

Kalamazoo County 4-H

Aerospace Sciences Project Guidelines

Project Leader or Superintendents: N/A

Project Social Media: N/A

Project Objectives & Life Skills*

- To demonstrate knowledge of engineering and construction through rocketry.
- Developing principles of flight, model rocket construction, model rocket safety

- **Head**
 - Resilience
 - Keeping records
 - Planning/organizing
 - Problem solving
- **Heart**
 - Communication
 - Social skills
 - Conflict resolution
 - Empathy
- **Hands**
 - Leadership
 - Responsible citizenship
 - Marketable skills
 - Teamwork
- **Health**
 - Self-esteem
 - Character
 - Managing Feelings
 - Stress management

**note these life skills are just some examples of what 4-H members will learn in this project*

Additional Resources:

[Exploring 4-H Aerospace](#)

[Rockets to the Moon !\[\]\(17413706fd4997a1a4bdf85c6864eee1_img.jpg\) !\[\]\(f419710cbe076aa30a9c6c031b5cbe84_img.jpg\) - National 4-H Council](#)

[Aerospace--Shop 4-H Curriculum](#)

[Purdue Aerospace 4-H Project](#)

[Soda Straw Rocket](#)

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Aerospace

Guidelines:

- Each 4-H'er will be required to build one new rocket for the project year.
- Each member will be required to exhibit one rocket in their current skill level. The rocket must be complete and ready to launch without the engine.
- Only one rocket building class may be entered each year.
- All rockets must be made by the 4-H'er. Model rocket kits are allowed.

Section J–Rocketry

- Beginning (1st year)
 - Exhibit
 - Project displayed must 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.
 - The video of the most recent test flight must be included with the project when judging.
 - 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](#).
 - Learning objectives
 - 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.
 - What is Newton's third law of motion and how does it pertain to rockets?
- Novice (2nd year)
 - Exhibited project
 - 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 and flight data sheet in your rocketry notebook.
 - Video of the most recent test flight must be included with the project when judging.
 - 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](#).
 - Learning objectives
 - How do model rocket engines operate?
 - What is an airfoil?
 - What is aerodynamics?
 - What is a fuselage?
 - What is an airframe?
 - What is propellant?
 - What is a nichrome wire?
 - Assist a more experienced rocketeer in setting up a launch site.
 - Launch one of your own rockets.
 - Complete a flight data sheet.
- Intermediate (3rd year)

- Exhibited project
 - 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 and a flight data sheet in your rocketry notebook.
 - Video of the most recent test flight must be included with the project when judging.
- 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](#).
- Learning objectives
 - 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?
 - keep records of your flights
 - Assist newer members with construction of single-stage rockets.
 - Take part in a rocket launch competition.
- Advanced (4th year)
 - Project should be a skill level 4 rocket.
 - Exhibited project
 - 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 and flight data sheet in record book.
 - 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).
 - Video of the most recent test flight must be included with the project when judging.
 - 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](#).
 - Learning objectives
 - 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?
 - What is the flight path of a typical rocket?
 - Set-up a proper launch site.
 - Assist newer rocketeers with construction of their model rockets and their learning objectives.

- Scaled (5th year)
 - Project should be a flyable scale model of an actual rocket
 - Exhibited project
 - The display will be a scale model of an actual rocket. It may be either from a kit or "scratch" built.
 - Rockets shall be painted and marketed to resemble the actual rocket.
 - Model must be on a stand that will not allow it to tip over or fall if bumped.
 - If "scratch" built, submit the model with your plans and parts list.
 - 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 are and why they are different (i.e. nearest standard body tube size, adjusted for rocket stability etc.).
 - Submit a completed flight data sheet
 - The video of the most recent test flight must be included with the project when judging.
 - 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](#).
 - Learning objectives
 - How to scale down.
 - What is the center of gravity?
 - What is the center of pressure?
 - How do you test a model rocket for stability?
 - How can a stability problem be cleared up?
 - Tour a space museum.
 - Learn about the facts of the actual rocket that corresponds to your model.
- Expert (6th year and beyond)
 - 4-H'er should design, build and test their own rocket.
 - Exhibited project
 - 4-H'er should learn how to design, build and test a rocket of your own design.
 - Model may NOT be tumble recovery.
 - Model must be on a stand that will not allow it to tip over or fall if bumped.
 - Submit the model with your plans, parts list and completed model rocketry record sheet.
 - Submit several completed flight data sheets.
 - The video of the most recent test flight must be included with the project when judging.
 - 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](#).
 - Learning objectives
 - Give a demonstration on rocket stability testing.
 - Assist newer rocketeers with their rockets and learning objectives.
 - What is the center of gravity?
 - What is the center of pressure?
 - How do you test a model rocket for stability?
 - How can a stability problem be cleared up?

- Educational Exhibit
 - Project can be a notebook, video, poster, or 3-D exhibit sharing your knowledge in the field of aerospace and rocketry. Project can be done each year but must be on a different topic and more challenging than prior years.
 - Suggested learning activities
 - 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
- Rocketry Notebook
 - Rocketry notebook is a cumulative notebook and must contain the current year and previous years notebook contents.
 - 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.
 - Pamphlets and articles may be included but a brief summary must be written for each one.
 - 1st year notebook requirements
 - 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".
 - 2nd year notebook requirements
 - 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. (basic Flight log on page 8 of this document)
 - Place the above items in your notebook in a section titled "second year".
 - 3rd year notebook requirements
 - Explain how model rocket staging works.
 - Write about how real rockets are built and staged.
 - Write a list of professionals that are involved with manned space flights and give a brief explanation of how they are involved. (Don't forget about the nutritionists who 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. (basic Flight log on page 8 of this document)
 - 4th year notebook requirements
 - 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 come across.
 - Explain the three basic types of drag and how aerodynamics are tested.
 - Include flight data sheets. (basic Flight log on page 8 of this document)

- 5th year notebook requirements
 - 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?
 - Include flight data sheets (basic Flight log on page 8 of this document)

Flight Log

4-H'ers Name:	4-H age:
4-H Club Name:	Years in this project:
Rocket Name:	

Each rocket must have its own flight log.

Date:	Sky Conditions	Wind Velocity & Direction	Barometric Pressure	Performance	Stability	Recovered	Damage
Example: 4-12-24	Overcast	1mph North	29.82 inhg	Tangled Recovery System	Completely Unstable	Yes	Moderate