



South Dakota 4-H Robotics & Engineering 2019 Challenge Packet – Recycle Challenge

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

Chuck Martinell | SDSU Extension 4-H Youth Program Advisor

Nathan Skadsen | SDSU Extension 4-H Youth Program Advisor

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

Department of Agricultural & Biosystems Engineering
College of Agriculture, Food & Environmental Sciences

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Event Overview

The South Dakota 4-H Robotics Challenge is an opportunity for youth who have been learning about robotics to demonstrate their learning, celebrate their accomplishments, and interact with others who share an interest in robotics.

Event Location

The event will be held Saturday August 31st, 2019 on the South Dakota State Fairgrounds, Huron, SD. The challenge will be held in the Nordstrom Exhibit Hall on the State Fair Grounds.

Tentative Schedule

8:00 Advanced Division (Autonomous) teams check-in: Receive team table assignment

8:20 Advanced Division (Autonomous) rules and challenge release

8:30-10:15 Advanced Division (Autonomous) team work period – presentations begin at 9:45

10:15 Advanced Division (Junk Drawer) teams check-in: Receive team table assignment

10:35 Advanced Division (Junk Drawer) rules and challenge release

10:45-12:30 Advanced Division (Junk Drawer) team work period – presentations begin at 12:00

1:00 Competitive Division teams check-in: Receive team table assignment

1:20 Competitive Division Team Challenge rules and challenge released

1:30-4:00 Competitive Division team work period

4:00 Final judging Competitive Division

4:45 Awards for Competitive Division

****This schedule is tentative and subject to change based on facility capacity and number of teams.***

Eligibility

1. Team registration is taken on a first-come-first-serve basis through August 1, 2019. This registration deadline will be strictly enforced.
2. Teams must have at least two members with a max of 4.
3. Advanced and Competitive team members need to be proficient with their chosen platform before the event.
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, 2019.
5. The Advance Division is for all 4-H ages (8-18)
6. The Competitive Division is divided into age groups Beginner/Junior (8-13) and Senior (14-18). The committee reserves the right to divide teams into appropriate groupings during check-in.

Event Content

The South Dakota 4-H Robotics Challenge is divided into the following divisions: Advanced and Competitive. After check-in and set-up, teams will gather for the Challenge Release. Each team within a division will receive their Challenge at the same time. Time has been allotted for questions and clarification after the Challenge Release. After the Challenge Release, each team returns to their pit area to program their robot to complete the tasks outlined in the challenge. The last 15 minutes of each Division will be utilized for showcasing each team's final program.

Advanced Division (Autonomous)

This division is for youth (ages 8-18) who have minimal experience with autonomous robot platforms (LEGO®, VEX, etc.). Youth will design, build, and program a robot to accomplish the tasks laid out in the appendix. It is **highly encouraged** that the **majority of their build and programing is completed prior to arriving at the fair** as they will only have one hour and fifteen minutes to make adjustments. They may use a stock build or design their own.

The Advanced Autonomous Division is a modified real time challenge; this means that portions of the challenge are provided in the Appendix A, but teams need to be prepared for changes on the day of the challenge.

Advanced Division (Junk Drawer)

This challenge does not use a robotics platform, rather teams are provided a 'trunk of junk' that they must utilize to complete a task. This challenge requires teams to be creative and use their engineering skills. Teams may only use materials provide at the challenge release.

The Challenge will be introduced in Appendix C, but the materials within the 'trunk of junk' will remain a mystery until the Challenge day. Teams will have an hour and fifteen minutes to design and construct their robot. In order to best prepare for the challenge, teams should familiarize themselves with topics covered in the 4-H Junk Drawer Robotics curriculum.

Competitive Division

This division is for youth wishing to try a competitive robotics event. The team should have previous experience using an autonomous robotics platform (LEGO® MINDSTORMS®, VEX, TETRIX®, etc.) and arrive at the challenge with their robot built and programed.

The Competitive Division is a modified real time challenge; this means that portions of the challenge can be found in the Appendices, but teams will not necessarily know everything about the challenge prior to the event. The competitive division will be divided into two categories Beginner/Junior (ages 8-13) and Senior (ages 14-18). Both groups will be required to complete an autonomous robotics challenge and a junk drawer robotics challenge. Points will be awarded based upon how much of the challenge is completed, as well as for team work and technical understanding. The point breakdown can be found in the Appendix with the corresponding challenge.

