

ROSIE REVERE, ENGINEER

A STEM, CCSS & NGSS Aligned Activity for K-4
Classrooms, Libraries, Bookstores & Families!

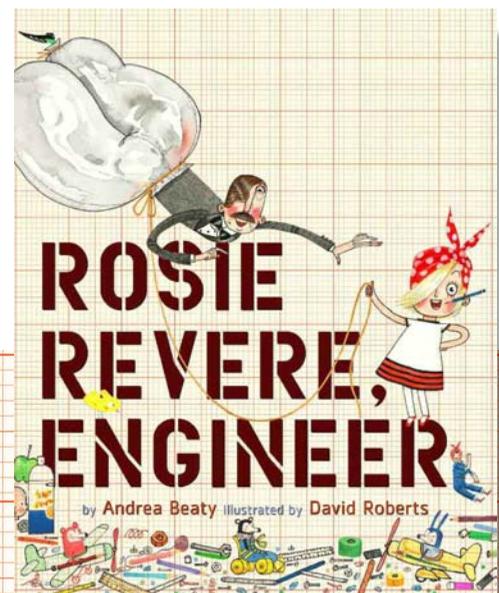


A step-by-step
hands-on intro to
the engineering
process for you &
your kids!

STEM!



Make my
Rosie-Copter fly &
experiment with
new designs!



ROSIE REVERE, ENGINEER

A STEM Event Kit for Libraries, Bookstores, Classrooms K-4, and Families

ABOUT THE KIT

In the picture book *Rosie Revere, Engineer*, Rosie overcomes a fear of failure to create a helicopter (first propelled by cheddar cheese spray and then by sturdier stuff). Rosie's process mirrors the problem solving, planning, designing, testing, failing, and redesigning process of Engineers.

This activity takes your readers through the engineering process by adapting the blades of a paper helicopter. Not familiar with STEM or Engineering programming or instruction? No worries. This event kit includes step-by-step instructions. It even provides sample dialogue. The kit contains everything you will need except for some common office supplies.

This kit was created by Carolyn DeCristofano, science educator and consultant with Blue Heron STEM Education, Curious City DPW, the creator of book-based programming kits for schools and libraries, and author Andrea Beaty. *CCSS and NGSS Standards alignments are located at the end of this kit.*

ABOUT THE BOOK

Rosie Revere, Engineer

By Andrea Beaty

Illustrated by David Roberts

Published by Abrams Books for Young Readers

ISBN-13: 9781419708459

Hardcover, \$16.95

Grades: K-4

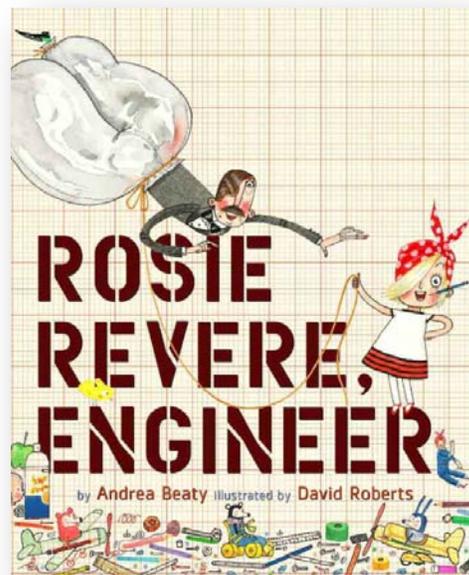
New York Times Best Seller

2013 Parents' Choice Award - GOLD

2014 Amelia Bloomer Project List

Bill Martin Jr. Award Nominee

"Told through Beaty's rhymes and Roberts's playful art, this tale of creativity and persistence will delight readers five and (way) up." —*Science Magazine*



Rosie may seem quiet during the day, but at night she's a brilliant inventor of gizmos and gadgets who dreams of becoming a great engineer. When her great-great-aunt Rose (Rosie the Riveter) comes for a visit and mentions her one unfinished goal—to fly—Rosie sets to work building a contraption to make her aunt's dream come true. But when her contraption doesn't fly but rather hovers for a moment and then crashes, Rosie deems the invention a failure. On the contrary, Aunt Rose insists that Rosie's contraption was a raging success. Rosie realizes that you can only truly fail if you quit.

