

DEPT H – SCIENCE, ENGINEERING and TECHNOLOGY

Judge: Ron Suing & Thomas Dobesh

Purple award \$5.00; blue award \$4.00; red award \$3.00; white award \$2.00

- A. The name and club of each exhibitor should appear separately on the back of each board or articles and, a set of plans so owner of exhibit may be identified if the entry tag is separated from the exhibit.
- B. Rockets must be supported substantially to protect the rocket from breakage. Rockets are to be mounted on a base that has dimensions equal or less than 12" x 12" and the base should be ¾" thick. No metal bases. If the rocket fins extend beyond the edges of the required base (12" x 12"), then construct a base that is large enough to protect the fins. The base size is dictated by the size of the rocket fins.
- C. The rockets must be mounted vertically. Please do not attach sideboards or backdrops to the displays. In addition, a used engine or length of dowel pin is to be glued and/or screwed into the board and extended up into the rockets engine mount to give added stability.
- D. Rockets must be equipped as prepared for launching, with wadding and parachute or other recovery system. Rockets entered with live engines, wrong base size or sideboards will be disqualified.
- E. A report, protected in a clear plastic cover, must include: 1) rocket specification (include original or photo of manufacture packaging stating rocket skill level), 2) a flight record for each launching (weather, distance, flight height), 3) number of launchings, 4) flight pictures 5) Safety (how did you choose your launch site? Document safe launch, preparations, and precautions) 6 objectives learned and 7) conclusions.
- F. The flight record should describe engine used, what the rocket did in flight and recovery success. Points will not be deducted for launching, flight or recovery failures described. This includes any damage that may show on the rocket. Complete factory assembled rockets will not be accepted at the State Fair.
- G. Judging is based upon display appearance, rocket appearance, workmanship, design or capabilities for flight, number of times launched and report. Three launches are required to earn the maximum launch points given on the score sheets. For scoring for the State Fair, only actual launches count, misfires will not count towards one of the required three launches.
 - For self-designed rockets only, please include digital recorded copy of one flight. In the documentation please include a description of stability testing before the rocket was flown.
 - Skill level of project is not determined by number of years in project. Skill level is determined by the level listed on the manufacturing packaging.
 - 4-H Rocket project levels are not intended to correspond to National Association of Rocketry model rocket difficulty ratings or levels.
- H. High power rockets (HPR) is similar to model rocketry with differences that include the propulsion power and weight increase of the model. They use motors in ranges over "G" power and/or weigh more than laws and regulations allow for unrestricted model rockets. These rockets are NOT appropriate for 4-H projects and will be disqualified.
- I. Posters can be any size up to 28" x 22" when ready for display. Example: tri-fold poster boards are not 28" x 22" when fully open for display.

AEROSPACE

All Model Rockets will be interview judged on Wednesday. 4-H members will sign up on Tuesday during project entry for an interview time.

Please arrive early to keep the process moving. Only 4-H exhibitors will be allowed at the judging table. If the 4-H member does not show up for the interview the ribbon will be lowered one placing.

Unit 2, 3, and 4

Youth enrolled in Aerospace 2, 3, or 4 may exhibit in any class within this division.

- H-850-001 Rocket - Any skill level ~~2~~ rocket with wooden fins and cardboard body tubes painted by hand or air brush.
- H-850-002 Aerospace Display - exemplifying one of the principles learned in the Life Off project. Examples include display of rocket parts and purpose, interview of someone in the aerospace field, or kit terminology. Include notebook containing terminology (definition), and what was learned. Display can be any size up to 28" x 22".
- H-850-003 Rocket - Any skill level ~~2~~ rocket with wooden fins and cardboard body tubes painted using commercial application (example commercial spray paint) (interview judged).
- H-850-004 Rocket – Any self-designed rocket with wooden fins and cardboard body tubes.