The teams will have 2.5 hours to complete both the autonomous and junk drawer challenges. It is up to them to decide how they will budget their time. During this time judges will ask questions about what they are doing/ have done and will be observing their teamwork.

Teams are required to record their building and programming process as they prep for the challenge. These records will count towards their final score and can be used as the determining factor in case of a tie.

Part 1: Autonomous robotics challenge can be found in Appendix B. Teams will need to arrive at the competition with their robots constructed and prepared to run the challenge courses. The day of the Challenge, teams will find the courses to be slightly modified (locations may be changed or steps may be added) and released to teams the day of the challenge. Teams must be familiar enough with their program that they can easily adjust their program to complete the Final Challenge.

Part 2: Junk drawer robotics challenge found in Appendix C, does not use a robotics platform, rather teams are provided a 'trunk of junk' that they must utilize to complete a task. This challenge requires teams to be creative and use their engineering skills. Teams may only use materials provide at the challenge release. The Challenge is introduced in Appendix C, but the materials within the 'trunk of junk' will remain a mystery until the Challenge day. Teams will have an hour and fifteen minutes to design and construct their robot.

What to Bring

1. An autonomous robot, your team notebook, and/or computer if your division allows it.
2. Robot garages—It will happen ... someone will drop their robot and watch the parts explode in a million directions. It's not pretty. **BRING A PLASTIC CONTAINER LARGE ENOUGH TO CARRY YOUR ROBOT DURING THE EVENT.** If it drops, you have a better chance of collecting all of the parts and reassembling your robot.
3. Knowledge of how to build and program using their chosen platform—you will not have time to learn at the event, but we will have technical advisors available.
4. Your teamwork and engineering skills—this is your chance to show them off, be innovative, creative, collaborative, and demonstrate your ingenuity.
5. A great 4-H attitude!—This is a fun chance to stretch your skills, see what other 4-H'ers are doing, and show off all the hard work you've put into the past year. Come ready to have fun and learn!

Odds and Ends

Attendance – When you registered for this event you indicated the number of team members attending. We understand that things happen, and a team who planned to attend may not be able to. If this situation arises, and you know in advance, please email Christine Wood at Christine.Wood@sdstate.edu so we can allow another team in.

Resources – Before the Event: if you have any questions or concerns contact Christine Wood at Christine.Wood@sdstate.edu. At the Event: we will have technical advisors to offer limited assistance with computer, programming, or component problems. Event staff will also be available to answer questions and clarify the challenges. We want you to have fun, learn something, and discover the amazing things you can do. We will do everything possible to make this fun and educational while keeping the playing field level. So, if you have a question, ask!

Robot Specifications – Competitive teams will be required to use an autonomous robot. This means robots should be programmed to run the course without any type of human intervention, so no push button commands, Bluetooth, or remotes may be utilized.

Role of the Adult Leader/Coach – This is the kids' event! Thank you for all the hard work you do to make these amazing experiences and learning opportunities available to 4-H'ers. Now is the time to watch with pride as they once again put it all together and show their stuff. You're here to supervise and provide guidance and encouragement from your coach's box. Let's watch them shine!

Safety – We expect everything will go smoothly and safely. No injuries, no accidents, nothing that a hug or a bandage couldn't remedy. However, as a leader you have to be aware of your responsibilities for the care and safety of your team members, their belongings, those around you, and the facilities. It starts when you get behind the wheel and doesn't end until the last team member is safely home. There will be a lot of valuables sitting on tables around this event. The State Fair Grounds are a busy place, and there will be many people in and out of the building and spectators watching the teams work and cheering them on during the Challenge Events. Use common sense. Don't leave valuables unattended. Establish and encourage rules for your team before you arrive. Keep your team members and their belongings safe.

Scoring Overview for Competitive Division

Each challenge will have its own individual score sheet (found in Appendix A, B, and C). However, the challenges are not the only aspect that the teams will be scored upon. Teams will be judged according to their 4-H values, technical understanding, records, robot builds, and programing abilities.

