South Dakota State University Extension

South Dakota 4-H Robotics & Engineering

2022 Challenge Packet

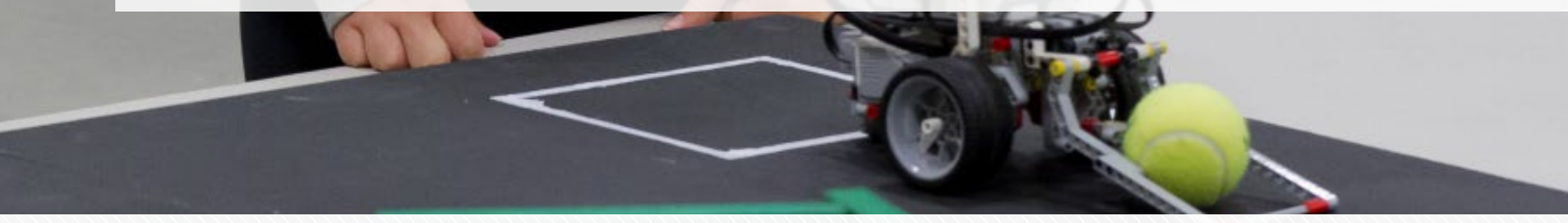
Christine Wood | SDSU Extension 4-H Science Technology Engineering and Math (STEM) Field Specialist

Nathan Skadsen | SDSU Extension 4-H Youth Program Advisor

Amanda Stade | SDSU Extension State 4-H Events Management Coordinator

Co-Chairs: Heather Lee and Amy Tiezen

Committee members: Larry Lee, Heather Hinners and Cindy Jager



Department of **Agricultural & Biosystems Engineering**

College of **Agriculture, Food & Environmental Sciences**

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Event Overview

The South Dakota 4-H Robotics & Engineering Challenges are an opportunity for youth to demonstrate their knowledge and mastery of robotics or engineering. This year there will be two separate opportunities for youth to showcase their skills at the South Dakota State Fair, one for robotics and another for engineering. Both showcase opportunities are open to teams as well as individuals.

Event Location

The event will be held Saturday September 3rd, 2022 on the South Dakota State Fairgrounds, Huron, SD. The challenge will be held in the Nordby Exhibit Hall on the State Fair Grounds.

Tentative Schedule

7:50 a.m. Check in for Robotics Session 1**
8-9:30 a.m. Session 1 of Robotics Challenge
9:20 a.m. Check in Robotics Session 2**
9:30-11 a.m. Session 2 of Robotics Challenge
10:50 a.m. Check in for Robotics Session 3
11 a.m. -12:30 p.m. Session 3 of Robotics Challenge
12:30 p.m. Awards
1:30 p.m. Check in for Open Build Egg Drop – These youth do not have to be preregistered to participate.
1:30-3:30 p.m. Open Build Egg Drop work time
2:30 p.m. Pre-Registered Egg Drop teams check in
2:30-3:30 p.m. Pre-Registered Egg Drop teams adjust design according to egg size.
**This schedule is tentative and subject to change based on facility capacity and number of teams.*
***There are a maximum of 6 slots during each session, so please indicate in the registration your first, second, and third choice of times.*

Eligibility

1. Registration is taken on a first-come-first-serve basis through August 9, 2022. This registration deadline will be strictly enforced.
2. Youth may register as individuals or as teams.
3. Teams may consist of youth from different counties.
4. All participants must be at least 8 years of age by January 1, 2019, but not have turned 19 years old prior to January 1, 2022.

Robotics Course Design Challenge

Youth have been tasked with designing their own robotics course. Youth will bring three deliverables to the State Fair: Challenge Booklet, Challenge Board, and Robot. Upon registration, teams will indicate the time they prefer to present their course during the 2022 SD State Fair.

Challenge Booklet

Within their challenge booklet, youth will indicate if the course is designed for a beginner, intermediate, or advanced audience. The storyline, tasks, and scoring will be outlined in the booklet as well. Junior and senior members will also be asked to include a list of skills that are mastered in completion of the course (example: youth who master this challenge successfully incorporate the wait block, or youth who master this challenge will successfully use the medium motor to move a block).

Robot

Youth will need to bring a robot designed and programed to complete the challenge they have designed. ANY robotics platform may be utilized.

Challenge Course

Youth will need to bring everything they need for their course. This includes all obstacles and the board itself.

