projectiles. Items that are launched through the air, whether free flying or tethered, are considered to be projectiles.

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5. All team members must wear safety glasses (provided at the event) during their matches.

Machine

6. Machines must be designed to operate by reacting only against the top surface of the playing field, the ramps and platform, the scoring buckets, the "dynamite", the opponents' machines, and the air. Machines are allowed to clamp to anything in the field. Machines which touch the ground outside the field boundary will be stopped for the duration of the match. Any "dynamite" already placed will remain on the field and will be scored normally at the end of the match.
7. Machines must display their school or team names or logos and their team number using the numbers from the kit.
8. During the contest the machine may only be interacted with through normal operation of the radio control system.
9. Gaining traction by the use of adhesives, or by abrading or breaking the surface of the field is not allowed.
10. The machine must remain within the maximum size limit, unconstrained, until the beginning of the match. Once the match begins, the machine may unfold and change size through its own power.
11. All machines will be inspected for compliance with the regulations before the contest. The winning machine may be inspected again following the tournament. "Secret" check-ins and inspections are not allowed.
12. No substitute machines are allowed. Spare parts are allowed. Alternate parts (analogous to snow tires on a car) may be used, but all parts must be present in each match and fit within the volume allotted for the machine. Teams are not allowed to add parts once the competition has begun. Teams may remove parts from their machine during the competition, but these parts may not be re-installed once the machine has played a match without them.
13. The machines may not leave the competition site between the time they are checked in and the start of the competition.
14. Motors from the printer may not be used electrically. They can be disassembled and used for parts. Other than this restriction the printer is a "parts resource". You may use wires, switches, and connectors from the printer as you like. You may use mechanical parts (springs, gears, bearings, etc.) and magnets from the printer as you like.

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15. Following the contest the RC control systems, batteries, motors, and wiring harnesses (parts listed on the "to be returned" sheet) must be returned to the local BEST organization. The rest of the machine may be retained by its respective school.

Field

16. Damaging the field, the controls, or the "dynamite" may result in disqualification. For example, using spiked wheels is considered damaging to the field and is illegal. (A wheel having a contact patch with at least one dimension greater than $\frac{1}{4}$ inch is not considered to be spiked.) Using adhesive to grip the "dynamite" is also illegal.
17. A machine may not intentionally contaminate the playing field or an opponent's machine with lubricant.
18. At the start of each match the machine must be placed in the designated starting box. Temporary alignment marks on the field are not permitted.
19. The playing field will be on the floor. No players are allowed on the field during a match. Players are not allowed to handle the "dynamite" prior to a match.
20. To sum it up, leave the playing field as you found it except for moving the "dynamite".

Control System

21. The control system is provided to allow wireless control of the devices. The transmitter, receiver, servos, speed controllers, batteries, battery chargers, and power supplies may not be tampered with or adjusted in any way. This means you may not put labels or rubber bands on the transmitters, nor may you make internal, reversible modifications to the joysticks.
22. The receiver, batteries, servos, and speed controllers are the only components of the control system which may be attached to the machine.
23. All the motors and electrical devices must be connected to the speed controllers using the supplied connectors. Only one battery per match may be used; the other batteries may not be on the machine even if unconnected.
24. If you are making a powered tandem device, you may use an umbilical to connect the two devices. This umbilical is considered part of the machine and is subject to the same constraints as the rest of the device.

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25. The control system must be returned unmodified at the end of the contest.
- 25'. Manage your batteries carefully. Each team is given two good batteries at the kickoff. These should be all you need. While running with one you should be charging the other. On contest day replacement batteries will only be provided upon proof of battery failure (ie. a broken wire). We need to address this issue. How does this sound, hubs?

Kit

26. Kit materials may not be changed chemically. The exceptions are that strings may be singed to prevent loose ends and that resin and hardener may be mixed to result in epoxy.
27. The motors in the kit may not be opened to change the gearing (of geared motors) or to re-wind the armature of any motors.
28. Limited numbers of replacement parts are available from your local BEST organization upon a justified request. Otherwise, lost or damaged kit material may be replaced only with identical components, which includes same material, dimensions, and treatment.

