

MIT OpenCourseWare  
<http://ocw.mit.edu>

2.007 Design and Manufacturing I  
Spring 2009

For information about citing these materials or our Terms of Use, visit: <http://ocw.mit.edu/terms>.

# Supreme Court Decisions and Rule Clarifications

- **Impound Questions:**

- Can I pack my machine into the sizing box nice and tight, then expand it out onto the table in the full potential starting area of the zone?

NO! Your machine should fit into the sizing box in its starting configuration. You cannot break your machine down into a bunch of pieces, force it into the box, and then expand it back out on the table. When you have set up your machine on the starting zone, it must still fit within the volume of the sizing box. You have a wide variety of options for where you locate this virtual sizing box, as long as it remains within the starting zone. The sizing box may not bulge and the lid must fit on and close.

- Why is the sizing box 16" by 16" by 25.8"?

Check your lecture notes for the golden rectangle. . .

- Do I need to have a control box and battery on my machine at impound?

The control box and battery do not count towards the 10lb weight limit. However, you do need to show that your machine will fit into the sizing box with these items installed.

- **Scoring:**

- How can I get three blocks into the 80 point bin? It looks like it can only

fit two on the web! Also, can I squish more blocks into a bin?

The 80 point bin is deep enough to hold three blocks. Note that blocks that are not completely within the vertical boundaries of the bin do not count. It is extremely difficult to force more blocks into the bin without damaging something, so you cannot force four blocks into the space of the bin. You may stack as many blocks as you want on top of the side bins. All blocks that fit within the confines of the walls extended vertically will count. You may only receive the multiplier for the first three blocks in the bin.

- Does the scoring multiplier work for three bricks in the 80 point bin?

Yes, since they are all vertical. Examples are found on the rules page.

- Do the extra points for a marked face count in the 80 point bin?

Yes.

- What happens if my block is hanging out of the bin a little bit?

For the bottom row valued at 10 points - A block not completely in the bin does not count. A block will be considered "in" the bin when no part of the brick protrudes across the entrance or exit plane of the bin. The judges will determine "in"-ness by running a straight edge along the face of the bins. Any blocks that are hit by the straight edge will not score. Partial blocks do not receive a score.

For the top three rows valued greater than 20, 40, and 60 points - If at least 50% of a block is within the bin, it will be scored. The referees will measure the block as necessary to determine the percentage of block in the bin. The straight edge rule does NOT apply to the top rows of bins.

For the side bins, You may stack as many blocks as you want into the side bins. All blocks that fit within the confines of the walls extended virtually will count. You may only receive the multiplier for the first three blocks in the bin.

- What happens if my machine is still touching a block in a bin at the end of the round?

If your machine is still in contact with the block at the end of the contest, the block still counts for score. If your machine is still moving after the contest ends, the judges will have discretion as to

whether the block counts.

How will blocks in the side bins be counted for the three or four block multipliers?

A line will be drawn on the 80 point bins extending off the bottom edge of the top row of bins. Any block completely above this line will count for multipliers in the top row (60 point row). Any block completely below the line will count for multipliers in the second from the top row (40 point row). Any block that crosses the line will not be counted for either multiplier. This line has no effect on the three block multiplier for placing three blocks vertically into the bin and all blocks in the bin still receive 80 points per block.

- How much do the blocks weigh?

The blocks are made of lightweight foam. The blocks are approximately 8 inches on a side. Measurements of the weight of the scoring items can be made anytime during lab.

- Can I come up with a device to remove my opponent's blocks or block the bins?

Yes, as long as you have satisfied the requirements for crossing the line. Also, make sure that you read the court decisions regarding aggression.

- If I intentionally or unintentionally move my blocks to the opponents side before scoring will I be penalized?

So, the rules don't explicitly prohibit you from moving your blocks onto your opponent's side of the table. Feel free to do so and you don't have to worry about accidentally pushing them over. However, you may want to make sure to completely think through the risks of using this move as a strategy. If you push your blocks across and the tiniest, little, itsy-bitsy part of your machine crosses the line, you will get hit with the penalty. If you manage to get lots of blocks across the line without crossing it, then you end up hurting yourself as you lose those blocks until you score. By the time you could move the blocks across the line without getting docked points, the other person can probably score or get out of the way already. Lots of ways to lose with little benefit = potentially risky strategy.

- What happens if I run out of blocks? Can I use my opponent's blocks?

Only use your opponent's blocks if you want to score for your opponent. Each player is limited to the number of blocks on the table at the start of the contest.

- What happens if I have three blocks in a segment and my opponent puts his block in the fourth spot? Do either of us get credit for the four blocks in a segment?

No. You may only receive the scoring multiplier if the blocks are all of your color. The colored blocks must be contiguous to count (eg. blue - blue - red - blue across a row does not count for a three or four block multiplier). Examples are found on the rules page.

- Do blocks in the 80 point bin count as being in a segment with the rest of the bins?

Yes, but only if the block falls within a row of the main bins. In other words, the first block in the 80 point bin would count as being in the 40 point row, while the third block in the 80 point bin would count as being in the 60 point row. A second block in the 80 point bin would not line up to be completely in one of these rows, so it would not count. Examples are found on the rules page.