Requirements

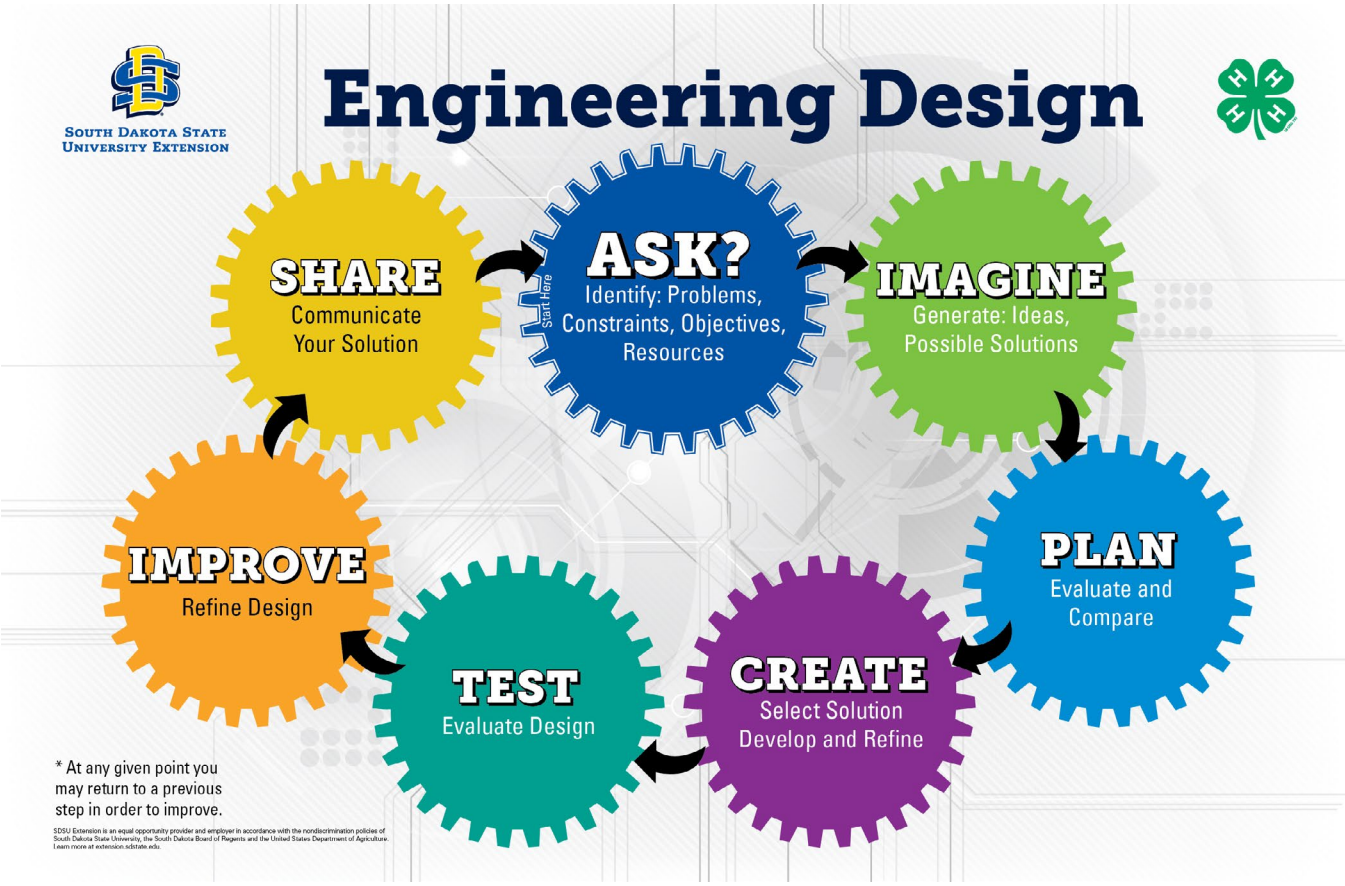
- Course maximum size is 4’ x 6’
- For Senior members the course and robot should make use of at least 2 sensors. It is highly encouraged that Juniors also use sensors. For Beginners, sensor use is optional.
- Course must include the movement of at least 2 objects

An example of a course design can be found at the end of the packet.