"Comically detailed mixed-media illustrations that keep the mood light and emphasize Rosie's creativity at every turn." —*Publishers Weekly*

"*Rosie Revere, Engineer* is an absolutely wonderful kids' picture book about a young girl who loves to invent...Written in delightful verse and filled with sneaky histories of women in aviation, it's perfect inspirational material for young makers." —BoingBoing

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ABOUT THE AUTHOR & ILLUSTRATOR

Andrea Beaty is the author of *Secrets of the Cicada Summer*, *Attack of the Fluffy Bunnies*, *When Giants Come to Play*, and *Iggy Peck, Architect*. She lives just outside Chicago. Learn more about Andrea at AndreaBeaty.com.

David Roberts has illustrated many children's books, including *Iggy Peck, Architect*, *Happy Birthday Madame Chapeau*, and *Dear Tabby*. He lives in London.

EVENT PREPARATION

Prepare - One Month in Advance of the Event

1. Locate a copy or copies of the picture book *Rosie Revere, Engineer* by Andrea Beaty and illustrated by David Roberts (Abrams Books for Young Readers).
2. If you are doing an event for the public, copy and post the Event Poster in this kit, hand it out in your community, and include it in a display. List the event in newsletters and online calendars with copy such as:

Do you like to imagine, experiment, and make amazing things? Join us for a reading of the bestselling picture book *Rosie Revere, Engineer* and to try your hand at making a Rosie-Copter fly. You may just discover you are an engineer in the making. All ages welcome, but best for ages 7-11.

3. Create a display of household and playroom detritus. Add a label with the following: From Household Trash to Engineers' Treasure! How could you use some of these objects in an invention?
4. Decide whether or not you will serve a snack. One cannot resist the temptation to suggest serving spray cheddar cheese. (Caution: Beware of the child who tries to use it for take off!)
5. Do you want to brush up on a grade-level description of engineering? We suggest searching for the "NASA for Kids: Intro to Engineering" page at education.nationalgeographic.com.

Prepare - One Week or More in Advance of the Event

1. Gather:
 - ___ Scissors (enough for each anticipated participant)
 - ___ Paperclips of the same size (enough for each anticipated participant plus a handful more.)
 - ___ Rolls of clear tape
 - ___ Hole punchers to share
 - ___ Staplers to share
 - ___ Scrap paper to share
 - ___ Pencils (enough for every two anticipated participants)
 - ___ Other design and craft supplies of your choice

ROSIE REVERE, ENGINEER

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2. Print the Rosie-Copter Templates on regular paper or cardstock. You will need one template for each anticipated participant plus extras for further experimentation or as take-home goodies.
3. Depending on your time and setting, decide how much you will prep the Rosie-Copter Templates. At a timed public event, we suggest:
 - ___ Cut out the Rosie-Copter Template.
 - ___ Cut along the dotted lines to make the Copter blades.
 - ___ Fold back along the double line to make the cockpit.
 - ___ Secure the fold with a paperclip (straight up and down and centered).
4. Print out *Rosie Revere, Engineer* Notebook sheets. You will need one for every anticipated participant.
5. Print out a few *Rosie Revere, Engineer* Design Department sheets to decorate the table where your design supplies will sit.
6. Print out a *Rosie Revere, Engineer* Guide to Engineers for display or distribution.
7. Print out the Rosie-Copter Sheet (with instructions) for children to take home to continue their experiments
8. Review the Engineering Activity. The text in bold italic is suggested dialogue to have with children. Some people like these prompts and some don't. They are there in case you will find them useful!
9. We suggest referencing and rereading the final pages of the book during the book discussion part of the activity. You may want to mark those pages.
10. (Optional) Select nonfiction books on engineering for a display to encourage reference and circulation.