Unit 5 – Drones

- H-850-005 Drone Poster – Exhibit must be designed to educate yourself and others on one or more of the following topics: drone technologies, uses of drones, the different types of drones, types of training needed to operate drones, and the laws and regulations users must follow. Posters can be any size up to 28" x 22".
- H-850-006 Drone Video – Exhibit must demonstrate how the drone interacts with the outside world. Examples include field scouting, surveying damage from natural disasters, drones used in commercial applications and settings, and drones used for structural engineering. Video should not exceed 5 minutes. Videos should be submitted to mnordboe2@unl.edu by Tuesday, August 9th at 6:30 p.m. Videos should also be uploaded to a video streaming application and exhibitors must provide a hard copy QR code for viewing.

ELECTRICITY

General Information – Electric Posters

4-H electricity related posters are to be entered in the engineering area for exhibiting and judging. Refer to Posters Department for general requirements.

***Indicates County Fair exhibit ONLY. Exhibitors should try, where possible, to fit their exhibit into an area with a State Fair entry.**

Unit 1 – For classes 901-904 please refer to 4-H manual Electric Unit 1

- *H-870-901 Bright Lights: Create your own flashlight using items found around your house. Flashlights should be made out of items that could be recycled or reused. No kits please.
- *H-870-902 Control the Flow: Make a switch. Use the following items: D cell battery, battery holder, insulated wire, 2- or 2.5-volt light bulb, bulb holder, paper clip, cardboard and two brass paper fasteners to create a circuit that you can open and close.

- *H-870-903 Conducting Things: Make a circuit with a switch and a light bulb that can be used to test different household items for their ability to act as an insulator or conductor. You must find five items that are conductors and five items that are insulators. Create a table that illustrates your results.
- *H-870-904 Is There a Fork in the Road: Use the following items to construct one parallel and one series circuit. Items: D cell battery, battery holder, insulated wire, bulb holder, and a 2- or 2.5-volt light bulb.

Unit 2 – For classes 911-913 please refer to 4-H manual Electric Unit 2

- *H-870-911 Case of the Switching Circuit: Use the following items: two D cell batteries, two battery holders, light bulb, bulb holder, a 2 inch by 6-inch piece of cardboard, six brass paper fasteners and approximately two feet of 24 gauge insulated wire to build a three-way switch. Write a short essay or create a poster that illustrates how three-way switches function.
- *H-870-912 Rocket Launcher – Construct a rocket launcher out of the following materials: a plastic pencil box that is at least 4 inches by 8 inches, single pole switch, single throw switch, normally-open push button switch, 40 feet of 18-22 gauge stranded wire, 4 alligator clips, 2-by-6 board 6 inches long, 1/8 inch diameter metal rod, rosin core solder, soldering iron or gun, wire stripper, small crescent wrench, pliers, small Phillips and straight blade screwdrivers, drill, 1/8 inch and ¼ inch drill bits, rocket engine igniters, additional drill bits matched to holes for two switches. You must successfully build a rocket launcher and light two rocket igniters with your launcher. You DO NOT have to actually fire a rocket off of the launcher. Create a poster using photographs to show the “step-by-step process” you used to build your launcher.
- *H-870-913 Stop the Crime: Build an ALARM using the following materials: On-Off push button switch, mercury switch, buzzer-vibrating or piezoelectric, 9-volt battery, 9-volt battery holder, 4 inch by 4 inch by 1/8-inch Plexiglas board to mount circuit on; rosin core solder, soldering gun/iron, two feet of 22-gauge wire, wire strippers, hot glue sticks, hot glue gun, and a plastic box with lid to mount your alarm circuit on. Create a poster using photographs to show the “step-by-step process” you used to build your alarm.
- *H-870-914 Unit II Electrical Tool Kit – Prepare the electrical maintenance kit for general maintenance of electric circuits and appliances.
 - a) Prepare kit. Kit should include but not be limited to the following items ... toolbox, voltmeter, side cutter, needle nose pliers, knife, wire stripper, straight screwdriver, Phillips screwdriver, fuses, black electrical tape, assortment of wire nuts. The toolbox should be sized to accommodate all the tools in an orderly fashion. Items do NOT have to be newly purchased.
 - b) Prepare kit using contents determined by the exhibitor. A written description of the kit’s purpose and an inventory list of contents is required.
- *H-870-915 Unit II – Electric Energy – this class is open to 4-H’ers creativity. A basic report (can include pictures) on a field trip or an exhibit of some other activity related directly to a chapter in Unit II.
- *H-870-916 Unit II – Hazard Identification - ** A collection of four pictures of electrical hazards. Pictures shall be placed two on a page with a brief description of the hazard. Project shall also have a cover page including name, age, and project identification. Pages will be placed in a protective cover.