4-H Values – Total possible points 1,400

Skills	Criteria				Points
	50	100	150	200	
Participation – All members take an active part of the team effort	Rarely	Some of the time	Most of the time	All of the time	_____
Teamwork – It is clear that the team works together as a unit	Rarely	Some of the time	Most of the time	All of the time	_____
Respect/Sportsmanship – Team members are knowledgeable of and follow all rules involving Challenge Day. Students show respect to all participants.	Rarely	Some of the time	Most of the time	All of the time	_____
Integrity – Coaches, parents, or other adults offer assistance, but the students are CLEARLY doing the work among themselves	Rarely	Some of the time	Most of the time	All of the time	_____
Engineering Notebook – Records are kept in the notebook and provides a clear picture of the robot design process and programming process	Rarely	Some of the time	Most of the time	All of the time	_____

Engineering Design – Total possible points 1000

Criteria				Points
50	100	150	200	
Design shows little to no creativity	Design has some creative aspects	Design is creative	Design is very creative	_____
Design is inefficient and ineffective	Design is either inefficient or ineffective	Design is efficient and effective at completing most tasks	Design is efficient and effective at completing all tasks	_____
Program shows little to no creativity	Program has some creative aspects	Program is creative	Program is very creative	_____
The program is ineffective	Program is effective at completing some tasks	Program is effective at completing most tasks	The Program can complete all tasks	_____
Team cannot explain robot and program design	Team cannot explain robot or program design	Team can mostly explain robot and program design	Team can fully explain robot and program design	_____

Awards for Competitive Division

Award	Description
Clover Award	Team notable for exemplarity demonstration of 4-H values
4-H Robotics Award	Top scoring team from all areas
Engineering Design Award	Top scoring team for engineering design

4-H Robotics Contact Information

Christine Wood – Robotics Committee Advisor

SDSU Extension 4-H Science Technology Engineering and Math Field Specialist
605-782-3290
Christine.Wood@sdstate.edu

Chuck Martinell

Robotics Committee Co-Chair
SDSU Extension 4-H Youth Program Advisor
Chuck.Martinell@sdstate.edu

Nathan Skadsen

Robotics Committee Co-Chair
SDSU Extension 4-H Youth Program Advisor
Nathan.Skadsen@sdstate.edu

Please contact us with any questions or concerns.

Appendix A – Advanced Autonomous Robotics Challenge

The challenge includes a scenario description and a diagram with specific measurements for each part of the course.

Challenge 1 – Knock Down Throw Down

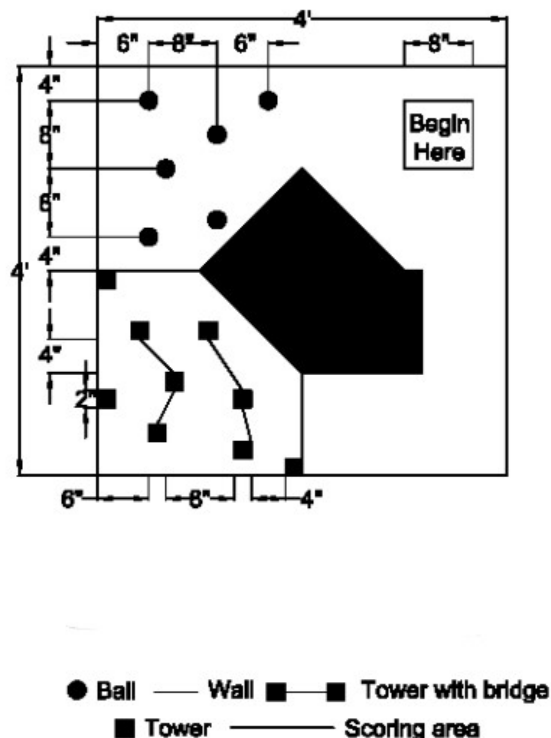
Welcome to America's greatest new game, Knock Down! In this version of bowling you are able to collect as many balls as you want to bowl. The key to the game is to keep the balls on the table, while knocking over as many pins as possible.

You will have 90 seconds to complete the game. The challenge will only be scored once.

Scoring (Figure 1)

Task	Possible Points	Max Points
Bonus (Move balls into scoring location)	50	300
Knock over free standing towers	100	900
Cause bridges to Collapse	50	200
Complete course with .01-30 Seconds Remaining	100	100
Complete course with 30.01-60 Seconds Remaining	200	200
Complete course with 60.01+ Seconds Remaining	300	300
Crossing A Wall Line per occurrence	-200	
Bonus Container Moved Out of Container Zone and not into Pickup Zone	-50 per material	-300
Touching or Redirecting Robot (per occurrence)	-200	-200
All balls in scoring Area Bonus	300	300
	Max Points Possible	2100

*Every human assist of the robot will deduct 500 points from final score



Appendix B – Competitive Autonomous Robotics Challenges

Each challenge includes a scenario description and a diagram with specific measurements for each part of the course.