- I have a question about the scoring multiplier. Is the multiplier only applied to your score at the time when the multiplier is activated, or is the multiplier applied to your final score at the end of the round?

The scoring system updates continually throughout the duration of the contest. So, your score will be automatically updated if you earn a multiplier. However, if your opponent removes a block from the multiplier combo, the multiplier will be removed and the score will be updated based on the new configuration of blocks.

- **Aggression on an Opponent:**

- May we throw the other robot out of the playing field?

If you do it nicely and with love and no malice....you are just

helping them to explore new horizons. . .

- May we flip our opponent over onto its backside?

...and help them show the audience their awesome underbelly paint job? of course! BUT this is NOT Battlebots....if you get too violent about flipping or your focus is disabling your opponent while doing nothing to score. . . . the judges will disqualify you. History has shown that actively blocking (pinning them against the wall) is one of the best strategies (use a Molestabot, maybe one that is part of main robot, and then it detaches and the main robot goes and does its scoring thing). Active scoring strategies are encouraged over negative spoiling tactics.

- Would my opponent be disqualified for repeatedly ramming into a part of my machine, such as a barricade, until it breaks?

No, if you build a barricade and it is in your opponent's way. You are responsible for building a wimpy barricade.... else we will have a nightmare of judging. Beware of barricades that can cause entanglement problems.

- If our opponent has clamped onto the table and we try to lift them off and accidentally rip a part of the table off do we get disqualified? Or do they?

It will be the judges' discretion, BUT it is not likely that they will be upset over this.

- I am a little uncertain about the crossing the line rule. If my opponent meets the requirements by placing blocks in the bins, can I then cross the line?

No. If your opponent has met the crossing requirements, you may not cross until your opponent has crossed the line. If you cross the line without having met the requirements, you will be penalized. However, if your opponent has met the requirements and crossed the line, you may also cross the line.

- If my opponent crosses the line without scoring. will I get penalized if I then cross the line without meeting the scoring requirements?

No. Only the first person to illegally cross the line will be penalized.

## • Projectiles:

- Can an un-tethered part detach from my robot to hinder my opponent or to help me score (not a projectile or a net)?

Sure! Be careful about offensive tactics - you must satisfy the criteria for crossing the line before ANY part of your machine can cross the line.

- Can my machine shoot projectiles?

Yes! BUT, remember a few things -

1. The naked phone booth rule always applies. If you are afraid to have someone point your projectile shooter at you, it probably is not a good idea. Prof. Slocum or your lab instructors will give definitive answers on the risk of specific projectile designs.

2. If you have a tether attached to your projectiles, be sure that it does not become entangled in anything. Using tethers as nets or bolas is not allowed. Historically, judges will re-run a contest where a machine is accidentally entangled by a tether. The judges view repeated entanglements with extreme unhappiness.

- Are bolas (two weights tethered together with \*one\* rope) allowed? Technically, it's not a net, which is explicitly disallowed in the rules. However, it can still be used to entangle in a similar fashion.

No, you may not use a bola or any other such device!! N weights tethered together still count as a bola. It is entanglement that we do not allow!!!! (not even Battlebots allows them!).

- May we throw untethered objects onto the playing field?

The judges have been thinking about this, and we have decided that we will not allow anyone to launch a bunch of random obstacles. It is not in the spirit of the competition (great mechanical design and strategy vs. great mechanical design and strategy). Untethered projectiles are allowed, but not recommended. As always, remember that the naked phone booth rule applies.

- In the rules, it explicitly states that no nets are allowed. However, the Supreme Court Decisions elaborate to say that it is intentional entanglement in any form that is not allowed. Is it allowable to use a string-mesh net in a case where there is no intent to entangle (i.e., as a

collection device for scoring mass?)

That is a real tough question . . . If you string a net and someone gets caught in it, even if you have no intent to entangle them, you are still liable and will be disqualified under the rules. There otherwise would be far too many "meshas" that were there for "gathering with no intent".

- **Autonomous Robots:**

- Is it allowable to have a completely autonomous robot?

Sure, BUT you cannot add batteries or other power sources. You can only use the wireless control system and power electronics we provide. You may add any other electronics you wish (microprocessors, filters, resistors, pretty blinking lights, etc), but be mindful of the weight limit! Also be careful of the complexity of an autonomous system, as there may be incredibly simple and robust solutions that are purely mechanical. Always make sure you have a countermeasure for the risk that the control system doesn't work.

- The stuff I've seen on the course web page about sub-robots involves tethers and what you can't do with them. Do sub-robots \*need\* to be tethered? (i.e., an autonomous sub-robot powered by the motors.)

Nope. You can have sub-robots controlled separately with a wireless control system on the main robot. If your robot will be using any wireless communications, be sure that they don't interfere with the table control system's radio frequencies. Some very useful and disruptive strategies can be formed with an independent machine that doesn't require any communication. However, you only have one battery to do all this with!

- May our robot have different modules that can be swapped before rounds depending on the opponent?

Absolutely, that is an excellent example of good design and strategy! But you will have to show at impoundment that each configuration of your machine meets weight and size limits in their specific starting configuration.



