Student Additive Manufacturing Competition (AMC)

Rules and Guidelines 2019

Important Dates

- April 19th - Design Summary Submissions
- April 26th - STL Submission Deadline
- May 21st - Competition Day
Contestant Requirements

The contest is for enrolled students at an accredited university, college, community college or high school only. Students attending the contest must be 16 years of age or older in accordance to SAMPE conference regulations. The following rules are to be considered an outline of the requirements and are subject to interpretation by the Governing Committee. The contest is intended to provide an opportunity for students to learn and expand their abilities in additive manufacturing and engineering design. Any design or concept which is not consistent with the spirit of these rules will be disqualified. Students are encouraged to ask for clarification of these rules. The governing committee will publish the question(s) and the committee’s answer on the SAMPE AM contest web site: http://www.nasampe.org/?page=additivecontest

2. Contest entries will only be accepted on an individual basis with only one entry allowed per category. Students must be SAMPE members. Students are encouraged to solicit advice, instruction, and training from faculty, peers, and industry members during the design of their structure. However, the final design entry must be the original work of the individual.

3. Each student must submit a 1-page design summary in PDF form of their entry for approval by the Governing Committee (email address: AdditiveManufacturingContest@sampe.org). Please refer to the AMC Design Summary Example for formatting and clarification.

Each design summary will be check for compliance with contest rules and scored by the Governing Committee. The design summaries will be scored on the metrics of: thoroughness, clarity, adherence to the guidelines, and style.

The Summaries must include the following elements or they will be returned without review or approval:

- Student’s Name and Email Address. This email address will be used by the Governing Committee to provide feedback and/or approval for the design summary as well as confirming other contest details.

- Registration Number (e.g., 07-XXXX) Note: If you registered online, your Registration Number was generated and sent to you via email as part of the registration process. If you registered via mail or fax, your registration number will be emailed to the email address provided on your form once SAMPE has received it into the registration system. If you are unable to location your number, please email priscilla@sampe.org

- Name of school

- Faculty advisor name and email

- Visual depiction of your design (sketch, screenshot of CAD model etc...)
• Written description of your design (Why did you choose it? What makes it unique?)
• Calculation of your design’s structural capability. Should include failure mode prediction and should account for buckling.

The Governing Committee will approve or send instructions for required revisions to attain approval no later than April 22nd. Changes may be made to a design after the proposal has been approved; however, the design may be disqualified if the changes violate the spirit of the rules.

Registration is allowed through April 19, 2018. However, entries that have not submitted their design summary and STL file for approval by April 22st may be subject to disqualification if they are not fully compliant with the competition rules.

**Students are encouraged to submit design summaries early in order to receive approval and feedback earlier.

**General Rules**

Students will design a structure that will be tested to failure between the platens of a typical load frame. See this link for more information. Load will be limited to 10,000-lbs to protect the load frame. The design must be approved by Governing Committee so as not to put the load frame in jeopardy. The material will be ASA polymer that is compatible with the provided printer. Entries may be assembled from multiple printed parts. Only printed parts maybe used in the assembly and no adhesives will be allowed to assist assembly. Support material may be used to create the part. Any trapped support material will be considered part of the structure and thus included in the weight. Basic hand tools (hobby knifes, files and sand paper) will be available for finishing and fitting work.

**Additive Catagories**

A. Compression Column
(More coming soon...)

**A. Compression Column Details**

Students will design a rigid vertical support (column or tower) that will be tested to failure. The column must have at least a 2:1 aspect ratio (its height must be at least twice its width). It must fit on a 6-in diameter platen and not be taller than 36-in. No part of the column may extend outside of this cylinder (6-in diameter by 36-in long). Columns may not deflect more than 20% of their original height. If they do, the peak load will be determined up to the 20% deflection point. Columns must be a minimum of 2-inches tall and hold a minimum of 100-lbs to be considered for awards.

The columns will be ranked according to the score below, larger values being better. Please note that this means there is NO advantage to exceeding the ultimate design load. Also, taller and lighter structures will score better.
\[ \text{Score} = \text{Weight}_{\text{normalized}} \times (-3) + \text{Height}_{\text{normalized}} \times (4) + \text{Load}_{\text{normalized}} \times (2) \]

Where all normalized values will be done so using the following formula. This means the highest scoring entry for each category will receive a score of 1 and the lowest scoring a 0. This will then be multiplied by the weighting factors shown above. Please reference the scoring example sheet found at the AMC website for more details.

\[
\text{Weight}_{\text{normalized}} = \frac{(\text{Your column weight} - \text{Min of Competitors})}{(\text{Max of competitors} - \text{Min of Competitors})}
\]

\[
\text{Height}_{\text{normalized}} = \frac{(\text{Your column height} - \text{Min of Competitors})}{(\text{Max of Competitors} - \text{Min of Competitors})}
\]

\[
\text{Load}_{\text{normalized}} = \frac{(\text{Your columns peak load} - \text{Min of Competitors})}{(\text{Max of Competitors} - \text{Min of Competitors})}
\]

First place, second place and third place will be awarded to the highest three scores. In the event of a tie, the entry with the shorter print time will be awarded the higher place.

**Printing Details**

The contest will employ the Fortus 450mc 3d printer from Stratasys. Information is available at this link. This printer utilizes ASA material; the spec sheet for this material is available at this link. Students will submit an STL file of their design for printing via email. All entries will be printed by the committee prior to the show. Students may view their entries beginning at 8am on Tuesday, May 21st. Post-processing and assembly may be done until test time. However, entries may not leave the test area. Students need not attend the event to enter the contest. If necessary, they may submit assembly instructions via email. However, the committee cannot guarantee that the assembly will meet the student’s design intent. STL files will be checked for quality and prepared for printing by the committee. Printing parameters are intended to be consistent across all contestants and will only be adjusted if approved by the committee.

Standard entries will be printed with no more than 3 shells and will have 100% infill. Submissions will be printed using a T16 tip, which has a bead profile of 0.020” wide and 0.010” high. A minimum wall thickness of at least 0.040” should be used to accommodate 2 beads of material. Ideally, a larger minimum wall thickness will increase the odds of a successful print.

Note, there is no maximum print time requirement. Each entry must be printed in one single print envelope. That is, each entry (including all pieces) must be able to fit within a 6”x7”x6” box for printing. See Below for example.
Awards

Each category will have First place winner who will be awarded $500. Second place will be awarded $300 (USD). Third place will be awarded $200 (USD). Awards will be given in the form of a check issued to the contestant and mailed to the address identified on the Registration Form.

The contestant who receives the highest point total from design summaries and category score will receive a SAMPE AMC trophy.

Questions

When submitting a question, please reference the relevant paragraph(s) in the rules, and include any supporting pictures/images in a Microsoft Word document if needed. All questions and responses may be posted to SAMPE website:

https://www.nasampe.org/page/additivecontest

Submit question(s) for review by the Governing Committee at AdditiveManufacturingContest@sampe.org

The Governing Committee

- Harrison Scarborough, Electroimpact
- Joseph Vanherweg, Stellar Exploration