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## **SkillsUSA 2019 – Additive Manufacturing State Challenge – *Heads to Tails***

### Overview

The below contest has been designed with the upcoming National Additive Manufacturing Competition in mind and are designed to challenge students' understanding of and skills in Additive Manufacturing.

This year's contest challenges students to design a 3D-printed device to flip an unmodified U.S. quarter, from heads to tails. They will need to design a device that fits into the testing rig and performs a specific task. They will also need to use their 3D printing knowledge to design a part that prints within the specified build volume, materials and times specified.

The contest descriptions can be found on page 3, with the contest criteria on page 4 and 5.

If you have questions about the contest, please email: [apanek@depcollc.com](mailto:apanek@depcollc.com) .

## Materials & Supplies Needed

Materials to be Provided by Student Competitor(s):

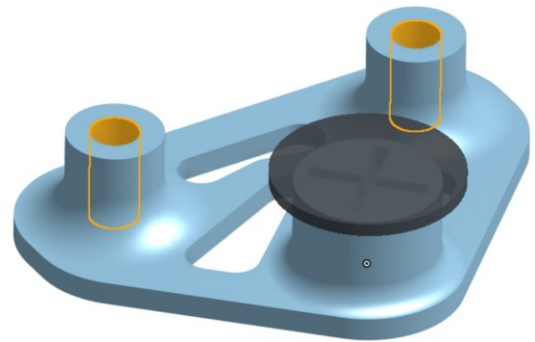
- 3D design submitted by March 21<sup>st</sup> (please e-mail designs to [apanek@depcollc.com](mailto:apanek@depcollc.com))
- Engineering notebook (date of contest)
- Presentation (date of contest)

Materials to be Provided by State Competition Host:

- 3D printed testing rig
- Lumber (least 12"x12" to secure rig to)
- US Quarters
- "Standard" 4 cm rubber bands for each competitor ([Amazon Link](#))
- Student designs 3D printed

## About the Testing Rig

- The Challenge Rig is a single 3D-printed bracket consisting of 2x ¼-inch "mounting holes" and a "coin stand".
- The overall dimensions of the rig are as follows: 2" (long) x 2.75" (wide) x 0.625" (tall).
- It is recommended that competition host have the rig printed and attached to a flat surface (a piece of lumber or plywood is sufficient). The Contest 2 rules will utilize the flat surface below the rig; so the surface should be at least 12"x12".
- The files to print these two parts can be found on GrabCAD here: <https://grabcad.com/library/2019-testing-rig-1>

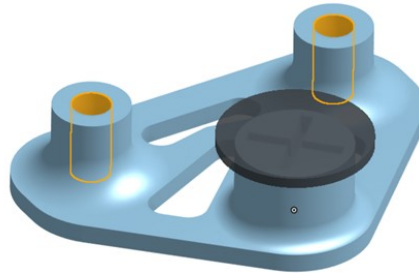


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## SkillsUSA 2019 Additive Manufacturing State Challenge

### Quarter Query - Heads to Tails

Welcome to the “Quarter Query” challenge! The task at hand is to design and use a device made of only 3D printed parts to flip an un-modified U.S. quarter (provided at the competition location) from heads to tails.



“What’s the catch?” you say. Well, there are four, and here they are:

1. The device may only be operated by a single, unbent finger. Note: the device may not attach to the finger in any way.
2. The device must remain in contact with at least one Connection Point (orange in the diagram) at all times.
3. The quarter will begin heads-up on the Coin Pedestal (X mark) and must finish tails-up anywhere on the flat surface provided.
4. The device must follow these 3D printing specs. Measured in GrabCAD Print:
  - Prints in less than 2 hours
  - Has a build volume of no greater than 2x2x2 in
  - Uses no more than 5 in<sup>3</sup> of model material
  - Uses no more than 2 in<sup>3</sup> of support material

Sound impossible?

Here’s some help: you may use one rubber band in your design. The rubber band that you must use in testing will be provided to you at the competition, but if you want to practice ahead of time, this is the model that will be provided.

The competition rig will be fixed to a large flat surface, and its file can be found here <https://grabcad.com/library/2019-testing-rig-1>

(Moderate)

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## Contest Criteria

Prior to contest day:

Students should submit designs by March 21st, 2019 to:

Aaron Panek; [apanek@depcollc.com](mailto:apanek@depcollc.com)

On contest day, students must submit:

1. Engineering Notebook (Engineering notebook guidelines below)
2. 3D printed design files
3. Printed part (Provided by contest chair day of contest)
4. Presentation of design

1. Engineering Notebook should:

- 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 FDM distinctly addressed (i.e. part strength, part orientation) especially including any expected risks during printing
- Design decisions and alternatives are documented and evaluated thoughtfully

2. 3D Printed Design - Students must create a design that:

- Prints in less than \*2 hours\*
- With a build volume of no greater than \*2X2X2in\*.
- Using no more than 5 in<sup>3</sup> of build material
- Using no more than 2 in<sup>3</sup> amount\* of support material

*Students must submit CMB files to be printed via GrabCAD Print- <https://grabcad.com/print?locale=en> no later than 11:59 CST on March 21<sup>st</sup>, 2019. Choose the F170 3D Printer as template printer, in GrabCAD Print. Final prints will be delivered day of contest so that students can test, assemble/modify and be evaluated.*

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### 3. 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: Part functions way team intended in 3 out of 3 tests.