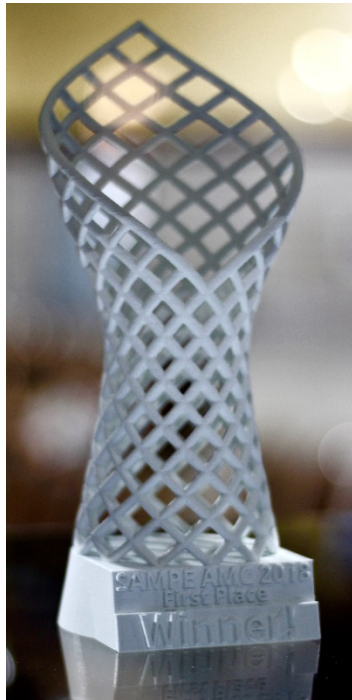




## **Student Additive Manufacturing Competition (AMC)**

### **Rules and Guidelines 2023-24**



## Important Dates

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- April 12<sup>th</sup> – Deadline for Design Summary with .STL Submission Attached
- May 21<sup>st</sup> – Competition Day and Student Check-in

## Contestant Requirements

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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 with 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(s) on the SAMPE AM contest web site: <https://www.nasampe.org/page/additivecontest>

2. Contest entries will only be accepted on an individual basis with only one entry allowed per student. 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 submitting student.

3. Each student must submit a **1 to 2 page** design summary in **PDF form** of their entry for approval by the Governing Committee (email address: [studentadditive@sampe.org](mailto:studentadditive@sampe.org)). Students must use the **AMC Design Summary template** linked on the competition page and **fill out all information completely** to be entered while also following the Name\_Summary\_Date.pdf naming convention for the file. Each design summary will be checked 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.

NOTE: Your registration number should be 6 digits and should start with a 2. 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 locate your number, please email Lauren McLean at [lauren@sampe.org](mailto:lauren@sampe.org)

The Governing Committee will approve or send instructions for required revisions to attain approval no later than 2 days after the Design Summary and STL Deadline.

Registration is allowed through the Design Summary and STL Deadline; however, entries that have not submitted their design summary and STL file for approval by the week of the deadline 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 on their design earlier. If there is enough time, the Governing Committee will recommend improvements if any significant design issues are noticed during the review process.**

## General Rules

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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. This limit is only intended as an upper bounding limit, the optimal design solution will not likely approach this limit. All entries will be printed using un-filled, un-reinforced, and un-blended ABS polymer. Entries may be assembled from multiple printed parts. Only printed parts may be used in the assembly and no adhesives will be allowed to assist assembly. Support material may be used to create the part but designs that print without support are suggested since removal of support material can damage delicate features. Any trapped support material will be considered part of the structure and thus included in the weight. Basic hand tools (hobby knives, files and sand paper) will be available for finishing and fitting work at the conference if needed.

## Additive Categories

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### A. Compression Column

#### A.1 Compression Column Category

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Students will design a rigid vertical support (column or tower) that will be tested to failure. The column must fit on a 6-in diameter platen and must be designed to be 36-in tall; there will be an allowed +/- 1 inch height tolerance band to account for assembly tolerance stack-up. 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 hold a minimum of 100-lbs to be considered for awards. There will be an initial 5 lb preload applied during setup. During the test, the top platen will move down and compress the column at a speed of 3.6 inches per minute. Please note that there is NO advantage to exceeding the ultimate design load. Also, lighter structures will score better.

All weights and loads will be normalized using the following formulas. This means the highest scoring entry for each category will receive a score of 1 and the lowest scoring a 0.

$$Weight_{normalized} = \frac{(Your\ column\ weight - Min\ of\ Competitors)}{(Max\ of\ competitors - Min\ of\ Competitors)}$$
$$Load_{normalized} = \frac{(Your\ columns\ peak\ load - Min\ of\ Competitors)}{(Max\ of\ Competitors - Min\ of\ Competitors)}$$

The columns will be scored according to the score below, larger values being better.

$$Score = -Weight_{normalized} + Load_{normalized}$$

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.

