MECH 202 Spring 2009 Competition Project – "The Truss Climber" (updated April 3, 2009)

Your team is to design, fabricate, assemble and compete with a device that will climb a roof truss and satisfy the rules of the competition. The MECH202 TA's are the "Judges of the Competition." Bob Thilmont and Bert Vermeulen will act as Chief Judges.

The Time

The Competition will be held Saturday, May 2 starting at 10am in Eng 100. You should plan for this to take most of the day.

The Competition

1. The course will be a simulated roof truss with two sides, each of which is just less than 8 feet long and angled up about 20 degrees.
2. At the top center of the truss there is a hole approximately ½" in diameter. The objective is to build a device that carries a small flag up the truss and is the first to place this flag in the hole.
3. At the start of each round of the competition, two devices will be placed on opposite ends of the truss. The devices must fit entirely on the truss. At the starting time, the device can extend no more than 12 inches from the base of the truss in the direction of its peak. No part of the device may touch the ground. At the starting time, the device can extend no more than 12 inches from the base of the truss in the direction of its peak. The device cannot extend beyond the base of the truss by more than 6 inches at the starting time.
4. At the start of the round of the competition, each of the two competing teams will be given a flag that has a small flagpole. The flag must be carried on the device.
5. At the sound of "go" you will start your device. Once you have started the device, no one can physically touch the device until the round is finished and the judges have declared a winner. No part of the device may be left behind after the device starts. All parts of your device must ascend the truss.
6. Each round of the contest is 45 seconds long. At the end of the round, the devices will preferably be stopped or stop themselves.
7. During this 45-second period, the judges will observe whether either of the two devices placed their flag in the hole. If so, the device that placed its flag first will be deemed the winner.
8. If neither device placed its flag in the hole during the 45-second period, the device that (a) completely cleared the obstacle and (b) moved its flag closest to the hole will be declared the winner.
9. If neither competing device completely cleared the obstacle, then the device that moved its flag closest to the hole will be declared the winner.
10. The competition will be "double elimination" so each team will have at least two chances to participate

Other Rules

11. Machines will not be weighed. It is believed that overly heavy machines will self-penalize.
12. The device can use only the top of the truss and the upper ½ " of the sides for guidance and balance. There will be a line painted on the truss to identify this ½" mark. We reserve the right to place anything below that ½" mark to help identify any vehicles that violate this rule.
13. In case of a tie, the lightest device will be judged the winner.
14. The truss is not perfectly symmetrical. There are differences in features depending upon which side of the truss you will be ascending. There is also an obstacle (a non-symmetrical set of cross beams partway up the truss) that your device must overcome. You will be allowed to take any measurements of the test fixture prior to the competition. You will not be allowed to test your device on the test fixture prior to the competition. This is quite a realistic requirement. When the Americans and Russians raced to get to the moon, they could not run a test of their device on the moon before they sent it.
15. Your device can be made from any materials that you would like to use. However, you cannot use any energy storage method or device that might be deemed hazardous. Examples of hazardous energy storage devices include, but are not limited to:
    - Chemical explosives, gunpowder, combustion processes, or highly exothermic reactions (such as model rockets).
    - A compressed fluid that might release too quickly
    - A spring or other storage device that can release a tremendous amount of energy too quickly.

- Any element that is deemed to be unnecessarily harmful to either the roof truss or another competitor's device.

The TA's will serve as "OSHA" safety inspectors. You will need their certification from a safety inspector at least 18 hours prior to the start of the competition. It is in your interest to contact the safety inspectors early to ensure that you do not waste time on a device that may not be certifiable.

16. No human thrust (pushing, pulling, nudging, shooting, etc) allowed at any time. You are allowed to touch the device to start it, but that touching must not provide a force that creates work (force * displacement up the truss).
17. ANY intentional attempt to damage the opponent in lieu of meeting the objectives of the competition will be grounds for disqualification. In the case of destruction deemed by the judges to be accidental, but severe enough to unfairly influence the competition's outcome the judges may permit repairs and a rematch.
18. Your device must remain a single unit at all times – no "free" or unattached components are allowed at any time.