Unit 3 (Wired for Power)

- H-870-001 Electrical Tool/Supply Kit – Create an electrical supply kit to be used for basic electrical repair around the house. Include a brief description of each item and its use. Container should be appropriate to hold items.
- H-870-002 Lighting Comparison – Display studying the efficiency of various lighting (incandescent, fluorescent, halogen, Light Emitting Diodes, etc.). Exhibit could be a poster display or an actual item.
- H-870-003 Electrical Display/Item – Show an application of one of the concepts learned in the Wired for Power project. Examples include re-wiring or build a lamp, re-wiring or making a heavy-duty extension cord, or developing an electrical diagram of a house. Exhibit could be a poster display or an actual item.
- H-870-004 Poster should exemplify one of the lessons in the Wired for Power project. Posters can be any size up to 28"x22".
- *H-870-922 Unit III – Electrical Wiring – Project will be a picture story showing participation by the 4-H member in wiring a building, home, room, or other structure. Exhibitor will be interviewed.

Unit 4 – Electronics

- H-870-005 Electrical/Electronic Part Identification – Display different parts used for electrical/electronic work. Exhibit should show the part (either picture or actual item) and give a brief description, including symbol of each part of its function. Display should include a minimum of 10 different parts.
- H-870-006 Electronic Display – Show an application of one of the concepts learned in the Electronics project. Examples include components of an electronic device (refer to p.35 of the electronic manual).
- H-870-007 Electronic Project – Exhibit an electronic item designed by the 4-H'er or from a manufactured kit that shows the electronic expertise of the 4-H'er. Examples include: a radio, a computer, or a voltmeter.
- H-870-008 Poster should exemplify one of the lessons learned in the Entering Electronics project. Posters can be any size up to 28"x22".
- *H-870-931 Unit IV – Wiring diagram for house, building, room, or fuse panel
- *H-870-932 Unit IV – Electrical Safety - ** Project will consist of 10 pictures of different electrical Hazards and pictures of those same hazards after they have been repaired. Exhibitor will be interviewed on the hazards and the repair process. One of the repaired hazards will be brought to the interview.

- *H-870-933 Electrical Equipment – Entire electrically powered equipment that is to be used for useful productive work. Include plans, bill of materials, cost and operating instructions under a plastic cover.
- *H-870-941 Any Unit – Other article, not eligible for State Fair.
- *H-870-942 Completed Project Activity Guide – exhibit the activity guide from the 4-H Electric Level series.

** Some hazards are not age or skill level appropriate. Therefore 4-H members should NOT attempt to repair these hazards.

WOODWORKING

The ability to build objects as designed by another person is an important life skill. Professional woodworkers often are hired to build objects to exacting specifications as laid out in a written plan.

Requirements:

All articles exhibited must include a plan (with drawing or sketch or blueprint) stating dimensions and other critical instructions a builder would need to know how to build the project. Plans may include narrative instructions in addition to the dimension drawings and include any alterations to the original plan. Part of the score depends on how well the project matches the plans. If the plans are modified, the changes from the original need to be noted on the plans. All plans used for making the article must be securely attached and protected by a clear plastic cover.