Judges Scorecard

Skills	Needs Improvement (1 point)	Average (2-3 points)	Excellent (4-5 points)
Course– How unique and creative is the robotic course? Does it use unique challenges or obstacles? Is the course appropriate for the audience noted? Does the course fit within the storyline? (add 1 pt for Beginner and Junior teams using sensors).			
Storyline– Is there a story line with the robotics board? Does the course provide a background for the challenge as well as effectively outline the tasks that need to be completed. Does the course fit within a narrative?			
Robot Design – Is the robot design creative? Does it appear to address the challenges in the course? Does it use at least 2 sensors? Is the robot able to complete the course that it has been designed for?			
Scoring – Does the robot course have a scoring system? Does the scoring seem appropriate for the skill level of each task? Are their opportunities for points to be awarded as well as taken away?			
Presentation – Are youth effective in sharing their course and the tasks that need to be completed? Are the 4-H youth able to answer questions from the judges? Are all youth aware of why decisions were made in the design process? If a team presentation, are all youth participating in the presentation?			
Mastery (Jr./Sr. Only)– Do youth list at least one skill mastered for each task of the robot challenge? Are the skills noted appropriate for the challenge level listed (example: a robot moving forward and backward is appropriate for a beginner, but not an advanced challenge)?			
Total:			

Engineering Design Challenge – Egg Drop



Using the Engineering Design Method, youth will construct a device with the purpose of protecting an egg from cracking when falling from a height of 5 to 10 feet. Eggs will first be dropped from 5 ft; if they survive, the height of drop will increase.

Youth should keep a notebook and record the process of developing their design using the engineering design method. The state event is the share portion.

During the design process, junior and senior teams should also track the cost of materials they purchased for their build. A tracking sheet and receipts must be included in their design notebook. The total cost of materials used in the final build cannot exceed $5. When determining total costs, teams will need to determine the unit cost of each material they have purchased. For example, if youth purchase a 100 ft roll of saran wrap for $1, it costs $.01 per foot. If during the creating, testing, and improving portions of the design process youth use all 100 feet of the roll the total cost is $1. Using recycled items is encouraged. Recycled items are items whose primary purpose has already been used (for example an empty pop bottle). Recycled items are not items that are available just because they haven't already been used (for example, paper clips in a desk drawer).

Requirements

- Eggs must survive drop.
- Maximum size of device is 5" x 5"
- Price of the device is limited to $5 (Senior and Junior teams only)

Egg Dop Build Expense List for

_____ Team

Description	Use Count	Amount
Total		

Supplies Expense List

Description	Full Purchase Cost	Count at Purchase	Single Purchase Cost
Purchased Supplies (Start of list, not complete)			
Reused Supplies (Start of list, not complete)			
Total			

Judges Scorecard

Skills	Needs Improvement (1 point)	Average (2-3 points)	Excellent (4-5 points)
Creativity – How unique and creative is the design? Does it make unique use of the materials?			
Durability – The mechanism is capable of surviving multiple drops.			
Engineering Design Method – Did the youth utilize the engineering design method? Can they articulate what the engineering design method is?			
Cost (Senior and Junior Only) – Is the device cost effective? Total cost can be used as a tie breaker if needed.			
Presentation – Are the 4-H youth able to answer questions from the judges? Are all youth aware of why decisions were made in the design process? If a team presentation, are all youth participating in the presentation?			
Effectiveness – Did the egg survive the fall?			
Total			
Highest survival drop: _____ ft			

* Scoring: Winner will be decided first based on the highest drop survival and then the overall points given.

The following is an example of a robot course design
Challenge 1 — Starkiller Base Trench Run

Scenario – Intermediate

Story Line

Before our attack on the Starkiller Base, we have been able to sneak you onto the planet. However, we can only risk you being on the planet for 3 minutes before you are detected. We have a list of tasks for you to accomplish and it is your goal to get as many of them done as possible. There is a canyon separating your landing zone from two of our objectives. Luckily, Bothan spies were able to mark a path that will safely lead you through the canyon. Good luck. May the force be with you!

Objectives (Figure 1)

1. Your mission objective is to complete as many tasks as possible within your 3 minute time frame. Those tasks are:
   a. Press the call button
   b. Follow the line through the canyon (top to bottom)
   c. Follow the line through the canyon (bottom to top)
   d. Disassemble the tower located at the bottom of the board
   e. Deliver the dish part of the tower to the storage location
   f. Collect a sample rock from the bottom of the board
   g. Deliver the sample to the lab location
2. If you complete at least three of the above tasks and return to the Start Box, the points for each task you complete will be doubled.
3. The call button is considered to be pushed if some part of the robot comes to rest on the button for at least 1 second.
4. In order to score points for either successfully delivering the rock sample or the tower dish, the object must be placed completely within its drop off zone.
5. A line sensor may be used to make it through the canyon but does not have to be used
6. The mission ends when either the timer reaches zero or your robot returns to the start location.
7. Your team will get one attempt to accomplish the mission.