Clarification to the Ground Rules (04/03/09)

19 Timing

Each round will have a maximum of five minutes for you to place your device onto the truss, start, compete and remove the device from the fixture. If you device fails to start or becomes disassembled during the competition you will forfeit that round. If both teams fail to pass the starting line rule 13 shall apply.

Your team must check into the registration table 15 minutes prior to your round. Failure to do so will result in a forfeit for that round. Once your round is complete you will need to track your team's placement on the bracket sheet and note the time of your next competition. You will be responsible to be ready on time for subsequent rounds based on the brackets you are assigned. If you fail to show up to your respective round you will forfeit that round.

20 Allowable device dimensions

During each round of the competition your device must remain in a space that extends two feet horizontally in either direction from the center of the top surface of the truss fixture and two feet in height from the top of the truss fixture.

21 Location and predictability of the ground (lighter than air)

All devices must be completely supported by the truss. No part of the device shall touch the ground or any other surface that is not part of the truss. Nor shall any team members be allowed to support the device at the starting line. You may only touch your device to; engage its start from the line on the judge's command, to remove it from the truss once the round is completed or to prevent damage to the device.

22 Remote Control

Rule 18, which states that "the device must remain a single intact unit at all times" eliminates the use of a remote control. A wired remote would have to be touched during the round and would then be disallowed by rule number 5 in the original project specification.

23 The ½" painted line

The ½" painted line marks the region of the truss and the obstacle below which the devices cannot touch. A device will be disqualified if it comes into direct contact with the truss below the line. This will apply to any device which may tilt due to the obstructions in the truss or from the normal assent to the top.

24 Flags

Your group will be given a flag prior to your round. No modifications of the flags will be allowed. You may purchase flags for testing at Michaels. The flags we will use are 4”x6”Economy US Flags. These should cost $0.49. Below is a scan of the bar code:

25 Definition of planting the flag

The flag stem must penetrate the metal cylinder by at least 1”. The flag can be dropped into the cylinder or suspended in the cylinder while being attached to the device.

If your flag is released and it does not enter the cylinder it will not be considered a successful plant.

26 Can your device block the hole from the other team?

Your device will be allowed to cover the hole provided your device will start planting or at least attempt to plan the flag within 3 seconds or less of blocking the hole. If you block the hole and the flag cannot be successfully planted you must prove to the judges through your design process that the device was designed with the intent to plant the flag within the 3 second rule. If you cannot nor attempt to plant the flag and just block the hole with the intent of blocking the competing device, your group will be disqualified.

27 Inserting the flag through the bottom

You may insert the flag through the bottom of the hole provided the flag clears the top of the cylinder.

28 Energy

See rule 15. If your team is not willing to stand next to your device without protective clothing or safety glasses, your device will be considered hazardous! However, since some individuals are braver than others, the judges reserve the right to deem a device hazardous.

29 Damaging the Fixture

Your team will be disqualified if your device intentionally or unintentionally damages the fixture in any manner including but not limited to: breaking the truss, generating noticeable nixes or notches that will impact the integrity of the competition, adding foreign substances such as oil or lubricants onto the truss.

30 Use of living beings

The device cannot contain any biological components.