4-H'ers must be in Unit 3 or 4 for the exhibit to be considered for State Fair. All projects must have appropriate finish. *At State Fair if the project (i.e., picnic tables, wishing wells, swings, chairs, bridges, doghouses, etc.) is designed to be used outside, it will be displayed outside.*

All plans used for making the article must be attached to the article and protected by a clear plastic cover and include exhibitors name, club, and county. Each individual is limited to 2 exhibits per level and one per class number.

*Indicates County Fair exhibit only. Exhibitors should try, where possible, to fit their exhibit in to an area with a State Fair entry.

H-911-901 (A-D) ... Article as shown in Unit 2 or comparable items using power hand tools, electric jigsaw, power drill, and/or oscillating sander (Score sheet SF 91)

- *H-911-901A Tool Box (in manual)
- *H-911-901B Bird House (in manual)
- *H-911-901C Step Stool (in manual)
- *H-911-901D Project from comparable plans from other sources

Unit 3 (Nailing It Together)

H-911-001 Woodworking Article (SF91) – Item should be made using either joints, hinges, dowels, or a dado joining, made using skills learned in the Nailing It Together manual. Item is required to be appropriately finished. Examples include ... bookcase, coffee table, or end table. (May enter 2 items in this class.)

H-911-003 Recycled Woodworking Display (SF 91) – Article made from recycled, reclaimed, or composite wood. Article must be appropriately finished and/or sealed and utilize one or more woodworking techniques from page 2 of the Unit 3 manual. Exhibit must include the woodworking plan and a minimum one-page report of how the engineering design process was used to develop the woodworking plan.

Engineering Design Process ...

- 1) State the problem (Why did you need this item?)
- 2) Generate possible solutions (How have others solved the problem? What other alternatives or designs were considered?)
- 3) Select a solution (How does your solution compare on the basis of cost, availability, and functionality?)
- 4) Build the item (What was your woodworking plan, and what processes did you use to build your item?)
- 5) Reason for article finish (What type of finish, how did you finish or why you choose this finish?)
- 6) Evaluate (How does your item solve the original need?)
- 7) Present results (How would you do this better next time?)

H-911-004 Composite Wood Project (SF96) – 60% of the project must be wood and 40% made from other materials such as metal, rubber, resin, etc. All plans and plan alterations must be attached to the article. Protect with a cover. If project is designed to be outside, it is required to have appropriate outdoor finish because project may be displayed outside.

H-911-005 Outdoor Wood Projects made with Treated Wood (SF97) – Treated wood projects DO NOT have to have a finished coating. All plans and plan alterations must be attached to the article. Protect plans with a cover if project is designed to be outside. Examples include picnic tables, planters, outdoor furniture, etc.

Unit 4 (Finishing Up)

H-911-006 Woodworking Article (SF91) – item made using skills learned in the Finishing It Up project. Examples include ... dovetailing, making a pen using lathe, overlays, using a router, etc. Item is required to be appropriately finished.

H-911-008 Recycled Woodworking Display (SF 91) – Article made from recycled, reclaimed, or composite wood. Article must be appropriately finished and/or sealed and utilize one or more woodworking techniques from page 2 of the Unit 4 manual. Exhibit must include the woodworking plan and a minimum one-page report of how the design and engineering process was used to develop the woodworking plan.

- 1) State the problem (Why did you need this item?)
- 2) Generate possible solutions (How have others solved the problem? What other alternatives or designs were considered?)
- 3) Select a solution (How does your solution compare on the basis of cost, availability, and functionality?)
- 4) Reason for article finish (What type of finish, how did you finish or why you choose this finish?)
- 5) Build the item (What was your woodworking plan, and what processes did you use to build your item?)

- 6) Evaluate (How does your item solve the original need?)
- 7) Present results (How would you do this better next time?)

WELDING

(All metal welding processes accepted.)

