

# 2024 Additive Manufacturing

Contest Date: April 13th

**Orientation:** 8:00 am Amway Grand Plaza Hotel – Room to be determined at later date.

- Competition will begin immediately after orientation. All competitors must check-in by 8:00 am. Computers and other related items may be dropped off prior to competition.
- Orientation and Contest area will be closed to observers until 11:00 am. No instructors are permitted inside the contest zone.

**Competition:** 8:30 am – TBD (Based on the total number of teams)

- Upon arrival at orientation, students will be provided with the timeslot for their competition. The first timeslot will begin at ~8:30 am and will run every 30min until we have accommodated the number of teams there to compete.
- Students are to return to the competition area 30 min after the last timeslot (official time will be provided at the competition) to hear which teams will be called back for the 2<sup>nd</sup> round of group judging. The top-placing teams will be selected from this group.

**Purpose:** To evaluate each contestant's preparation for employment and to recognize outstanding students for excellence and professionalism in the field of Additive Manufacturing.

**Contestants:** 1 team (2 students) from each school that has pre-registered to be part of the event.

**Requirements:** Each team is responsible for bringing their 3D Printed model to the competition for testing. No parts will be printed at the competition. Models must adhere to the contest outlines from the proposed standards.

**Clothing: Clothing Requirements:**

**White collared shirt – No logos**

**Black Tie**

**Black slacks**

**Black leather shoes solid black**

**Black accessories**

## **Contest Criteria**

### **On contest day, students will:**

- Provide Engineering Notebook (Engineering notebook guidelines below)
- Present Design to judges and answer questions.
- Showcase the functionality of the 3D printed component.
- Provide resumes to judges (each participant must have one, these will not be collected, only verified that they have them).

### **Engineering Notebook Guideline:**

- The Engineering Notebook should contain robust content, including at a minimum the following:
  - Be clearly labeled with contestant name(s), date and page # on each page
  - Begin with a problem statement
  - Include discovery and documentation of approach to solve problem
  - Include sketched design concepts with critical features labeled
  - Critical dimensions clearly labeled in design sketch
  - Considerations for designing for additive manufacturing distinctly addressed (i.e. part strength, part orientation) especially including any expected risks during printing
  - Screenshots of the print time and material usage for all printed parts
  - Design decisions and alternatives are documented and evaluated thoughtfully

### **Presentation Criteria**

- The team clearly describes their understanding of the problem to be solved.
- Design Process: good design logic is used for key design choices was intentional and well-communicated
- The presentation is professional and well-rehearsed
- Practical evaluation
- Teams may use a laptop to assist with the presentation, though not required.

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# SkillsUSA 2024 Additive Manufacturing State Challenge

## Medallion Models

Welcome to the “logo Medallion” challenge!

The task at hand is to design an eye-catching Medallion that represents your school, yourself, mascot, state, country, event, or hobby.

Design Examples:

- Bump Maps
- Displacement Texture
- Color/Material Changes
- Embossed/Debossed Text
- Motion

Example of a Basic Design



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## **Competition Requirements**

1. The design **must** be completely 3D printed.
2. The design **can** be 3d printed using any technology.
3. The design **must** contain at least two legibly printed words.
4. The design **can** contain 3D printed bodies that are glued together for the final part.
5. Parts **can** be colored or painted.
6. The printed design **can** have moving bodies.
7. The design **must** be at least 3" x 3" x 1/4"
8. 3D Printed Design - Students **must** create a design that:
  - o Is original and designed by contestant
  - o Prints all parts in less than **8** hours
  - o Uses less than **5** cubic inches of model and/or support combined for all parts.

## **Tips for Competitors**

Here are some tips to maximize the points awarded to you:

- Build debossed text on a horizontal surface for best results. This may require building the part on its edge or standing up.
- Paint 3D is a free tool to help design the part.
- Try to leverage a design with multiple printed colors or technologies for a more creative part.
- Leverage post-processing techniques to smooth or color printed bodies.
- Additional moving parts may add to your score but can produce more points of failure on the final assembly.
- Use online resources (YouTube, GrabCAD Tutorials)
- Whenever intellectual property (IP) deters you from a project, try using approximate geometries to communicate the design intent.
- Optional design for additive manufacturing learning resources:
  - Stratasys Think Additively™ Masterclass:
    - o <https://youtube.com/playlist?list=PLUYaY5EIPtNBdU-s-7I9rI05IBHHITarI>

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## **State Competition Procedure**

Before or on contest day:

1. Students submit Engineering Notebook (Engineering notebook guidelines below)
2. Students submit print files in both CAD (.step, .iges, .sldprt, etc.) and mesh (STL, 3MF, OBJ, etc) format to **[State Designated File Share Site]**
3. Students submit physical parts
4. Students submit final assembly if applicable
5. Students submit their Presentation

## **State Competition Judging Criteria**

1. The Engineering Notebook should contain robust content, including at a minimum the following:
  - 1.1. Be clearly labeled with contestant name(s), date and page # on each page
  - 1.2. Begin with a problem statement
  - 1.3. Include discovery and documentation of approach to solve problem
  - 1.4. Include sketched design concepts with critical features labeled
  - 1.5. Critical dimensions clearly labeled in design sketch
  - 1.6. Considerations for designing for additive manufacturing distinctly addressed (i.e. part strength, part orientation) especially including any expected risks during printing
  - 1.7. Screenshots of the print time and material usage for all printed parts
  - 1.8. Design decisions and alternatives are documented and evaluated thoughtfully
2. The design must adhere to the Competition Requirements stated in the prior page.
3. Quality of final assembly
  - 3.1. Does it perform the function in the manner it was designed to do?
  - 3.2. Does it meet all requirements in contest guidelines?
  - 3.3. Do inserted components or multiple printed parts mate together properly?
  - 3.4. Did the students design the part with additive manufacturing in mind?
  - 3.5. Is there sufficient tolerance between parts for movement?

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4. The design must illustrate best practices for “design for additive manufacturing (DFAM)”. Below are some *potential* DFAM metrics to optimize for.
    - 4.1. Build Time
    - 4.2. Post-Processing/Support Removal Time
    - 4.3. Functionality Optimization (gear ratio, pliability, strength, etc.)
    - 4.4. Monetary Savings
    - 4.5. Material Consumption
    - 4.6. Energy Usage
    - 4.7. Component Consolidation (lack of store-bought hardware)
    - 4.8. Lightweighting for Ergonomics
  
  5. Presentation Criteria
    - 5.1. The team clearly describes their understanding of the problem to be solved.
    - 5.2. Design Process: good design logic is used for key design choices. Intentional and well-communicated
    - 5.3. The presentation is professional and well-rehearsed
    - 5.4. The presentation emphasizes quantitative improvements (measured and estimated) of the time, quality, or cost of the improvement as well as any DFAM tactics employed.
    - 5.5. Practical evaluation: team demonstrates visually (videos, photos, drawings, animation, etc) the task they improved, both before and after.