

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



TIME: 20-30 MINUTES

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

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.

View How A Baler Makes A Square Bale:
http://www.youtube.com/watch?v=_BVtirYc6Pc



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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?

Post who designed the most accurate, most reliable or both accurate & reliable over time.

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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STEM PATHWAYS

career

Hay Swift Kick STEM Challenge

Did You Know? The first hay baler was designed in 1932. Today's hay baler is highly mechanized with many parts working simultaneously. View: <http://www.youtube.com/watch?v=BVtirYc6Pc> What does the hay ejector (kicker) remind you of when in operation?

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.



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Hay Swift Kick STEM Challenge

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



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Sources:
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Handbook, 2014-2015 Edition,
bls.gov/ooh