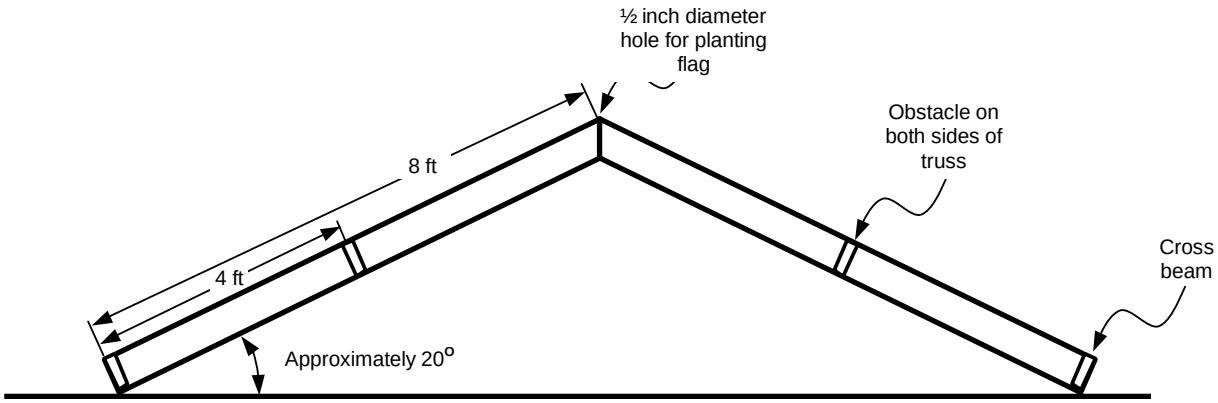
31 Protests

All protests must be registered immediately after the competing round. You must qualify your protests based on the ground rules and the project definition. Keep good engineering records (engineering book) of your development process to use to defend your positions. If you have no supporting documentation at the day of the competition, your protest will be disallowed. Bert Vermeulen will be the final judge on all protests.

32 Definitions

Forfeit = Team loses the round
Disqualification = Team is eliminated from the competition

Sketch of the Truss (approximate and not to scale)



Judges Decisions Disclaimer
In a competition of this nature it is hard to anticipate all the interpretations of the rules and situations that will arise in the competition. Therefore, anything not covered by these rules and the interpretations of the rules will be decided by the judges. These rules are subject to optimization, and may be altered by the staff to preserve the "spirit" of the contest**.**

The Rewards
1. The winning team will receive an A for the course and will not have to take the final examination
2. The 2nd place team will receive an A for the project and a 100 for the final
3. The 3rd place team will receive an A for the project

We have also asked the following two faculty members to identify specific areas of merit:

- Dr. Schaeffer to identify the group that exhibits the highest standard of manufacturing craftsmanship in their device.

- Dr. Alciatore to identify any groups that should deserve recognition from a mechatronic standpoint.

The Lead Up
Your design group may ask any questions whatsoever of Bob Thilmont, Bert Vermeulen or the TAs. This is strongly encouraged to ensure that your device meets the spirit of the competition. We encourage you to use RamCT to ask these questions. If you email questions to us, these questions and their answers will

be posted on RAMCT. If you have any of us sign a “non-disclosure agreement” (sample attached), we will then discuss with you confidentially those issues you have, and will not disseminate your questions or the answers to the entire class.

Required Report

Grading for this competition will consist of a required report. Your competition outcomes will not affect the grade of the report (unless you place in one of the top 3 positions). The report will be turned in at the time of the competition, the first time your device runs on the truss. Please bind the report in a professional manner. The report will consist of:

Page 1:

- Names and contact information for each member of your group
- A title identifying the device
- A scaled version of the assembly drawing to fit in the remainder of the space of page 1