Challenge 1 – Ironman Robotics Challenge

Scenario – Intermediate

You must complete the grueling Ironman Robotics course. In this challenge you will need to move the (tennis balls) into the containment area. Each containment area can only hold two balls and the balls must remain in the zones when time is called.

Mission (Figure 2)

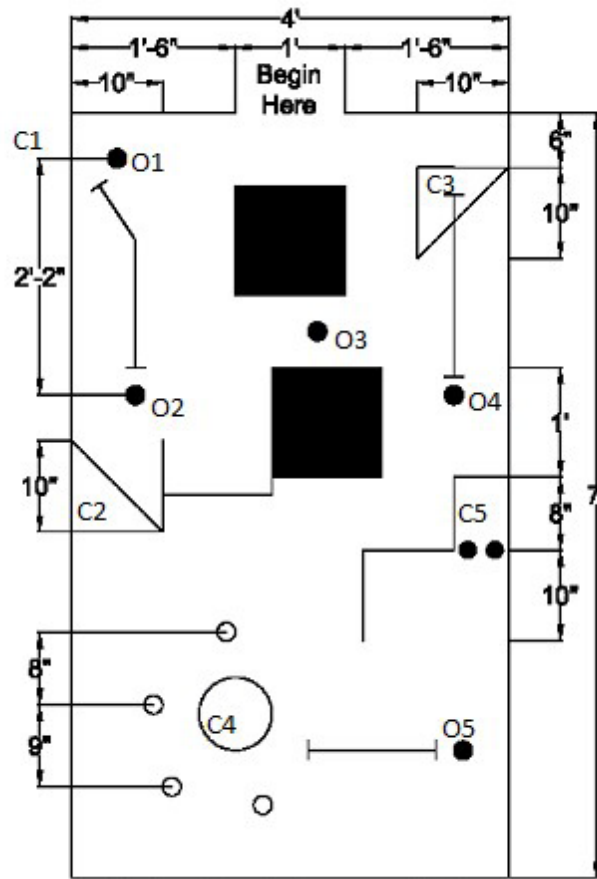
Refer to Appendix B Figure 2

1. Starting in the start zone you must place all five objects into containment fields. Two objects can be placed in each containment area.
2. This event is timed at 3 minutes per run.
3. The challenge ends once all five objects are placed into containment fields or the timer reaches 3 minutes.
4. Teams are limited to one attempts.

Scoring

Task	Maximum Possible Points
Place one object into containment zone (5 Objects in 5 different containment zones)	300
Cross over a Wall Line (per occurrence)	-100
Cross into a pit (per occurrence)	-500
Finish .01-30 second early (You may only earn one time bonus)	100
Finish 30.01-60 seconds early (You may only earn one time bonus)	200
Finish 60.01+ seconds early (You may only earn one time bonus)	300
Touch or Redirect the Robot	-500
Return to Start and End Run	300
Total possible with no deductions	2100

Challenge Dimensions – Figure 2



Robotics Intermediate Course #1

● Object — Wall —|— Colored tape line

O=Object C=Containment Area

Object number corresponds to
containment number

**CAD Drawing provided by Chelsey Morrow, B.S. Civil Engineering, SDSU 2015*

Challenge 2 — Robot Construction Zone

Scenario – Adapted from WSU Shocker Mindstorms

It is construction time at the State Fair! We've asked that you design a robot to help move construction material around and deliver it safely.

Mission

Refer to Appendix B Figure 3, 4, & 5

You must complete 3 challenges for bonus. You will only get one attempt at the challenge.

1. Starting at #1 you must travel to Building Material 1 (#2) and pick it up. The material is a ring (2 inches in diameter).
2. Drop off Building Material 1 at location #4.
3. Pick up Building Material 2 (#5)
4. Transport Building Material 2 to the carrier (#6)
5. Push the carrier to safety (off the board)
6. Return to Start