All welds exhibited in Class H-920-1 or H-920-2 must be mounted on a 12" high x 15" long display board of thickness not to exceed 3/8". Attach each weld on a wire loop hinge or equivalent, so the judge can look at the bottom side of the weld when necessary. Each weld should be labeled with information stated 1) type of welding process (stick, MIG, TIG, Oxy-Acetylene, etc.) 2) kind of weld, 3) welder setting, 4) electrode/wire/rod size, and 5) electrode/wire/rod ID number. Attach a wire to display board so it can be hung like a picture frame. If no plans are included with welding article or welding furniture, item will be disqualified.

ARCS & SPARKS

- H-920-001 Welding Joints (SF281) – A display of one square groove, one lap, and one t-joint weld.
- H-920-002 Position Welds (SF281) – A display showing three beads, welded in the vertical down, horizontal and overhead positions.
- H-920 – 003 Welding Art - (SF283) – any art created using tack welds to hold the metal pieces together (examples include horseshoe projects). Type of welder, welder settings, all plans, plan alternations, and a bill for material must be attached to the article. Protect plans with a cover. If project is designed to be outside, it is required to have appropriate outdoor finish.
- H-920-004 Welding Article (SF281) – Any shop article where welding is used in the construction. 60% of item must be completed by 4-Her and notes regarding laser welding or machine welding must be included. Type of welder, welder settings, all plans, plan alterations, and a bill for material must be attached to the article. Protect plans with a cover. If project is designed to be outside it is required to have appropriate outdoor finish because project may be displayed outside.
- H-920-005 Welding Furniture (SF282) – Any furniture with 75% welding is used in the construction. 60% of item must be completed by 4-Her and notes regarding laser welding or machine welding must be included. Type of welder, welder settings, all plans, plan alterations, and a bill for material must be attached to the article. Protect plans with a cover. If project is designed to be outside it is required to have appropriate outdoor finish because project may be displayed outside.
- *H-920-006 Plasma Cutter/Welder Design – Plasma cutters/welders allowed for detailed design(s) to butt cut into metal. 4-H'ers will create a notebook describing the design process to create the "artwork" to butt cut into the metal. ~~This exhibit is not eligible for entry at the State Fair.~~

In the notebook include:

- a) A photo (front and back) of the finished project.
- b) Instructions on how the design was created (include software used), this allows for replication of the project
- c) Lessons learned or improvements to the project
- d) Steps to finish the project

- H-920-007 Composite Weld Project – (SF 280) – 60% of the project must be welded and 40% made from other materials such as wood, rubber, etc. Type of welder, welder settings, all plans, plan

alterations, and a bill for material must be attached to the article. Protect plans with a cover. If project is designed to be outside, it is required to have appropriate outdoor finish because project may be displayed outside.

4-H Welding Project Tips and Suggestions:

Class 1

1. All welds should be made with the same electrode/wire/rod size and number.
2. Welds should be made only on one side of metal so penetration can be judged.
3. Welds should be cleaned with chipping hammer and wire brush. Apply a coat of light oil (penetrating oil) to the metal to prevent rusting. Wipe off excess oil.
4. It is suggested that all welds be on the same size and thickness of metal. These pieces, referred to as coupons, should be 1.5 to 2 inches wide and 3.5 to 4 inches long. A good way to get this size is to buy new cold rolled strap iron and cut to length. The extra width is needed to provide enough metal to absorb the heat from the welding process and prevent the coupons from becoming too hot before the bead is completed. Narrower coupons will become very hot, making an average welder setting too cold at the bead start. Just about right in the middle, and too hot at the end. The correct way to weld narrow strips is to make short beads and allow time to cool, however this project requires a full-length bead.

Stick Welding

Suggested coupon thickness – ¼” if using 1/8” rod

Suggested rod – AC and DC straight or reverse polarity – first E-7014, second E-6013

MIG Welding

Suggested coupon thickness – ¼” if using .035 wire and 1/8” if using .23 wire

Oxy-Acetylene

Suggested coupon thickness – 1/8”

Suggested rod – 1/8” mild steel rod

Class 2

1. It is suggested that all welds be on same size and thickness metal. These pieces are referred to as coupons. The welds can be on one coupon that is about 4”x4” or on individual coupons that are about 2”x4” and ¼” thick. Suggested rods for this class of position welds for AC and DC straight or reverse polarity is, First E-6013, second E-7014, and E-6010 for DC reverse polarity only.
2. Welds should be cleaned with chipping hammer and wire brush. Apply a coat of light oil (penetrating oil) to the metal to prevent rusting. Wipe off excess oil.

