

Kalamazoo County Fair 4-H Aerospace/model Rocketry Guidelines

Each member will be required to build one new rocket for the project year.
The recommended skill level for age groups are as follows:

Skill Level A

Beginning Skill Level B

Novice

Skill Level C

Intermediate Skill Level D

Advanced

Skill Level E

Scale Rockets

Skill Level F

Expert Rocketry

Exhibit Requirements to be as follows:

Each member to exhibit one rocket per required skill level complete and ready to launch.*
Weather permitting, each member will be required to launch his/her rocket as part of the exhibit using smallest recommended engine. If actual launching cannot be accomplished due to weather, a mock launching will be required.

* Without engine

Judging of exhibit will be as follows:

Quality of Rocket Construction 30%

Completeness and Neatness of Workbook 25%

Knowledge of Project and Launching 45%

Department O

Section B - Model Rocketry

Superintendent -

1. All articles must be made by member.
2. Articles made from kits cannot be entered in a given year.
3. Only one rocket building class may be entered in a given year.

Class

Beginning 1 rocket

Novice 1 rocket

Intermediate 1 rocket

Advanced 1 rocket

Scaling 1 rocket - Scale model

Expert 1 rocket - New design

Poster and/or a three dimensional exhibit

Rocketry Notebook

JUDGES SHEET

Members Name _____ Date _____

Age _____ Years in Project _____

Rocket Construction:

Glue Joints (4 to 6 points) _____

Alignment of Parts (4 to 6 points) _____

Sanding and Preparation for
finishing (4 to 6 points) _____

Quality of Painting (4 to 6 points) _____
(Award full six (6) points if
painting is not required) _____

Decal placement and alignment
(4 to 6 points) _____

Worksheets:

Worksheets complete (10 to 15 points) _____

Neatness of Worksheets (5 to 10 points) _____

Knowledge of Project and Launching:

This portion is to be an oral review between the judge and member only, and is to cover the construction of the members rocket, the rocketry project in general, the test launching of the members rocket, and the safety practices.

(25 to 45 points) _____

4-H MODEL ROCKETRY SAFETY CODE

1. CONSTRUCTION - My model rockets will be made of lightweight materials such as paper, wood, plastic and rubber, without any metal as structural parts.
2. ENGINES - I will use only pre-loaded factory made model rocket engines in the manner recommended by the manufacturer. I will not change in any way nor attempt to reload these engines.
3. RECOVERY - I will always use a recovery system in my model rockets that will return them safely to the ground so that they may be flown again.
4. WEIGHT LIMITS - My model rocket will weigh no more than 453 grams (16 oz.) of propellant.
5. STABILITY - I will check the stability of my model rockets before their first flight, except when launching models of already proven stability.
6. LAUNCHING SYSTEM - The system I use to launch my model rockets must be remotely controlled and electrically operated, and will contain a switch that will return to "off" when released. I will remain at least 15 feet away from any rocket that is being launched.
7. LUNCH SAFETY - I will not let anyone approach a model rocket on a launcher until I have made sure that either the safety interlock key has been removed or the battery has been disconnected from my launcher.
8. FLYING CONDITIONS - I will not launch my model rocket in high winds, near buildings, power lines, tall trees, low flying aircraft or under any conditions which might be dangerous to people or property.
9. LAUNCH AREA - My model rockets will always be launched from a cleared area, free of any easy to burn materials, and I will only use non-flammable recovery wadding in my rockets.
10. JET DEFLECTOR - My launcher will have a jet deflector device to prevent the engine exhaust from hitting the ground directly.
11. LAUNCH ROD - To prevent accidental eye injury I will always place the launcher so the end of the rod is above eye level or cap the end of the rod with my hand when approaching it. I will never place my head or body over the launching rod. When my launcher is not in use I will always store it so that the launch rod is not in an upright position.
12. POWER LINES - I will never attempt to recover my rockets from a power line or other dangerous place.
13. LAUNCH TARGETS 7 ANGLES - I will not launch rockets so their flight path will carry them against targets on the ground, and will never use an explosive warhead nor a payload that

is intended to be flammable. My launching device will always be pointed within 30 degrees of vertical.

14.PRE-LAUNCH TEST - When conducting research activities with unproven designs or methods, I will, when possible, determine their reliability through prelaunch tests. I will conduct launchings of unproven designs in complete isolation from persons not participating in the actual launching.

As a member of the Model Rocketry Program, I promise to faithfully follow all rules of safe conduct as established in the above code.

Participant Signature: _____ Date _____

Parent Signature: _____ Date _____

FAIR EXHIBIT

ROCKETRY

All rockets are to meet the guidelines outlined in "Model Rocketry", a 4-H project for members and leaders.