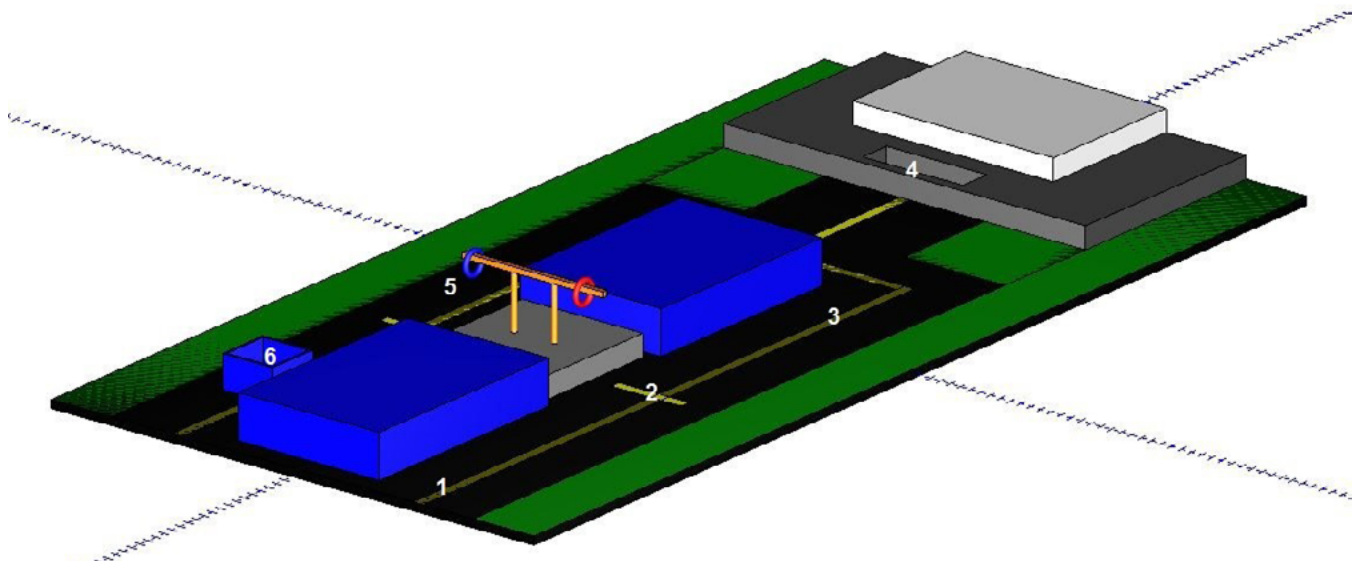


Figure 3: Isometric view of the Taj Mahal Challenge. Numbers represent various points in the challenge and are listed in the Mission steps above.

Scoring

Task	Maximum Possible Points
Start in starting Box (not counted to Challenge Bonus)	300
Collect Building Material 1 (Red Ring)	200
Drop Building Material 1 at Drop Off Zone (Drop in Blue Box 150, Else 100)	400
Collect Building Material 2 (Blue Ring)	100
Drop the Building Material 2 in the transport carrier (Drop in carrier 250, Else 150)	100
Push the carrier off the board	750
Return to Start	100
Total	1000

Challenge Bonus 2x for completing 3:

Challenge Dimensions

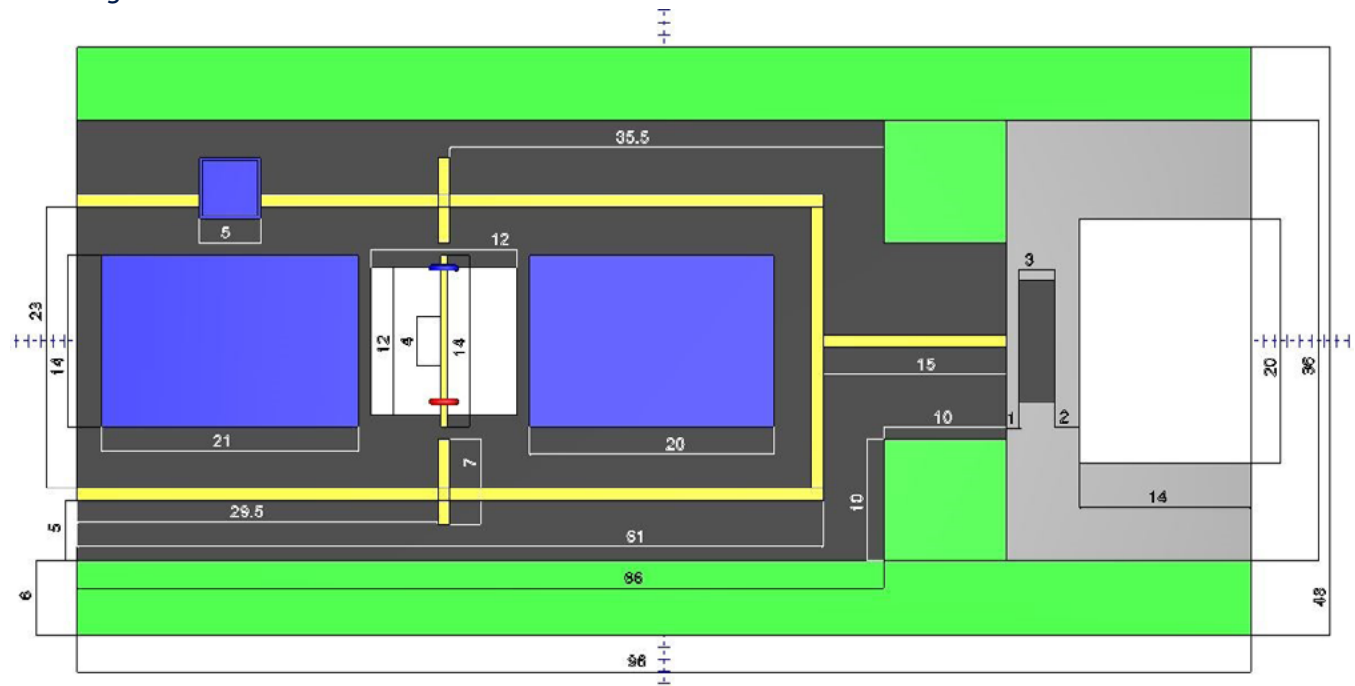


Figure 4: Top view of challenge board with dimensions. All measurements are in inches. The design is symmetrical. The location the rings are hung may vary, so be prepared to pick them up regardless of where they are at on their perch.



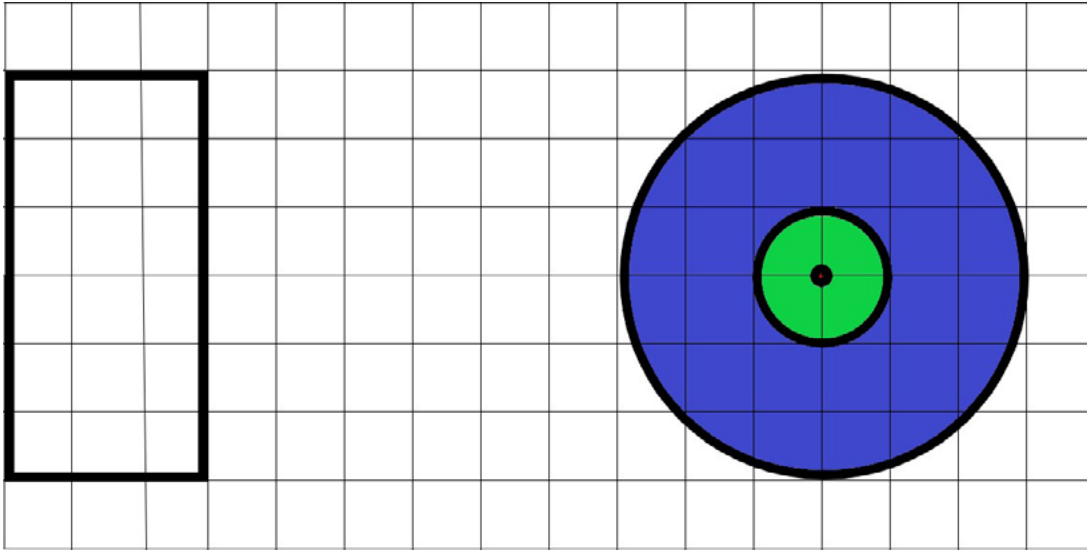
Figure 5: Back view of challenge board with dimensions. All measurements are in inches. The red and blue rings are both 2 inches in diameter and $\frac{1}{4}$ inch thick.

Appendix C – Junk Drawer Robotics Challenges

Each challenge includes a scenario description and a diagram with specific measurements for each part of the course.