Scoring

Mission Objectives	**Maximum Possible Points**
Press the call button	200
Follow the line through the canyon from top to bottom	300
Disassemble the Tower	400
Deliver Dish from Tower to Storage Zone	700
Collect a Sample (successfully pick up a rock)	200
Deliver Sample to Lab Zone	500
Follow the line through the canyon from bottom to top	300
2x Bonus for Completing 3 Mission Objectives and Returning to Start Box	2x Total Points
Additional Points Available	
Start in the Start Box (Launchpad)	100
Return to Start Box (Launchpad)	250

Challenge Dimensions 4'x8'

- Each Grid Represents 6"
- Squares Containing Cliffs will have a 6" vertical face. These squares will have some percentage of them covered by a cliff.
- The black line is a flat line that runs the length of the canyon
- The blue and red box is a flat surface

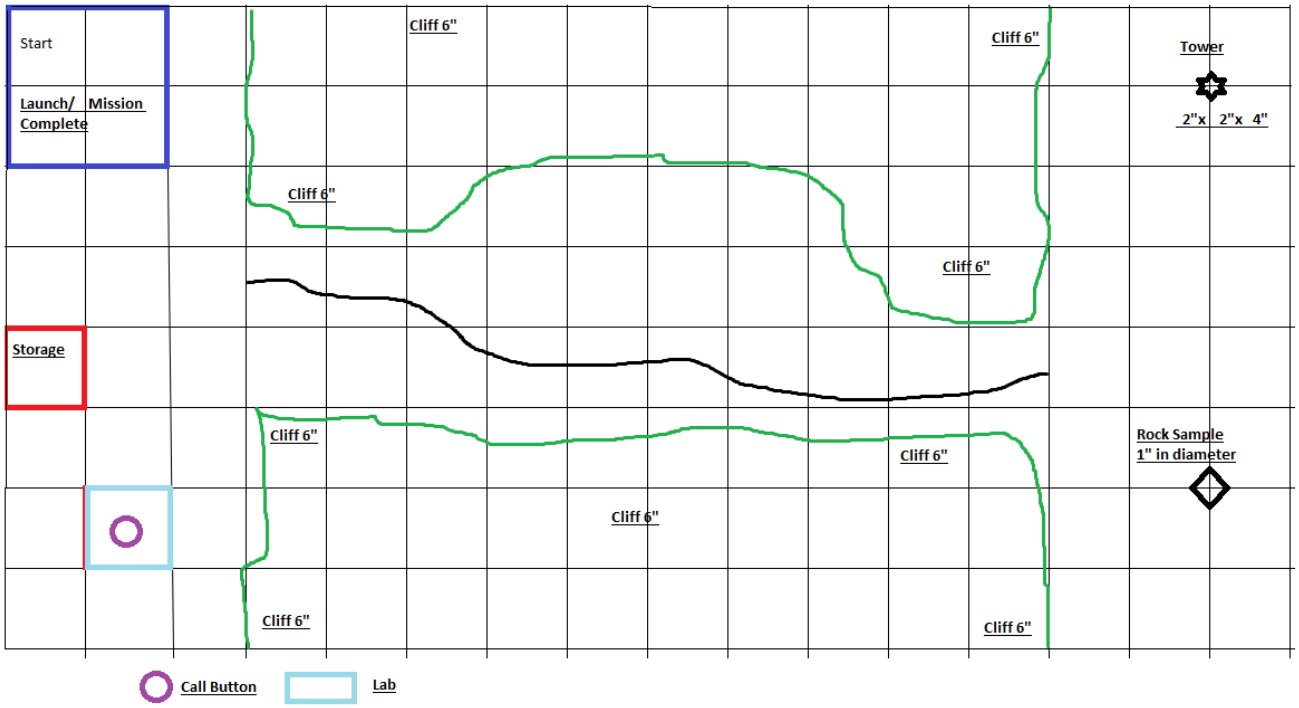


Figure 1 – *Grid is 6 in. squares

4-H Robotics Challenge Registration
Due: August 9, 2022

Email Forms to: Christine Wood – christine.wood@sdstate.edu

County: _____

Team or Individual Name: _____

Coach: _____ Phone Number: _____

Email: _____

Team Member	Age
1.	
2.	
3.	
4.	
5.	

Rank your team's session preference (1 most preferred, 3 least preferred):

_____ Session 1 8:00 a.m. _____ Session 2 9:30 a.m. _____ Session 3 11:00 a.m.

4-H Engineering Challenge Registration
Due: August 9, 2022

County: _____

Team or Individual Name: _____

Coach: _____ Phone Number: _____

Email: _____

Team Member	Age
1.	
2.	
3.	
4.	
5.	

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