STEM PATHWAYS
Hay Swift Kick STEM Challenge!

The Problem
Baler Logistics needs to design a kicker, bale ejection system, for one of their latest square balers. You have been contracted to work with a team to create a prototype.

The Challenge
Using the materials provided, design a model that is accurate and reliable for moving the bale to the target.

Find a Solution
ASK: What are some possible ideas?
PLAN: Test out your ideas
CREATE: Put your ideas to the test
IMPROVE: Review results & make changes

Things to Consider
1. What are the anticipated bale specs for the kicker to handle?
2. What component(s) drive the kicker’s accuracy and precision (reliability)?
3. How will design materials chosen be impacted by environmental conditions?

Choose Your Design Materials
- Rubber Bands (various sizes)
- Craft Sticks (various sizes)
- Plastic Utensils (spoons, forks)
- Plastic or Metal Bottle Caps
- Masking Tape
- Bales (mini-marshmallows, square shaped cereal, toy building blocks, make your own bales)
- Masking Tape

SAFETY ALERT:
You are making a projectile device! Do not take aim at anyone when testing!

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937-521-3865, http://www.ohio4h.org/STEM-Pathways
# Hay Swift Kick STEM Challenge!

## Materials and Supplies
- Craft Sticks (various sizes)
- Rubber bands (various sizes)
- Plastic Utensils (spoons, forks)
- Plastic or Metal Bottle Caps
- Hay Bale (mini-marshmallows, toy building blocks/hay bales, square shaped cereal, design your own bale)
- Masking Tape or Glue Gun

## TIME: 20-30 MINUTES

### Design Space
- 4 ft. x 4 ft. table space per team
- Set parameters: # of craft sticks, # of rubber bands, # of bottle caps, plastic utensils, bale types, etc.
- Target for testing: accuracy and reliability.

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## Engage the Learner
- What climatic and growing conditions might impact material choice?
- How will bale size and weight affect kick pan or lever materials selected?
- What affects does leverage and spring have on the bale kicker's accuracy and precision (reliability)?

## Observations & Conclusions
- Did your hay kicker work as you intended? What’s your model’s accuracy percentage? reliability percentage?
- What worked? What didn’t? Knowing what you know, what changes will you make to improve accuracy & precision?
- If you could choose another material, what would it be? How would you use this material?

### STEM Career Path … Agriculture Systems Technologists
- Who else might be involved? Climatologists, agronomists, agriculture safety specialists, agriculture and mechanical engineers, economists, etc.
- Who benefits? Agriculture producers through reduced labor costs, farm-related injuries, uniformed hay bales for sale, competitive edge of manufacturers, etc.
- What other industries might benefit from this work? Food processing and manufacturing, toy companies, sports equipment, etc.

Refer to Career Focus Card for more details.

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**Note:** Have each team select a bale or test their prototype with the same or different bales.

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**STEM PATHWAYS**: OHIO STATE UNIVERSITY EXTENSION

**FACILITATOR PROCESSING**

**STEM PATHWAYS**

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**THE OHIO STATE UNIVERSITY**

**COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES**

CFAES provides research and related educational programs to clientele on a nondiscriminatory basis. For more information: go.osu.edu/cfaesdiversity.
### SCIENCE
**Agronomist**

What characteristics determine hay’s feeding value and quality?

- Grass/forage species, year in production, maturity when cut and harvested.
- Growing and weather conditions
- Weed and foreign debris
- Insect and disease damage
- Moisture content, feed value analysis, storage conditions

### TECHNOLOGY
**Agriculture Systems Technologists**

How can improved baler mechanization and operation improve hay quality and profitability?

- Bale uniformity for ease of transport and handling
- Environmental conditions impact equipment reliability, performance and product quality
- The baler’s hay kicker reducer handling time and labor costs.

### ENGINEERING
**Mechanical Engineer**

What other labor intensive tasks have improved with new technologies?

What task or chore do you have that you wish there was a machine to do it for you?

- Mechanical engineering is the broadest engineering field. They design, develop, build and test mechanical devices, including tools, engines and machines.

### MATH
**Agriculture Equipment Dealer**

What determines the number and type of hay balers stocked by a local equipment dealer?

- Type of agricultural production in the area (crop type, livestock produced, irrigation, etc.)
- Farm size and age of agriculture producers and farm operators
- Local and national weather conditions (drought, flood, etc.)
- Agriculture commodity and market prices determine dollars available to purchase new equipment or replace existing equipment.
Agriculture Systems Technologist

**Finding Solutions For...**
- Agricultural equipment, water quality and water management, bio-renewables and biofuels, biological products, livestock facilities, food processing and more.
- Maximizing production, minimizing costs and optimizing social, economic and environmental benefits.

**Job Forecast Looks Like...**
- **Median Income:** $71,090 per year
- **Job Outlook:** 5% growth from 2012-2022
- **Job Environment:** Indoor and outdoor field experiences testing equipment and designs
- **Expected Growth Areas:** Precision agriculture, bio-renewables and biofuels, water quality and management, food processing

**Skill Set Needed...**
- **High School Courses:**
  - Math: algebra, geometry, calculus
  - Science: biology, chemistry, and physics
  - Specialized: drafting, computer science, engineering, robotics
- **Problem-solving:** apply engineering and technology to new circumstances
- **Teamwork:** design solutions involving biological, mechanical or environmental dimensions, work and receive feedback from a variety of backgrounds
- **Communication:** actively listen, writes and speaks well
- **Initiative:** attention to detail, willingness to take on challenges and responsibilities

**Education and Training Required...**
- **Entry Level Jobs:** Require Bachelor’s degree
- **Additional Training and Certifications:** Increased earning potential for those that seek advanced training, masters and doctorates