Class _____: Beginning rocketry, Building a skill level 1 single-stage rocket.

Class _____: Novice rocketry, building a skill level 2 or 3 single stage rocket.

Class _____: Intermediate rocketry, building a skill level 2 or 3 multi-stage rocket.

Class _____: Advanced rocketry, building a skill level 4 rocket.

Class _____: Scaled rocket, build a flyable scale model of an actual rocket.

Class _____: Expert rocketry, designing, building and testing your own rocket.

Class _____: Poster 22 x 28 and/or a three dimensional exhibit 22 x 28 x 18" deep.

Class _____: Rocketry Notebook.

BEGINNING ROCKETRY

Objectives: To learn the basics of rockets and how to build and launch your own model rocket.

Things to Learn:

What are rockets and how do they fly?

What are the uses of rockets?

What are the basic parts of a model rocket and their purpose?

How to prepare a model rocket for flight?

How to safely launch and recover your rocket.

Things to do:

Lead a discussion on the uses of rockets.

Explain to your rocketry group what Newton's Third Law of Motion is and how it pertains to Rockets.

Exhibit Guidelines:

Display will be a skill level 1, single-stage model rocket constructed per the kits directions.

Model may NOT be "tumble" recovery.

Model must be painted. Adding decals is optional.

Model must be on a stand that will not allow the rocket to tip over or fall if bumped.

Submit the model with a completed model rocketry record sheet.

SAFETY: Remember, this project is for the building and flying of model rockets and at all times members will follow the Rocket Safety Code of the National Association of Rocketry. These rules are listed in the front of the manual and apply to all divisions.

NOTE: This project may be repeated for two years only, however, a different rocket must be exhibited each year.

NOVICE ROCKETRY

Objectives: To enhance the skills learned in "Beginning Rocketry" and increase your knowledge of flight principles.

Things to Learn:

How do model rocket engines operate? What is an airfoil?

What is aerodynamics? What is fuselage?

What is an airframe? What is propellant?

What is a nichrome wire?

Things to do:

Give a short talk to your rocketry group on one of the above topics.

Assist an experienced rocketeer in setting up a launch area.

Launch one of your own rockets and complete a flight data sheet.

Exhibit guidelines:

Display will be a skill level 2 or 3, single-stage model rocket constructed per the kits directions.

Model may NOT be "tumble" recovery.

Model must be painted. Decals should be applied if included with the kit.

Model must be on a stand that will not allow the rocket to tip over or fall if bumped.

Submit the model with a completed model rocketry record sheet.

Submit a flight data sheet for the launch you made.

SAFETY: Remember, this project is for the building and flying of model rockets and at all times members will follow the Rocket Safety Code of the National Association of Rocketry. These rules are listed in the front of the manual and apply to all divisions.

NOTE: This project may be repeated for two years only, however, a different rocket must be exhibited each year.

INTERMEDIATE ROCKETRY

Objectives: To learn the principals and benefits of rocket staging.

Things to learn:

What is a frustum? What are gees?

What is supersonic? Why are rockets multi-staged?

How can a single-stage rockets' velocity be increased?

Do those items apply to multi-stage rockets also?

Things to do:

Give a talk to your rocketry group on one or more of the above topics.

Keep records of your flights.

Assist junior members with the construction of their single-stage rockets.

Take part in a rocket launch competition.

Exhibit Guidelines:

Display will be a skill level 2 or 3 multi-stage model rocket constructed per the kits directions.

Model must be painted and decaled.

Model must be on a stand that will not allow the rocket to tip over or fall if bumped.

Submit the model with a completed model rocketry record sheet.

Submit a flight data sheet from the competition you participated in.

SAFETY: Remember, this project is for the building and flying of model rockets and at all times members will follow the Rocket Safety Code of the National Association of Rocketry. These rules are listed in the front of the manual and apply to all classes.

NOTE: This project may be repeated for two years only, however, a different rocket must be exhibited each year.

ADVANCED ROCKETRY

Objectives: To demonstrate all the items learned thus far by relating them to others and constructing a difficult model rocket.

Things to learn:

What are the three basic types of drag?

Explain each basic type of drag.

What is a wind tunnel?

What is laminated?

What does "peak out" mean?

What is inertia?

What is a parabola?

Things to do:

Lead a discussion on the flight path of a typical rocket.

Set-up a proper launch site.

Assist junior rocketeers with construction of their model rockets and learning their "things to learn".

Keep your completed flight data sheets.

Exhibit guidelines:

Display will be skill level 4 model rocket constructed per the kits directions.

Model must be painted and decaled.

Model must be on a stand that will not allow the rocket to tip over or fall if bumped.

Submit the model with a completed model rocketry record sheet.