Class 3 & 4

1. All welds should be cleaned and protected from rust with paint or light oil. Plans are to be complete enough that if they were given to a welding shop, the item could be made without further instructions. Bill of materials should include a cost for all items used including steel, electrodes, paint, wheels, etc.

4-H PETROLEUM POWER

Small Engines

Unit 1 (County Fair Only)

- *H-890-900 Small Engine Display/Item – Show an application of one of the concepts learned in the Crank It Up project. Examples include ... parts of engine, sources of power, lubrication, air filters, cooling systems, or safety. Exhibit could be a poster display or an actual item.

Unit 2 (County Fair Only)

- *H-890-1 Small Engine Display/Item – Show an application of one of the concepts learned in the Warm It Up project. Examples include ... comparison of engine oil types, transmissions, or safety related to engines. Exhibit could be a poster display or an actual item.

Unit 3 (County Fair Only)

- *H-890-2 Engine Display/Item – Display/Item should exemplify one of the lessons learned in the Tune It Up project. Examples include ... diagnostic tools, fuel systems, ignition systems. If a complete engine is exhibited it will not be started. However, display needs to report process of building/rebuilding engine and how/where engine will be utilized (i.e., lawn mower, weed eater, snow blower, etc.). Gas tanks are to be empty.

Tractor (County Fair Only)

- *H-890-910 Individual tractor service record as described in Unit III of the tractor project manual. 4-H'ers will need to design own service record form or adapt the service record shown in Unit IV of Tractor project.
- *H-890-911 Tractor Demonstration Display – To be exhibited by an individual only. Exhibit should show some part or system of a tractor. Include a brief description of how the part or system functions. Prepare the display on a 24" high x 32" wide board – not to exceed ¼" in thickness. (Score Sheet F 7-56-79)

Bicycle (County Fair Only)

- *H-910-901 Bicycle demonstration display to be exhibited by an individual. Exhibit may include: 1) parts or system of a bicycle, 2) worn or broken parts, or 3) a step-by-step procedure of how some repair or service job is performed. A limited number of photographs are acceptable. Actual parts or cut-aways of parts are recommended. The exhibit is to be prepared on a 24" high x 32" wide board not to exceed ¼" in thickness. (Score Sheet F 7-56-79)
- *H-910-902 Bicycle Safety Scrapbook
- *H-910-903 Bike Restoration – Exhibitors of bicycles need to restore/overhaul/upgrade a bicycle to include current safety features. A report must be included, covered by clear plastic, describing costs, repair costs, and what was done. "Before" and "After" photos should be included.
- *H-910-904 Bicycle Rodeo – Events include Safety Quiz, Safety Inspection, Balance, and Figure Eight. There will be two divisions ... Junior Division (8-11 4-H age) and Senior Division (12 and up 4-H age). Each participant must bring his/her current bicycle for safety inspection. This event must be entered on Tuesday of the Fair by 6:30 p.m. It is open only to 4-H members enrolled in the Bicycle Safety project. This event will be held on

Wednesday following the Model Rocket Performance Competition. **Helmets will be required to participate in the Bicycle Rodeo.**

4-Wheelin' (County Fair Only)

- *H-895-900 Poster – Poster should exemplify one of the lessons learned in the 4-Wheelin' project. Posters can be any size up to 28"x22".
- *H-895-901 4-Wheelin' Project Manual – A completed project manual will be judged on completeness, readability, and neatness.

