



# Additive Manufacturing

## Career Competition

Career Cluster: Manufacturing/STEM

State Qualifying Exam: No

National Contest: Yes

Participation: Team of 2

### Competition Description

Evaluate the competitors understanding and ability to design a functional/movable assembly using additive manufacturing (DFAM).

### Tasks To Be Evaluated

1. Engineering Notebook content.
2. CAD designs.
3. Quality of final assembly.
4. Design for additive manufacturing (DFAM).
5. Presentation.

### Clothing Requirement

#### National Requirement:

**Class E:** Competition Specific: Business Casual Attire

- Official SkillsUSA white polo shirt
- Black dress slacks or black dress skirt (knee-length minimum)
- Black, closed- toe dress shoes.

#### State Requirement:

National Requirement OR

- White polo shirt or button-down dress shirt (other colored polo/dress shirt will be subject to deductions)
- Black dress slacks or black dress skirt (knee-length minimum)
- Black, closed-toe dress shoes.
- Any embroidered names or school patches must be covered, if applicable.

### Provided by Competitor

- All competitors must create a one-page resume and submit a hard copy to the technical committee chair at orientation.
- Paints (optionals)

### Provided by Technical Committee

- Scratch paper and pencils.
- Printed models.
- Caliper.

### Additional Information

No reference materials may be used other those provided by the technical committee.  
Presentation time: 8 minutes per team.

Models will be printed in white, teams will be able to pick up models at the competition orientation and paint if they choose to.

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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 ¼"
8. 3D Printed Design - Students **must** create a design that:
  - Is original and designed by contestant
  - Prints all parts in less than **8** hours
  - Uses less than **5** cubic inches of model and/or support combined for all parts.
9. Students **must** submit files to be printed via State designated file share site no later than **11:59 PM** on **[Thursday, April 11th]**. Final prints will be delivered the day of the contest so that students can test, assemble/modify and be evaluated.

## **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:
    - <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 [2024 Submission Link](#)
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.