Don't Have Time for the Full Activity? Simply print out the Rosie-Copter Sheet (with instructions) for families to take home.

Preparation for the Day of the Event

1. Lay out your *Rosie Revere, Engineer* Design Department table with scissors, paperclips, clear tape, hole punchers, staplers, scrap paper, other supplies, and your *Rosie Revere, Engineer* Design Department signs. If you plan to allow multiple rounds of design, place additional Rosie-Copter Templates on this table as well. (There is no need to prep them with the fold or cut.)
2. Place the Rosie-Copter Sheet (with instructions) for children to take home to continue their experiments.
3. Place your Rosie-Copter Templates, *Rosie Revere, Engineer* Notebook sheets, and pencils within reach for distribution.

ROSIE REVERE, ENGINEER

A STEM Event Kit for Libraries, Bookstores, Classrooms K-4, and Families

4. Place your *Rosie Revere, Engineer* Guide to Engineers for display or distribution.
5. (Optional) Lay out your snack and nonfiction books on engineering.

ENGINEERING ACTIVITY

Read and Discuss the Book's Depiction of Engineering

Note: The text in bold italic is suggested dialogue to have with children. Some people like these prompts and some don't. They are there in case you will find them useful!

1. Read the picture book *Rosie Revere, Engineer* aloud.
2. Revisit the book's treatment of failure. Show the two-page spread of the heli-o-cheese-copter in the air and then turn the page to show it after the crash.
Why did Rosie think her heli-o-cheese-copter failed?
3. Revisit the aunt's redefinition of failure as success. ***Why didn't Great-Great-Aunt-Rosie think Rosie failed?*** Show the spread of Great-Great-Aunt Rose hugging Rosie. Reread the page beginning with "You did it!"
4. Explore what it means to be an "engineer." Reread the spread with Rosie brainstorming new ideas. Begin with "Your brilliant first flop..." and read to the end of the next page ending with "bold dreams of a great engineer."
What do you think an engineer is?
5. Elicit definitions of an engineer and share this definition from NASA. (Source: "NASA for Kids: Intro to Engineering" at education.nationalgeographic.com). ***Engineers are people who design and build the things we use every day. What did Rosie build?***
6. ***Engineers solve problems. What problem was Rosie trying to solve?*** Elicit the response that she was trying to build a "gizmo" to help her aunt fly.
7. ***Engineers come up with ideas and make plans.*** Show the spread with Rosie in bed thinking. Point out the helicopter toy and its red helicopter blades. ***What has to happen for the helicopter to fly?*** Turn to the picture book spread of the heli-o-cheese-copter in the air. Elicit the answer that the blades have to spin.
8. ***Engineers experiment or try things. What did Rosie experiment with as helicopter blades?*** Elicit the response that she used a can of cheddar cheese spray.
9. ***Engineers make mistakes.*** Show the spread where Rosie crashes.

ROSIE REVERE, ENGINEER

A STEM Event Kit for Libraries, Bookstores, Classrooms K-4, and Families

10. ***Failure or mistakes allow engineers to improve their plan. How did Rosie improve her plan?*** Turn to the end spread where Rosie is putting on new helicopter blades. Compare and contrast the picture of the heli-o-cheese-copter in the air with the new design to see what has changed. Elicit the observation that she has changed the helicopter blades.