All-Terrain Vehicle (ATV) (County Fair Only)

- *H-945-901 ATV Project Poster (14"x22")

Robotics

Youth enrolled in Virtual Robotics, Junk Drawer Robotics (Levels 1, 2, or 3), Robotics Platforms may exhibit in any class within this division.

- H-861-001 Robotics Poster (SF 236) – Create a poster (28" x 22") communicating a robotics theme such as "Robot or Not," "Pseudocode," "Real World Robots," "Careers in Robots" or "Autonomous Robotics," "Precision Agriculture" or a robotic topic of interest to the 4-H'ers.
- H-861-002 Robotics Notebook (SF 237) – Explore a robotics topic in-depth and present your findings in a notebook. Documentation should include any designs, research, notes, pseudocode, data tables, or other evidence of the 4-H'ers learning experience. The notebook should contain at least three pages. Topics could include: a programming challenge, a programming skill, calibration, sensor exploration, or any of the topics suggested in Class 1.
- H-861-003 Robotics Video (SF 238) – This class should be displayed in a notebook. The notebook should include a video clip on a CD/DVD that demonstrates the robot performing the programmed function. Include your pseudocode and screenshots of the actual code with a written description of the icon/command functions.
- H-861-004 Robotics/Careers Interview (SF 239) – Interview someone who is working in the field of robotics and research the career in robotics. Interviews can either be written or in a multimedia format (CD/DVD). Written interviews should be in a notebook. Written reports should be 3 to 5 pages, double spaced, 12 point font, and 1" margins. Multimedia reports should be between 3 to 5 minutes in length.
- H-861-005 Robotics Sensor Notebook (SF 241) – Write pseudocode which includes at least one robotics sensor activity. Include the code written and explain the code function.
- H-861-007 Kit Labeled Robot (cannot be programmed) and Notebook (SF 243) – This class is intended for explorations of robotic components such as arms or vehicles OR educational kits marketed as robots that do not have the ability to be programmed to "sense, plan, and act." The exhibit

should include a notebook with the robot the youth has constructed. Included in the notebook should be (1) a description of what the robot does, (2) pictures of programs the robot can perform, (3) why they chose to build this particular form, and (4), how they problem solved any issues they might have had during building and programming. A picture story of assembly is recommended. If robot is more than 15" wide and 20" tall, they may not be displayed in locked cases.

H-861-008 3-D Printed Robotic Parts (SF244) – This class is intended for youth to create parts through 3-D printing, to help create their robot or aid the robot in completing a coded function. Projects should include a notebook describing the process used to create the project, describe the success of your designed piece (did it work), intended use of the product and the modifications made to the item.

Junk Drawer Robotics (County Fair Only)

All exhibits should be original designs made with objects and materials from your trunk of junk. Kits purchased commercially will not be accepted.

*H-861-901 Junkdrawer Robotics Level 1 – Youth will exhibit one of the following from the Level 1 manual

- A self-designed balance beam you have created
- A self-designed mechanical arm that has at least two of the three axes of movement
- A self-designed gripper for your mechanical arm

*H-861-902 Junkdrawer Robotics Level 2 – Youth will exhibit one of the following from the Level 2 manual

- A can-can robot that will make drawings on paper
- A rover (Es-Car-Go) with a gear train that is able to climb a ramp
- A design for an underwater ROV that can be powered to go up and down in a tank of water

*H-861-903 Junkdrawer Robotics Level 3 – Youth will exhibit one of the following from the Level 3 manual

- A self-designed and built or modified machine that will travel forward and backward using electrical power
- A self-designed mechanism that will sense a barrier (both front and back) and change motor or wheel direction
- Build and compare at least two types of circuits
- A self-designed original robot that can perform a specific task.

GEOSPATIAL

Youth enrolled in Geospacial may exhibit in any class within this division.

H-880-001 Poster – Create a poster (not to exceed 14"x22") communicating a GPS theme such as How GPS or GIS works, Career that use GPS or GIS, how to use GPS, What is GIS, GPS, or GIS in Agriculture, Precision Agriculture, or a geospatial topic of interest.