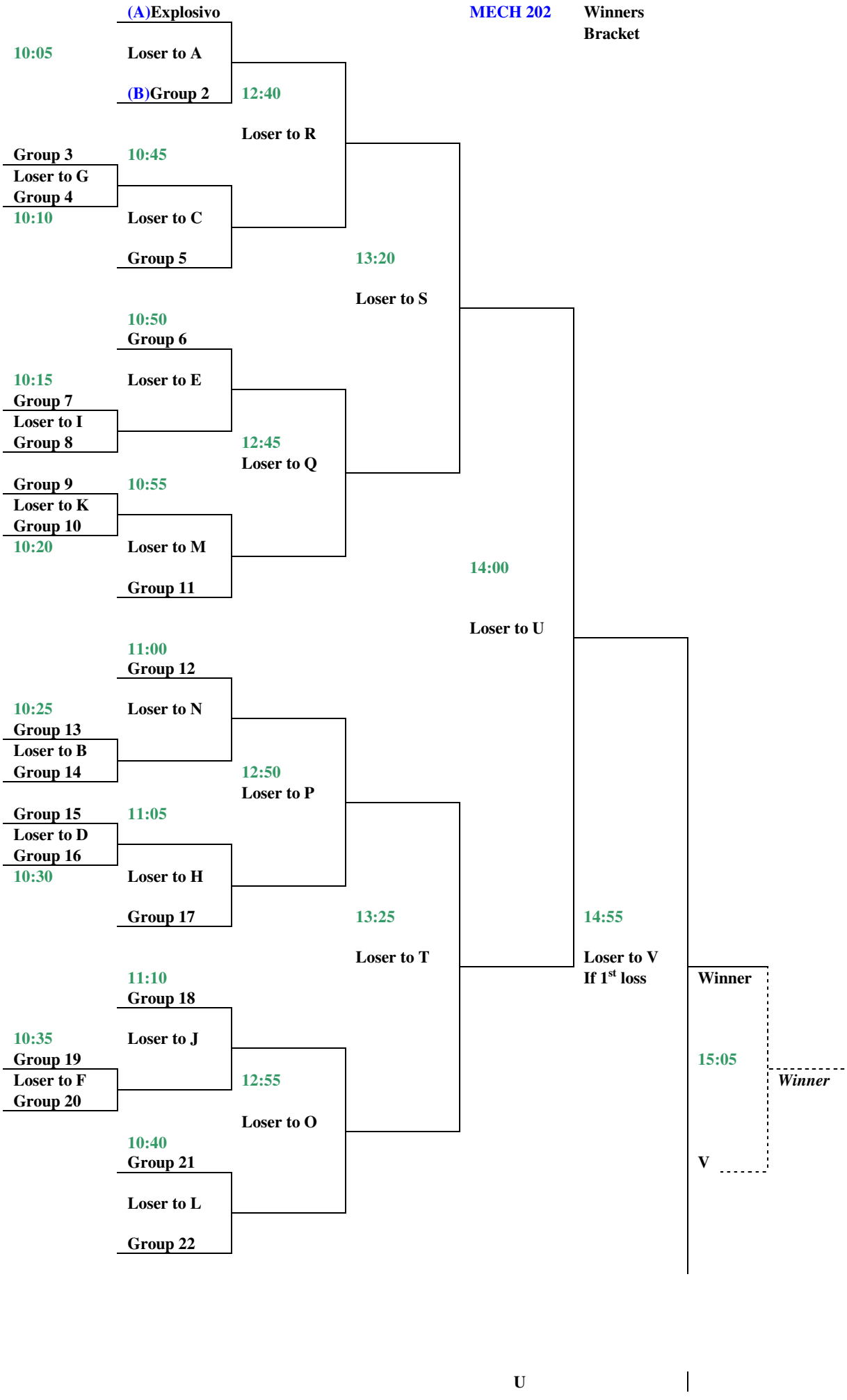
Report:

1. A copy of the bill of materials of all parts in the device
2. A set of annotated (described) Pro/E physical solid models of each component of the device – annotation should label or describe key elements of the component, or interesting features. Anything that is a standard part should be listed in the bill of materials with enough information so that someone could purchase it, but does not need to drawn.
3. All 2D engineering drawings as described above – one per page
4. A detailed exploded assembly of the device showing how the physical solid models fit together, complete with screws etc. – an example is shown below
5. A short description of the function of the entire device as best your group can figure out.

Request for Confidentiality

The undersigned agrees to hold confidential information of a competitive nature with the group members listed here. If the discussion leads to items of general interest (eg. – rules, competition or grading clarification), the design group allows publication of those items of general interest. Otherwise, any discussion of a competitive nature leading to a competitive advantage for the group will be held confidential.

Signed: Dated:


(A)Explosivo
MECH 202
Winners Bracket
10:05
Loser to A
(B)Group 2
12:40
Loser to R
Group 3
10:45
Loser to G
Group 4
10:10
Loser to C
Group 5
13:20
Loser to S
10:50
Group 6
10:15
Group 7
Loser to E
Loser to I
Group 8
12:45
Loser to Q
Group 9
10:55
Loser to K
Group 10
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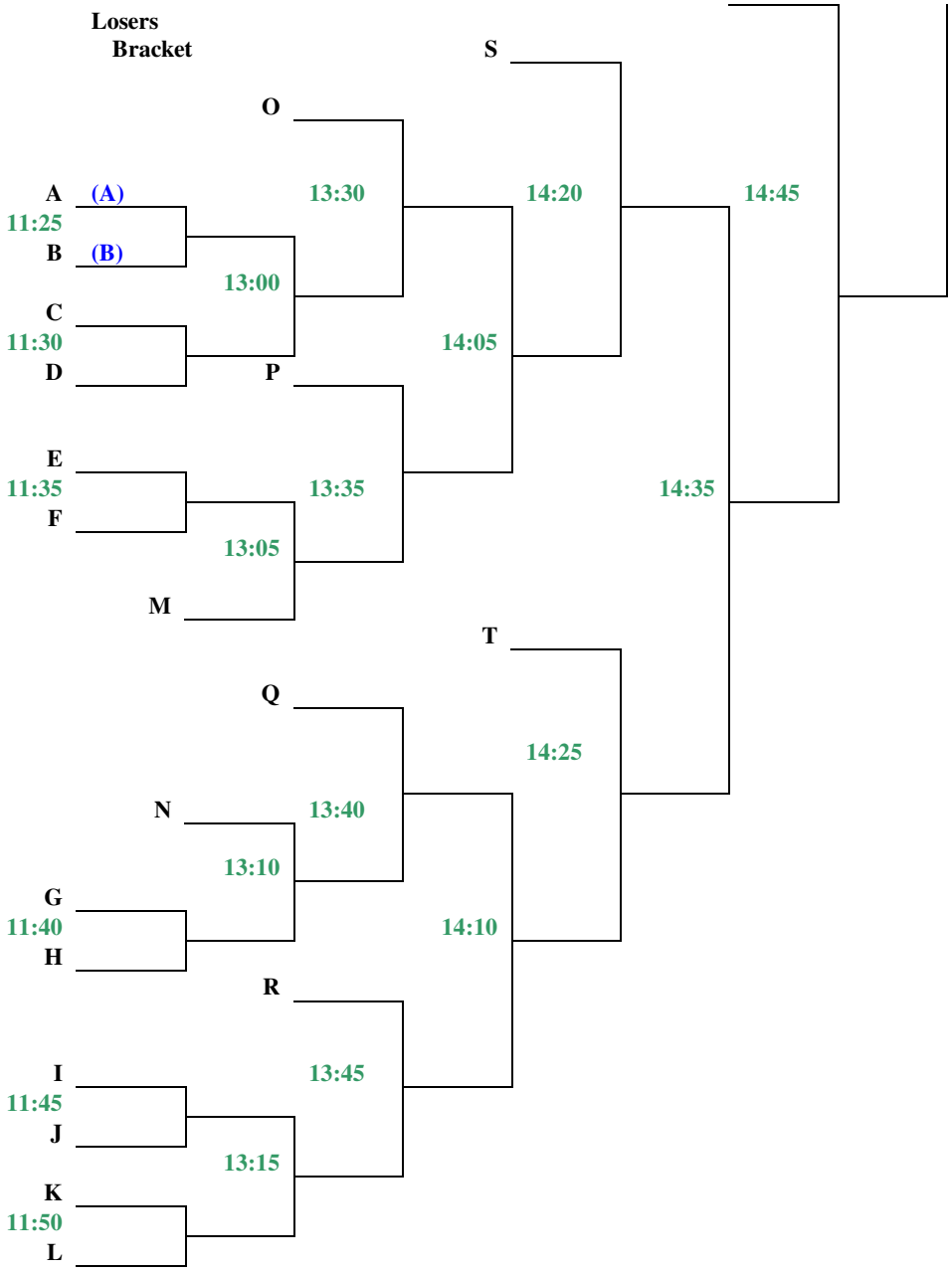
Loser to M
Group 11
14:00
Loser to U
11:00
Group 12
10:25
Group 13
Loser to N
Loser to B
Group 14
12:50
Loser to P
Group 15
11:05
Loser to D
Group 16
10:30
Loser to H
Group 17
13:25
Loser to T
14:55
Loser to V
If 1st loss
Winner
11:10
Group 18
10:35
Group 19
Loser to J
Loser to F
Group 20
12:55
Loser to O
15:05
Winner
10:40
Group 21
V
Loser to L
Group 22
U


Losers
Bracket
A
(A)
11:25
B
(B)
13:00
C
11:30
D
O
13:30
P
E
11:35
F
13:05
M
13:35
S
14:20
14:05
14:35
14:45
T
Q
14:25
N
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G
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R
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J
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K
11:50
L
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