Invite Readers to be Engineers

1. Show your Rosie-Copter Prototype. ***I have here a model of the Rosie-Copter.***
2. ***Let me show you how the Rosie-Copter flies.*** Stand, extend your arm as high as it will go, and drop the Rosie-Copter.
3. Introduce the challenge. ***Now, I would like it if Rosie did not crash land. The faster she lands the more damage she will do to her Rosie-Copter and herself. The slower she lands, the safer she will be. Let's see if we can make Rosie safer by making her Copter go slower. I want YOU to engineer a better, slower Copter. I want you to change this Copter to try and make it go slower.***
4. Distribute the Rosie-Copter templates.
5. ***As my group of engineers, we need to build and try out her first idea so we can see it in action.*** Demonstrate folding one blade forward and one blade back (or the whole assembly if you have not prepped it fully).
6. Invite children to observe the Rosie-Copter. ***Ready to try out the Rosie-Copter? I would like everyone to hold their Rosie-Copters in their right hands and then put those hands as far up in the air as you can.***

I'm going to do a "3-2-1, Drop" countdown. When I call out, "Drop!" let go of your copter and watch it carefully as it drops. See what you can notice. Then pick up the copter and wait for my next instruction.

Ready? 3-2-1...Drop! Allow children to drop and pick up their copters.

Wow! That was fast. Maybe we should try it again so you can have another look. Ready? 3-2-1...Drop! Again, allow children to drop and pick up their copters.

Let's do it one more time. Get ready to tell me what you notice! Don't forget to pick up your copter and wait for my next instruction. Ready? 3-2-1...Drop!

7. Once children have picked up the copters, settle them down and ask them to sit so you can talk about what happened.

Well, what did you notice? Prompt students to recall that the copter spun, the blades went up, the copter crashed, and it all happened fast.

ROSIE REVERE, ENGINEER

A STEM Event Kit for Libraries, Bookstores, Classrooms K-4, and Families

That's Rosie's problem – the copter fell so fast it landed hard; it crash landed. I wonder how we might make it go slower so it lands more softly. I bet some of you already have ideas. Anyone?

Children might be shy...but usually there will be one or two children who want to volunteer their ideas. This may warm up the group.

8. Introduce this challenge's design constraints. *Those are all interesting ideas. Before we try anything, though, I think there's a little more you need to know about.*

Engineers sometimes cannot do everything they want to do. They have rules or constraints. The constraints may be that they only have certain materials or they only have a little bit of money to work with. These constraints leave them with rules to work within.

I am going to give you a rule for this first round of engineering. You can only make changes to the blades of Rosie's Copter. Not the cockpit [point to space below the blades] or the weight on the cockpit [point to the paperclip].

Create Engineer Teams

1. Pair children with each other or with an adult. *Now that we have our teams, I need one team member to volunteer to keep track of their engineering experiments in the Rosie Revere, Engineer Notebook.* Hand out *Rosie Revere, Engineer* Notebook sheets and pencil to each team
2. Have the children mark one of the Copters. *You each have a Copter, yes? I need one team member to write a #1 on their Copter blade. This Copter will be your Design #1. It will not change. You are responsible for keeping Design #1 from any changes. Understand?*
3. Have the children mark their experimental Copter. *Now I want you to put the # 2 on the other Copter. This Copter will be the second try for Rosie. You are going to change this Copter's blades in some way. You are going to make a change to the Copter blades that you think will make it fall slower.*

What kinds of changes could you make to the blades? Some answers could be: They could be made longer, they could be made shorter, they could be made a different shape, or they could be folded.

4. Bring the teams to the *Rosie Revere, Engineer* Design Department. *I want you to look over what materials you have to work with here in the Rosie Revere, Engineer Design Department. I then would like you to sit down as a team to decide what change you are going to make to your Copter blades.*

ROSIE REVERE, ENGINEER

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Get Engineering

1. Once teams are seated, invite pairs to record their idea in the notebook. ***If your idea is to make the blades of your Copter #2 shorter, take out your Rosie Revere Engineer Notebook and write "blades shorter" under "Design Change."***
2. Explain what will happen next. ***Once you have brainstormed what you will change, make a note about what you will change, and then...go ahead make your change!***
3. ***What do you think I will ask you to do after you make the changes to your Copter blades?*** Elicit the answer that you would like them to test it against the Design #1 Copter. Demonstrate making a change to the blades on one and then holding both arms up and dropping them at the same time.