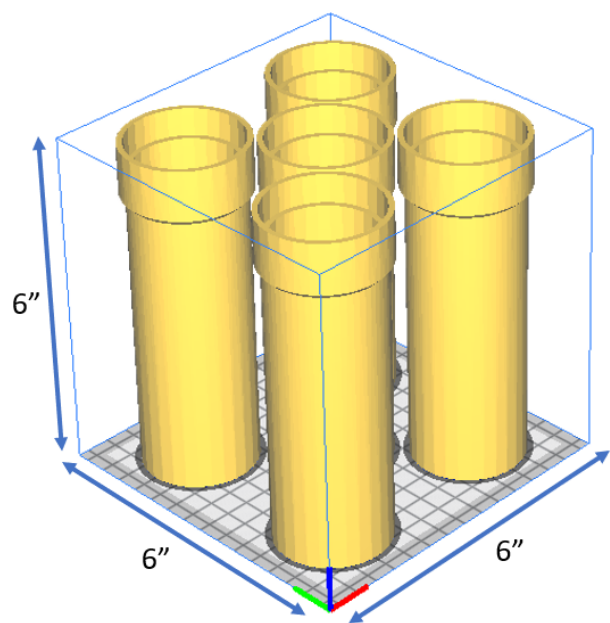
## A.2 Column Printing Details

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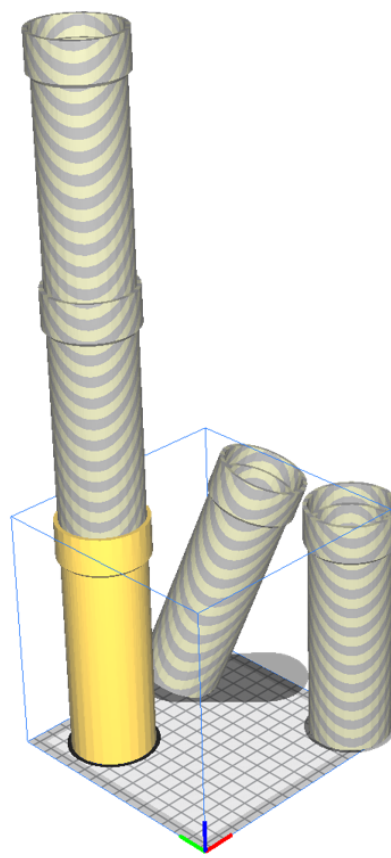
For this category of the competition, all entries will be printed by SAMPE on a Stratasys FFF machine from un-filled, un-reinforced, and un-blended ABS polymer. The entry will be multiple pieces, so **all pieces must be arranged in a single .STL file** for review and printing. Students may view their entries beginning at 9am on Tuesday, May 21<sup>st</sup>. Post-processing and assembly may be done until test time; some post processing may be done by the fabrication house, but students should arrive at the competition with the assumption that no post processing has been done and be ready to use the basic hand tools (hobby knives, files and sand paper) available at the competition check-in desk for finishing and fitting work. Entries may not leave the test area once formally submitted for cataloging by the students. Students **MUST ATTEND** the event to enter the contest. STL files will be checked for quality by the committee. Design for printing without support is suggested.

Entries will be printed with 4 shells and 30% infill. Default orientation of the print will be longest dimension aligned in the z-direction. A minimum wall thickness of at least 0.040" will be used to accommodate 2 beads of material. If students would like the fabricator to deviate from these parameter settings or default build direction, they must specify it on their design summary.

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"x6"x6" box** for printing. Due to the 36-in total height requirement, this will require the column to be built using multiple pieces that connect/stack together, all of which will need to fit inside a 6"x6"x6" box. See Below for example.



**Properly fits in build envelope requirement**



**Violates build envelope requirement**

## Awards

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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 an STL of the SAMPE AMC trophy.

## Questions

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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 [studentadditive@sampe.org](mailto:studentadditive@sampe.org)

## The Governing Committee

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- Joseph Vanherweg, Northrup Grumman
- Cory Cunningham, The Boeing Co.
- Adam Brown, The Boeing Co.