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March 20, 2023

If you are familiar with shuffleboard, air hockey, pinball, curling, or other similar type of game, then you understand the concept behind this year's Maryland State SkillsUSA Additive Manufacturing challenge.

**Your design/build task:** is to fabricate a lever mechanism that you can use to launch a mini shuffleboard puck.

The size of the shuffleboard puck is 7/8" in diameter. The outer ring of the puck is made of rigid plastic. The center of the ring holds a 1/2" steel ball bearing.

Your lever mechanism, whether you fabricate it as a single-part standalone device or multi-piece assembly, must fit within a cube no larger than 2" high, 2" deep, and 3.5" wide when fully assembled. Measurements will be checked before and during performance operations. No portion of your device can operate outside of the boundaries of the space defined by a 2"x2"x3.5" cube. No foreign materials of any kind can be used with your lever mechanism: no glue, rubber bands, clips, fasteners, plastic weld, acetone, etc. can be used on your device. It can only contain untreated 3D printed material as it comes out of the printer (excluding a cleaning station solution bath to dissolve any support material if needed).

Cost is just as important as performance for additive manufacturing. To maximize the points awarded for design, you must minimize the time and materials needed to manufacture your device, while still being able to reliably perform the required functions. To reduce the cost of manufacturing, you should minimize the amount of both model material and support material that are needed to build your device. Your team should also design a device that minimizes the total amount of time required for printing. You cannot exceed a total of 4 hours of build time for your device. A maximum limit of material is not defined, but efficient designs will rely on less material. Official confirmation of your build times and material use (both model and support) must be submitted by your teacher/coach/advisor to the judges at the contest, along with the make and model of your 3D printer and the type of material used (note: We have adjusted this year's state challenge to allow PLA, ASA, or ABS plastic at the request of our teams).

**Your performance task:** is to use your lever mechanism to propel the puck forward to a goal post with different point gates, ranging from 10 points to 50 points. From the time it is launched, the puck must remain in contact with the ground until it passes through the gate, and for the entire duration of its run. If at any time the puck becomes airborne, travels out of bounds, or tilts to the point that the ball bearing is not touching the floor (a side roll), the run is disqualified. Each team will have 5 attempts to launch a puck with their device for each of two different goal post setups: one straight shot setup, and one banked shot setup. Team members can alternate launch attempts or divide the two challenges among the two team members however they choose, as long as each team member performs 5 of the 10 allowed attempts. Your score will be determined on the outcome of the 3 best of 5 attempts for each goal post setup.

The distance the puck must travel will be no less than 15 feet and no more than 25 feet. The exact setup of the performance challenge will be determined by the judges on site, depending on available space, facilities, and flooring. The challenge will run on as smooth a flooring surface as can be found (like tile, linoleum, terrazzo, etc.). Teams will be allowed to examine the performance challenge setup prior to their runs, but no prior practice with the pucks or preliminary runs on the course with the point gates are allowed.

**In addition to your design/build and performance tasks:** your team will be required to present a brief explanation of your design to the panel of judges and answer related questions. The time allotted for design explanation and Q&A is no less than 4 and no more than 6 minutes per 2-person team. Both team members are required to be present and compete equally in all sections of the challenge.

Now that you have read the requirements of this year's challenge, know that you have an early deliverable to the judges. **Your team must submit the best version of the final design for your device to the contest chair by email from your teacher/coach/advisor, no later than 5:00 p.m. on Wednesday, March 22<sup>nd</sup>.** Your designs can be created in any CAD software or drawn by hand, whatever your team prefers. Your design drawings must be fully dimensioned, and can be submitted as PDFs or images, as long as all details and dimensions are clearly visible.

Regards,  
Joshua Brown