- **Kit Questions:**

- I've been told that in past years that handy boards have been permitted. Is this true?

You are allowed to do your own electronics, so if you want to, you can use a handy board and make an autonomous system....BUT you cannot add batteries or other power sources.

- I'm confused about additions. if people are allowed to add programmable electronics. What are we allowed to and not allowed to add as far as materials that are not in our kits?

We have always allowed people to use wire and logic, but no added power or motors (unless you build your own from scratch....not worth the effort). Every year some students ask about this, and we say "OK" and most students don't end up using it. You may not add any other items or substitute any other materials, except for fasteners.

- Can we exchange or trade kit materials?

No, the kit is "as is". You are allowed to buy your own fasteners and adhesives and electronic bits...that's it! See the kit page for information on replacements and exchanges and such.

- Are we allowed to construct our own pneumatic pistons? I know there was some confusion in past years, and I want to be absolutely sure at the beginning of this contest?

The only problem is we are not offering pneumatic lines, its an all-electric contest. The table is too big and the hassle of the lines makes it impractical. This also addresses the safety issues of pressurized containers. Anything you could want to do can be done with electric motors and screws. You can construct pistons to be used with the syringes, but that may prove impractical.

- To what extent may we process the kit materials? For instance, would it be permissible to heat-treat and anneal steel parts to make springs, or to turn the wood into sawdust and make a fiberboard material from that sawdust and an adhesive?

You can heat treat to your hearts delight...You can also grind and glue.

- Also, to what extent can copper wire be used? In past contests, it was said that non-kit electrical wire could be used to bear a load. What limits are there to the acceptable use of wire?

You can only use wire as electrical elements...else we will have people melting wire and making stuff.... You have more stuff in your kits than you can imagine. Focus your creative energies on using what you have as it is. Create a strategy and concepts that kicks butt with it as is. Please note that you must have a drawing before using the large machines (milling machines, lathes, water jet, etc). The shop guys will help you process the parts, but they will not make the parts for you. Drawings are not necessary, but are highly suggested, before processing materials using machines in the general area (belt sanders, drill presses, etc).

- Will we be able to use flexible plastic/rubber tubing? It is not on the kit parts list, probably because its main purpose was as pneumatic tubing, but it was also the best material with which to make compliant motor shaft couplings?

We will NOT provide hose as coupling material. Instead, we recommend that you consider the cheap brass or aluminum couplings.

- May we use the syringes as elements of a simple hydraulic system?

You may NOT create any fluid system (fluids are NOT part of the kit). You may create a pneumatic system if you want to, but only using elements in the kit.

- Are Velcro and zip-ties fasteners?

Yes, Velcro is a fastener, but you have to supply your own. Zip-ties are provided for cable management purposes and may be used to attach motors as described in the lecture notes. You may not use velcro, zip ties, or tape for any major structural purposes

Could you tell me if we're allowed to use Velcro to fasten an object to the contest table?

You can use Velcro hooks to stick to the carpet, but you CANNOT use adhesive backed velcro and stick the adhesive side to the table, because it could leave a film. Also, you cannot damage the carpet (velcro will not) by using other

fasteners, such as screws or pointy bits of metal! Note that the starting area will be painted and your velcro may not stick!

May I make creative use of rubber bands?

Yes you may, BUT they can store no energy (prior to the machines starting) that will be released once the contest starts.

Why? Because they are notorious for breaking and causing premature unintended release, which with some mechanisms can cause an owie.

Can I use a filter capacitor on the battery pack? Also, can I charge the capacitors before the round starts?

Yes you can. But, you can only charge the capacitors from the batteries you will use in that contest. The charging can start only after you have placed your machine on the contest table. You will be responsible for discharging them after the contest is over (use a lightbulb).

## **Safety:**

- What is the "Naked Phone Booth rule"?

DO NOT create any machine you are not willing to get into a phone booth with, where you are naked while your machine is operating in there with you (so no spinning spikes, flaming wheels of death, etc).

## **Table and Scoring Elements:**

- If I use sandpaper to grip the lexan, the plastic will probably get a little scratched up. Does this count as destroying the table. i.e. for disqualification?

You should be fine.

- Can you start with things dug into the carpet, to hold a machine from lifting off?

Not if you hurt our carpet. In other words, I should not be able to tell the

difference before/after. Now, if you have dug in and someone rams you and little tufts appear, that's OK, we will trim them, BUT you cannot then complain that the carpet is not letting you grab a good hold. It will be what it is.

- Is the contest table somehow coated, painted,...?

The contest table is constructed as follows:

- The base and some surfaces are constructed of wood.
- The top playing surface is covered in carpet. Starting zones, block locations, etc may be painted or marked in some manner that changes the consistency of the carpet.
- There are plastic walls around the entire table to prevent things from running away. The walls are not painted or coated.

- Can I grab onto the blocks with a skewer or pitch fork?

NO! You may not alter the physical integrity of the blocks in any way. This means that you may not use screws, pointy bits of welding rod, sharp bits of metal cut on the band saw, etc. If you destroy the blocks, you may be disqualified. Also, recall the naked phone booth rule.