Tournament

29. Referees have ultimate authority during the competition.
30. Each contest will be started by a referee and will end 2 minutes later when the buzzer sounds, unless whistled dead by the referees.
31. During the tournament a maximum setup time of 30 seconds will be allowed once the team arrives at the field. Teams will be notified of their field and position assignment at least two minutes before the match.
32. A maximum of 30 seconds will be allowed at the end of each match for removal of the machines.
33. Only two student members of each team are allowed in the team drivers' box during a match. Adult coaches and teachers are not allowed in the team drivers' box during matches. Students are not allowed to stand on platforms (or each other) to get a better view.
34. The team drivers' boxes are 4' by 4' and are set into the corners of the field.

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35. All contestants on the gym floor must wear appropriate shoes.
36. Only one person per match is allowed to drive the machine (operate the R/C transmitter). Each team must have a roster of at least 5 drivers or 50% of their team (rounded up), whichever is smaller. One driver will be used per match, starting at the top of the roster. Successive drivers will be used for the following matches until the list is exhausted, at which time we will start again at the top of the list. Additional team members may assist in setup and removal of the machine, but during a match only the driver and one other team member will be allowed inside the team box. No radios, walkie-talkies, or cellular phones are allowed in the gym (except for staff members).
37. Strategies aimed only at destruction, damage, or entanglement of an opponent's machine are not in the spirit of the competition and are not allowed. Turning over an opponent's machine is not considered damaging, but stabbing, cutting, etc. is illegal. Placement of blocking devices on the field is permitted, but placement of blocking devices on opposing machines is not permitted. Throwing of nets to capture or contain "dynamite" is permitted, but using nets to entangle another machine is not permitted. Note that your driving over another team's net which is on the field does not constitute an attempt by the other team to entangle your machine even if you do become entangled. Referees will disqualify a contestant from a match if a major breach of the rules occurs. Any contestant that is disqualified will lose the match.
37. The edges of the ramps and elevated platform are lined with 6" walls to prevent machines falling from the platform or ramps. Purposely pushing an opposing machine over the edge of the platform or ramp is not allowed and the offending machine will forfeit the game. If, in the eyes of the referees, the pushing over the edge was an accident the match will not be forfeit. This will be considered a "judgment call" on the part of the referees and no protests of their decision will be allowed. Note that pushing while on the platform or going up or down the ramps is allowed – just be careful where you push them. **Comments, please!**
38. A machine may not win a match through advantage gained by breaking a rule even if done accidentally. Referees may decide to rerun a particular match in such a case.
39. Each team will be provided with a table as a pit area. Each team may bring a toolbox with basic hand- and power-tools. If a part requiring machining is broken during competition, consult your local BEST organization. They will make their best effort given local shop and material availability to replace the part.

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40. Protests based on a violation of the rules must be presented, in writing, to a referee within 5 minutes after the completion of the match in question. After the 5 minute time limit has elapsed, no protests will be allowed and no changes will be made to outcome of the match. A ruling on a protest that changes the outcome of a match will not affect any previous matches. The Head Referee will make a ruling on any protests and the decision will be final. No protests will be allowed against judgment calls.
41. Practice time will be available the Saturday preceding the contest. Tables and electricity will be available; you will have to bring your own tools. Consult your local BEST organization for times and locations.
42. All questions concerning these rules (during the 6 week design and construction phase, not during the competition) must be submitted to the Game committee in writing. Submit to all committee members to ensure the question was received. All questions and answers will be distributed to all teams via the web.

Texas BEST

43. The teams that will advance to the Texas BEST playoffs at Texas A&M University will be the team that wins the BEST award at each hub and the top teams based on their placement in the local competitions. The total number of teams each hub will be allowed to send to Texas BEST is proportional to the number of teams competing at each hub. A rough estimate is that 1 team in 8 will advance to Texas BEST.
44. Teams which place high enough to go on to the Texas BEST playoffs at Texas A&M University are allowed to make repairs to their machines and to make functional improvements in the operation of their machine. The BEST organizers request, though, that teams not make major redesigns in an effort to copy another team's machine (we do not want a bunch of identical machines at Texas BEST).

If you have access to the Internet you may submit questions to "best@sh-gpl.ti.com". This will send the question to all members of the game committee. TI coaches not on the Internet should send questions to Steve Marum at MSGID: VOLT and Ted Mahler at MSGID: TWM. Other coaches without Internet access should call Steve at (903) 868-7513 or Ted at (903) 868-5135. Question submissions via the Internet are preferred.