H-880-002 4-H Favorite Places or Historical Site Poster (SF 272) – The 4-H exhibitor identifies a favorite place or historical site (including grave sites) in Nebraska. Exhibit should include latitude and longitude, digital pictures, and local area map. Poster size should not exceed 14"x22".

- H-880-003 GPS Notebook – Keep a log of at least 5 places visited using GPS enabled device. At least one site should be a community other than where you live. For each site, record the latitude, longitude and elevation. Also include a description of the site, a paragraph explaining what was interesting about the site or finding it. Photos of each site and/or cache are optional but encouraged.
- H-880-004 Geocache – Assemble a themed geocache. Each geocache should be a watertight container. It should include a logbook and pencil for finders to log their visits and may include small trinkets, geo-coins, etc. for the finders to trade. Documentation should include a title, teaser description and the geographic coordinates of the intended placement. **Register the site at geocaching.com, include a print-out of its registry.** The entry may include a photograph of the cache in its intended hiding place.
- H-880-005 Agriculture Precision Mapping – 4-Hers will assemble a notebook that will include a minimum of 2 digital copies of various data layers that can be used in precision agriculture to identify spatial patterns and/or correlations (printed copies of websites where applications can be purchased is acceptable). A report of how the analysis of the various data will be used to make a management decision.
- H-880-007 4-H History Map – preserve 4-H History: Nominate a Point of Interest for the 4-H History Map Project include copy of submitted form in folder or notebook. To nominate a site for the 4-H history map please go to <http://arcg.is/1bvGogV>. For more information about 4-H history go to http://4hhistorypreservation.com/History_Map. For a step-by-step video on nominating a point please go to this link: <http://tinyurl.com/nominate4h>. Write a brief description of historical significance of 4-H place or person (a minimum of one paragraph).
- H-880-008 GIS Thematic map – Using any GIS software, create a thematic. Thematic maps can utilize any subject of interest to the 4-H'er. Example map would be Amelia Earhart's or Sir Francis Drake's voyage, population density maps, water usage "x11" maps or 4-H project in Nebraska. Create GIS Map using data from books, and or internet. Use reliable data, (U.S. Census or U.S. Census Bureau, etc.) Map any size from 8.5" x 11" up to 36" x 24," should include Title, Base Map, Neat Line, North Arrow, and Legend. Identify the source of your information on the back of the map.

ENERGY

- H-900-001 Create and Compare Energy Resources Poster – Poster should explore 2 alternative/renewable energy resources. Compare and contrast the 2 resources including two of the following information: amount of energy created, costs of production, usability of the energy, pros/cons of environmental impacts, etc. Posters can be any size up to 28" x 22."
- H-900-002 Experiment Notebook – Notebook will explore the scientific method involving alternative/renewable energy sources. Information required: 2) Hypothesis, 2) Research, 3) Experiment, 4) Measure, 5) Report or Redefine Hypothesis.
- H-900-003 Solar as Energy Display - Item should be the original design of the 4-Her. Include the item, or picture if item is in excess of 6' tall or 2' x 2'. Include a notebook of why the item was designed and how it harnesses the power of the sun. Examples include solar ovens, solar panels, etc.

- H-900-004 Water as Energy Display – Item should be the original design of the 4-H'er. Include the item, or a picture if item is in excess of 6' tall or 2' x 2'. Include a notebook of why the item was designed and how it harnesses the power of water.
- H-900-005 Wind as Energy Display – Item should be the original design of the 4-H'er. Include the item, or a picture if item is in excess of 6' tall or 2'x2'. Include a notebook of why the item was designed and how it harnesses the power of wind.
- H-900-006 Other Nebraska Alternative Energy – Notebook should explore a Nebraska alternative energy source besides wind, water, and solar power. Include information on type of power chosen, infrastructure for distribution, what resources are needed to create this alternative resource, cost of production, and potential uses of bio-products.