Submit a flight data sheet for a rocket showing how performance was changed by using different sized engines (at least 3 different sized engines must be used).

SAFETY: Remember, this project is for the building and flying of model rockets and at all times members will follow the Rocket Safety Code of the National Association of Rocketry. These rules are listed in the front of the manual and apply to all divisions.

NOTE: This project may be repeated for two years only, however, a different rocket must be exhibited each year.

SCALED ROCKETRY

Objectives: To learn about actual rockets and how to scale.

Things to learn:

How to scale down.

What is center of gravity?

What is center of pressure?

How do you test a model rocket for stability?

How can a stability problem be cleared up?

Things to do:

Tour a space museum.

Give a talk on "How to scale".

Learn some of the facts about the actual rocket that corresponds to your model.

Exhibit guidelines:

1. Display will be a scale model of an actual rocket. It may be either from a kit or "scratch" built. Kalamazoo County 4-H's construction guide should be consulted for hints and tips on finishing.
2. Rocket shall be painted and marked to resemble the actual rocket.
3. Model must be on a stand that will not allow it to tip over or fall if bumped.
4. If "scratch" built, submit the model with your plans and parts list.
5. All models must include a completed model rocketry record sheet and a "scaling sheet" indicating the dimensions of the actual rocket, the scale you used, what your scaled dimensions should have been, what the scaled dimensions actually are and why they are different (i.e. nearest standard body tube size, adjusted for rocket stability etc.).
6. Submit a completed flight data sheet.

SAFETY: Remember, this project is for the building and flying of model rockets and at all times members will follow the Rocket Safety Code of the National Association of Rocketry. These rules are listed in the front of the manual and apply to all divisions.

NOTE: This project may be repeated, however, a different rocket must be exhibited each year.

EXPERT ROCKETRY

Objectives: To learn how to design, build and test a rocket of your own design.

Things to learn:

What is center of gravity?
What is center of pressure?
How do you test a model rocket for stability?
How can a stability problem be cleared up?

Things to do:

1. Give a demonstration on rocket stability testing.
2. Assist junior rocketeers with their rockets and "things to learn".
3. Model may NOT be tumble recovery.
4. Model must be on a stand that will not allow it to tip over or fall if bumped.
5. Submit the model with your plans, parts list and completed model rocketry record sheet.
6. Submit several completed flight data sheets.

SAFETY: Remember, this project is for the building and flying of Model Rockets and at all times members will follow the Rocket Safety Code of the National Association of rocketry. These rules are listed in the front of the manual and apply to all divisions.

NOTE: This project may be repeated, however, a different rocket must be exhibited each year.

POSTERS AND DISPLAYS

Objectives: To increase the awareness of model rocketry as well as to help learn about rockets (past, present and future) and their related professions.

Learning Activities: Read about one of the following topics:

Model rocketry safety
Launching and recovery systems for model rockets
Testing your own rockets
History of rockets
Professions that are involved with space flight
Views from space
Space suits
How food is prepared for and in space
Any other related topic

Exhibit guidelines:

Display or poster should not exceed 22" x 28" x 18" deep.

May be on any of the learning activities.

Display may utilize your rocket.

You may use drawings, clippings from magazines, photographs, or models you have assembled.

NOTE; This project may be repeated, however, you must have an exhibit on a different topic every year.

GENERAL NOTEBOOK GUIDELINES

Notebooks shall be of a standard 8 1/2" x 11" size.

Each year a hand written personal story shall be included.

Pamphlets and articles may be included but a summary shall be written on each one.

Drawings and photographs may be used.

All pages are to be numbered.

There shall be a table of contents listing what is included in each section and on what page it can be found.

This notebook is a progressive project! (2nd year notebook must include the 1st year notebook material; 3rd year notebook must contain the 2nd year and 1st year notebook material, etc.).

Exhibit guidelines are only the minimum requirements, you are encouraged to add your own ideas and feelings along with anything you think is important helpful, interesting, or educational.

FIRST YEAR NOTEBOOK

Objectives: To learn the basics of Model Rocketry and Model Rocketry Safety
Promote good penmanship and written communication skills.

Learning Activities: Read several of the different booklets that are available on Model Rocketry.

Learn some of the history of rockets and manned space flights.

Exhibit Guidelines: Must meet "General Notebook Guidelines".

State Newton's third law of motion and explain briefly what it means.

Write a short history of rockets and how they are used today and how they may be used in the future.

Name and label parts of a model rocket and state what each part is for.

Explain how to safely launch and recover a model rocket.

Place the above items in a notebook in a section titled "First Year".

SECOND YEAR NOTEBOOK

Objectives: To learn the principles of flight and how model rocket engines operate. To increase written communication skills.

