K-STATE Research and Extension

Explore Your Spark!

Aerospace/Rocketry Project

Blast off into the exciting world of rockets, satellites, and space exploration! In the Kansas 4-H Aerospace/Rocketry project, youth turn curiosity into action by learning how science and math make rockets fly. From designing and building to testing and launching model rockets, participants gain hands-on experience with engineering, physics, aerodynamics, measurement, and data collection. Youth learn to solve problems, improve designs, and discover how small changes affect flight. Along the way, they build teamwork, creativity, and critical-thinking skills that help them become Beyond Ready for the future, exploring careers in aerospace, engineering, technology, and other STEM fields while experiencing the excitement of a real rocket launch.

Starting Out
Beginner:

Understand the basics:

- Geometric shape.
- Mass and weight.
- Four fundamental forces in a rocket flight (thrust, gravity, drag, and lift).
- Newton's Laws of Motion.
- Simple rocket design and testing.
- Learn how to safely handle necessary tools for construction and flight.
- Learn how fins reduce turbulence and help stabilize the rocket during flight.

Learning More
Intermediate:

Learn more about:

- Safety Awareness.
- Relations between forces and rocket motion.
- Major factors affecting stability and trajectory.
- Fin size, shapes, and number of fins
- Nose cone angles
- Mass
- Wind direction
- Altitude measurement and calculation.
- Proper technique to pack a parachute.
- Affects of lift and drag on rocket flights.

Expanding Horizons
Advanced:

Understand:

- Impulse, momentum, and conservation of momentum.
- Center of gravity, center of pressure, stability test, and flight stability.
- Major design features affecting flight: fin and nosecone.
- Prototype, test, launch, and analyze your own solid-propellant rockets.
- Keep a flight log, troubleshoot, and analyze problems.

Beyond Ready

Ready to Lead

Youth involved in 4-H are **two times more likely to have the goal of becoming a leader.** Through real-world experiences and the guidance of caring mentors, they develop the confidence, communication, and decision-making skills needed to lead in today's changing world.

Ready to Serve

Youth who participate in 4-H are **three times more likely to engage in community service.** Service learning provides them with purpose and connection at a time when **more than 53% of Gen Z report feeling lonely.** Through 4-H, youth are empowered to serve with compassion and make a meaningful impact.

Ready to Build

With nearly **10 million unfilled jobs and 77% of employers seeking real-world skills,** 4-H helps youth build what matters. Through hands-on projects and career exploration, youth gain adaptability, problem-solving, and workforce readiness.

Ready to Conquer

While 52% of young people feel like they're failing at life goals, 4-H youth rise with resilience. Backed by research and supported by caring adults, they learn to overcome challenges, set goals, and take charge of their future with confidence.

Building a Ready Generation in a World of Change!

Aerospace/Rocketry Project
Expand Your Experiences!

Healthy Living:

- Display information about satellites that monitor air pollution and climate change to help protect public health.
- Explore the landscape surrounding your launch pad for potential safety hazards.
- Display information about the filtration and purification systems developed for spacecraft now used in homes and hospitals.

Science and Agriculture:

- Explore how satellites help farmers monitor crops, track soil moisture, predict weather, and manage water use.
- Learn how space-based data helps farmers grow food more efficiently and care for land and natural resources.
- Investigate how rockets launch telescopes and space probes to expand our knowledge about the universe.

Community Vitality:

- Create a poster or display showing how satellites provide communication, internet service, and emergency alerts around the world.
- Explore how engineers, scientists, technicians, and designers work together to build rockets and spacecraft that support economic growth.
- Present programs highlighting STEM education and career opportunities.

Communication and the Arts:

- Create videos, digital designs, or social media posts that explain how rockets work and why space exploration matters.
- Design rocket-themed artwork, posters, models, photography, or digital media to promote space exploration.
- Share how internet access and GPS navigation help people travel, share information, and stay connected.

Career Exploration:

- Job shadow or interview an aerospace professional.
  - Drone operator
  - Satellite technician
  - Aviation specialist
- Explore careers in aerospace/rocketry:
  - Materials Scientist
  - Rocket Propulsion Engineer
  - Flight Systems Engineer
  - Space Mission Scientist
- Tour colleges offering aerospace/rocketry education.
- Create a real/conceptual aerospace/rocketry product or service business; participate in a YEC (Youth Entrepreneurship Challenge).
- Explore cybersecurity jobs in the aerospace/rocketry career field.

Contact Information

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Resources & Events:

Connect with professionals and participate in hands-on learning opportunities to build confidence, resilience, and real-world skills:

- Club Day Presentation
- Create a local rocketry group.
- 4-H camps and events (K-State Open House, Discovery Days, etc.)
- County and State Fair Aerospace/Rocketry exhibit.
- American Rocketry Challenge (world's largest student rocket competition)

Curriculum & Resources:

Contact your local Extension office for project support.

- National 4-H Curriculum
- Kansas 4-H Project Website
- Tripoli Rocketry Association
- National Association of Rocketry (NAR)
- NASA Rockets Rock Module
- NASA Rockets Educator Guide
- Pitsco Education
- Baking soda & vinegar rocket
- Build and launch a Foam Rocket
- Stomp Rockets

4-H Record Keeping:

Learning to keep accurate records is a life skill.

- Setting 4-H Project Goals (4H1100)
- Kansas 4-H Record Keeping
- Complete Aerospace/Rocketry Journal tracking:
  - Parameters of a rocket
  - Structural changes, flight damage
  - Flight log
  - Progressive pictures of a rocket
  - Troubleshooting

Project Exhibit Ideas:

- Build an age-appropriate rocket exhibit.
- Create a picture notebook of building your rocket from start to launch.
- Create a poster explaining the effects on flight with:
  - Different nose cone designs
  - Different fin designs
  - Rocket basics
- Calculations of altitude and distance

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