Ask children to say whether the new copter was successful, reminding them that the idea is to make the new design go slower than Rosie's first design.

4. ***And should you just charge ahead and make another design?*** Elicit a discussion about repeating this test, observation, agreeing on the results, and recording them under "Results" section of the Rosie Revere Engineer Notebook. In an informal program, you may not have the opportunity to control this.
5. Elicit questions and then circulate to make sure teams understand their challenge.
6. Decide whether to offer teams a chance to redesign with additional templates or stop at this point. Some teams might have time for redesign while others are still working on their first improvement of Rosie's copter.

Meeting of Engineers

1. Bring the group back together. ***I would like all the brilliant engineers in this room to gather for a meeting to share their designs and results.***
2. Elicit results from the group. Ask each design team: ***What change did you make to Rosie's first design? What happened? Did your copter fall slower than Rosie's, faster, or about the same speed?***

Whether or not your design worked to make the copter go slower, you still have good information that will help all the engineers in the room.

3. Invite similar designs to the front of the room for a demonstration of their copters #1 and #2. ***Watch the copters made according to this design carefully. How are they the same? How are they different?*** Count down to a demonstration. Elicit responses. Invite children to take notes in their *Rosie Revere, Engineer* Notebooks of anything that interests them.
4. Repeat the demonstration with just the Copter #2 Designs and not Rosie's Copter #1. ***Watch carefully. Is there one that falls slower than the rest?***

ROSIE REVERE, ENGINEER

A STEM Event Kit for Libraries, Bookstores, Classrooms K-4, and Families

5. Discuss the results. *Are there reasons for different results?* Elicit the question of whether the height of the person makes a difference.
6. Discuss outcomes. *If you redesign your Copter, would you use this design feature?*

Repeat and Conclude

1. Repeat these demonstrations with different ideas until you have heard from each team or have reached your time limit.
2. If time, send your engineers back for another round of design. Regardless, make sure each engineer gets a Rosie-Copter Sheet (with the instructions) for home use.
3. Conclude with encouragement to keep experimenting and with a quote from the book. *I hope you will keep experimenting, failing, learning, and experimenting as all good engineers do. As Rosie says, "Life might have its failures, but this was not it. The only true failure can come if you quit."*

ALIGNMENT WITH THE STANDARDS

NGSS – Engineering Design

K-2-ETS1-1.

Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

K-2-ETS1-2.

Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

K-2-ETS1-3.

Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

Common Core – ELA

Kindergarten

CCSS.ELA-Literacy.RL.K.1

With prompting and support, ask and answer questions about key details in a text.

Grade 1

CSS.ELA-Literacy.RL.1.2

Retell stories, including key details, and demonstrate understanding of their central message or lesson.

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Grade 2

CCSS.ELA-Literacy.RL.2.1

Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text.

CCSS.ELA-Literacy.RL.2.3

Describe how characters in a story respond to major events and challenges.

Grade 3

CCSS.ELA-Literacy.RL.3.1

Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.

CCSS.ELA-Literacy.RL.3.3

Describe characters in a story (e.g., their traits, motivations, or feelings) and explain how their actions contribute to the sequence of events

Grade 4

CCSS.ELA-Literacy.RL.4.3

Describe in depth a character, setting, or event in a story or drama, drawing on specific details in the text (e.g., a character's thoughts, words, or actions).

Common Core – Math

Kindergarten

CCSS.Math.Content.K.MD.A.1

Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object.

Grade 1

CCSS.Math.Content.1.MD.A.1

Measurement and Data

Measure lengths indirectly and by iterating length units.

Order three objects by length; compare the lengths of two objects indirectly by using a third object.

Grade 2

CCSS.Math.Content.2.MD.A.1

Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.