Learning activities: Read the literature covering model rocket propulsion systems.

Read about manned flights and the principles that make flight possible.

Exhibit guidelines: Explain how to prepare a model rocket for flight.

Give a brief explanation on how the launch controller works and "fires" the engine of a model rocket.

Describe how the model rocket engine is constructed and what each portion is for.

Explain what aerodynamics, airfoil and airframe are and how they make flight possible as well as how they affect flight.

Include a completed flight data sheet.

Place the above items in your notebook in a section titled "second year".

Must meet "General Notebook Guidelines".

THIRD YEAR NOTEBOOK

Objectives: To learn why rockets are staged and begin to explore professional fields related to the aerospace industry.

Learning activities: Read about rocket staging.

Do research on what goes into building and launching a real rocket and what is done to prepare an astronaut for space flight.

Exhibit guidelines: Must meet "General Notebook Guidelines".

Explain how model rocket staging works.

Write about how real rockets are built and staged.

Write a list of professions that are involved with manned space flights and give a brief explanation of how they are involved. (Don't forget about the nutritionists whom set the astronauts diet; the garment manufacturers who make the space suits; the people who work in the tracking stations and the recovery teams).

Include several flight data sheets.

Place the above items in your notebook in a section titled "Third Year".

FOURTH YEAR NOTEBOOK

Objectives: To learn more about space age professions

To be able to explain drag.

Learning activities: Pick out six professions from your list in the third year notebook and read about them.

Read about drag and how wind tunnels are used to test aerodynamics.

Exhibit guidelines: Must meet "General Notebook Guidelines".

Write a one page report on each of four of the six professions you choose to research. The report should include what they do, how they prepare for their job, how they prepare for their job, how long it takes to learn the profession and any interesting information you came across.

Explain the three basic types of drag and how aerodynamics are tested.

Include flight data sheets.

Place the above items in your notebook in a section titled "Fourth Year".

FIFTH YEAR NOTEBOOK

Objectives: To learn more about a space age profession by doing in depth research.

To be able to design and test your own model rockets.

Learning Activities: Read about two professions listed in your third year notebook and not reported on in the "fourth" year notebook.

Read about cluster engine model rockets.

Read about how to test model rocket stability.

Exhibit guidelines: Must meet "General Notebook Guidelines".

Write a several page long report on one of the two professions you read about. Include everything you feel you should know to enter the field. (pay, how much schooling, what type of schooling, how long on the job to reach the "top", how many openings are expected, etc.).

Explain what cluster engines are and why they might be used.

Explain how to test a model rocket for stability and adjust the design if it is not stable. Can these principles be used on real rockets? Why or why not?

Place the above items in your notebook in a section titled "Fifth Year".

FLIGHT LOG

To help you keep a record of your rocket flights, we have provided a flight log. Each rocket you build will have its own flight sheet. Complete the flight log soon after the launch, while the data is fresh in your mind.

Weather information, such as wind velocity and direction, barometric pressure can be obtained from the weather bureau. Also, television weather reports will give the information you will need. Sometimes airports will supply the facts you need. The information received from these sources may not be exactly the conditions at the time of your launch, but it will be close. If you want more accurate data, you can purchase wind gauges and barometers from Edmund Scientific Co. Barrinton, New Jersey 08007.

SOURCES FOR MODEL ROCKET INFORMATION

The public library has information for model rocketeers, also local hobby shops are very willing to aid anyone interested in model rocketry.

Companies to write to:

Estes Industries, Inc.

Penrose, Colorado 81240

KALAMAZOO COUNTY
4-H MODEL ROCKETRY
RECORD SHEET

INTERMEDIATE, ADVANCED, AND EXPERT

Members Name _____

Age _____ Year in Project _____

Skill level of Rocket _____ Rocket Name _____

Cost of Rocket _____ Hours require to build rocket _____

Number of Fins _____ Number of Stages _____

Type of Recovery _____

Weight Empty _____

Engine numbers that can be used with this rocket _____

Recommended engine to be used for first flight _____

Test flight date _____ Engine used for test flight _____

In your own words describe the performance of your rocket on its test flight: _____

What modifications were made to your rocket after the first test flight:

TOTAL _____

4. What have you learned this year in constructing your rocket exhibit (list three)?

a) _____

b) _____

c) _____

5. Briefly explain how you might improve your next model rocket.

GUIDELINE EVALUATION

Are these guidelines easy to understand? _____

Do they cover most areas of interest? _____

Are they too difficult or too easy? _____

Is there anything you would like to see added, deleted or changed? If yes,
what? _____

Please complete and return to your community club leader or mail to:

Kalamazoo County Cooperative Extension Service
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