Junk Drawer Robotics

Landing Pad Challenge – Figure 6



Things to keep in mind:

1. You may only use materials provided in the Junk Drawer.
2. Each square represents 6".
3. You may choose anywhere in the start area (large rectangle area) to start your robot. Your robot may not leave the start area.
4. If your robot fails to move, stops, tips over, or gets stuck, you may rescue your robot and attempt to fix the problem, but your robot will incur a 'touch penalty'.
5. A rescue is defined as any time any member of the team touches any part of the robot after time has started.
 - a. Touch Penalty: If your machine just needs a little nudge or wiggle to continue on its way, but you don't want to do a restart, you can take a touch penalty instead.
6. Restarts: If your machine fails to start, gets stuck, tips over, goes astray or needs to be reoriented, moved or in any other way rescued, you may attempt to fix the situation and restart your machine, but
 - a. Your timer will restart the clock 30 second clock but not the overall running clock.
7. The playing area may not have anything affixed to it from your junk drawer.
8. Your machine must take a minimum of 5 seconds and a maximum of 30 seconds to complete the challenge.
9. You may place your machine anywhere you like in the start area, and it can move (or not) in any direction or for any distance.
10. The countdown will not begin until the judge says "Go".
11. You will have five scoring opportunities (5 marshmallows) to project the standard size marshmallow into the scoring area.
12. Your machine must only shoot one projectile at a time.
13. You are not able to reload a projectile manually.
14. Your machine may not be any higher than 8 inches.
15. Your machine must fit entirely in the start area and part of it must remain in the start area for the duration.
16. Your marshmallow is scored on where it ends it landing.
17. The whole marshmallow must be used but it can be modified.

18. If restarts force an overall time of 2 minutes the round will be immediately over and no more points can be earned.
19. Only two members of your team may be in the competition area during the round. They must remain behind or to the side of your machine.
20. Quantities of materials in each team's junk drawer are identical.
21. A few supplies are limited to the number provided in the kit, however you are permitted to request more of any item. If such requests can be granted without creating an unfair advantage, they will be.
22. Make requests for additional supplies to the technical advisors.
23. Report broken motors and dead batteries to technical advisors for replacement.
24. Your team will get one attempt to accomplish the mission.

Challenge Scoring

Task	Possible Points	Points Earned
Landing on Inner Ring	1000	
Landing in Middle Ring	500	
Landing on Outer Ring	250	
Touching Penalty	-50	
Restart Penalty	-20	

Junk Drawer Robot Design / Engineering – Points 600 (Jr. level) or 800 (Sr. level)

Criteria				Points
50	100	150	200	
Design shows little to no creativity	Design has some creative aspects	Design is creative	Design is very creative	_____
Design is inefficient or uses an excessive number of parts	Design is somewhat efficient	Design is efficient most of the time	Design is efficient all of the time	_____
Team has little to no knowledge of why some parts are located as they are on the robot or what they do	Team shows minimal knowledge of the robot design	Team shows moderate knowledge and understanding of their robot design	Team can thoroughly explain the design of their robot	_____
Team spent more than 10% over their budget*	Team spent more than their budget, but was less than 10% over*	Team was able to stay on budget but with no remaining funds*	Team was able to stay on budget with remaining funds*	_____

*Sr. Division teams will be required to manage a budget in addition to building their robots. This part of the rubric is for those teams only

4-H Robotics Challenge Registration - Non-competitive Divisions

Due: August 1, 2019

Email Forms to:

Christine Wood – christine.wood@sdstate.edu

County _____

Team _____

Coach _____ Phone Number: _____

Email _____

Team Member	Age	4-H Member?
1.		
2.		
3.		
4.		
5.		

Division? ☐ Advanced Autonomous (What type of robot will you be bringing _____)
☐ Advanced Junk Drawer

Team _____

Coach _____ Phone Number: _____

Email _____

Team Member	Age	4-H Member?
1.		
2.		
3.		
4.		
5.		

Division? ☐ Advanced Autonomous (What type of robot will you be bringing _____)
☐ Advanced Junk Drawer

4-H Robotics Challenge Registration - Competitive Divisions

Due: August 1, 2019

Email Forms to:

Christine Wood – christine.wood@sdsu.edu

County _____

Team _____ Division _____ Bg/Jr (8-13) _____ Sr. (14-18)

Coach _____ Phone Number: _____

Email _____

Team Member	Age	4-H Member?
1.		
2.		
3.		
4.		
5.		

What type of robot/software will you be bringing? _____

Team _____ Division _____ Bg/Jr (8-13) _____ Sr. (14-18)

Coach _____ Phone Number: _____

Email _____

Team Member	Age	4-H Member?
1.		
2.		
3.		
4.		
5.		

What type of robot/software will you be bringing? _____