CCSS.Math.Content.2.MD.A.3

Estimate lengths using units of inches, feet, centimeters, and meters.

CCSS.Math.Content.2.MD.A.4

Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit.

ROSIE REVERE, ENGINEER

Event for Young Engineers

MAKE!

THINK!

STEM!



Do you like to imagine, experiment, and make amazing things?

EXPERIMENT!

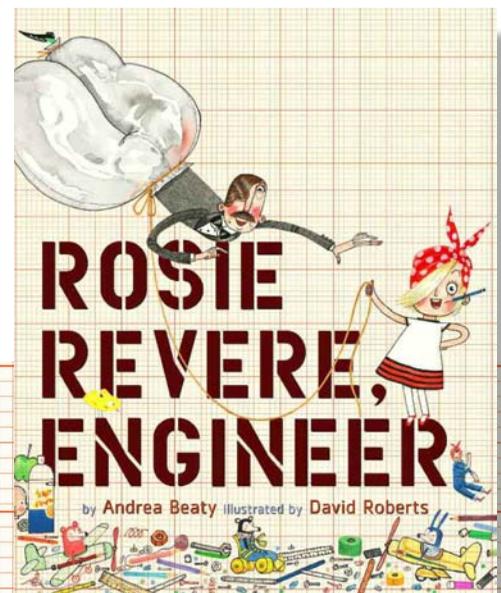
Make my Rosie-Copter fly and design your own better flying machine!

MAKE MISTAKES!

TEST!

DESIGN!

IMAGINE!

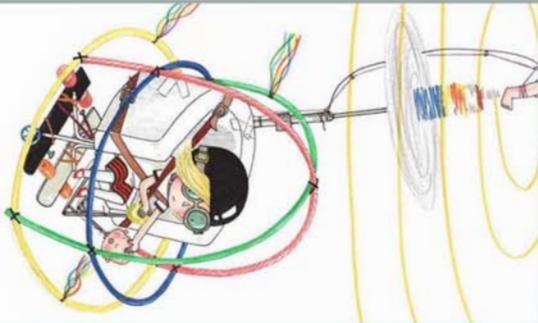
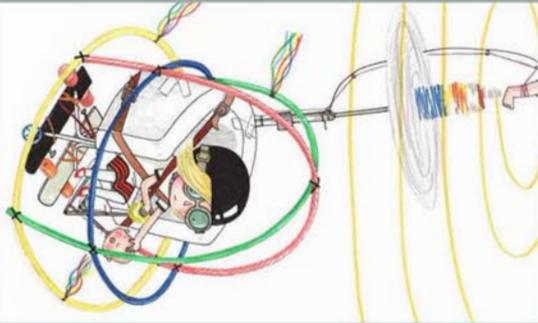
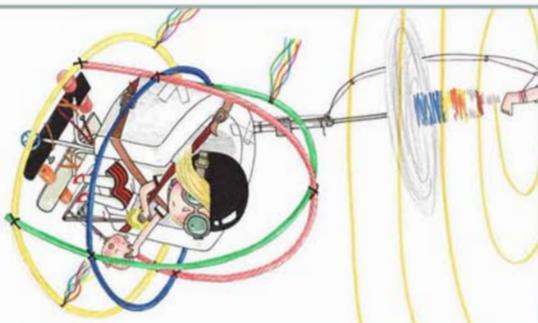
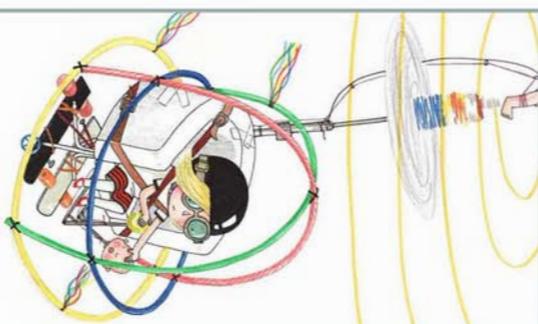
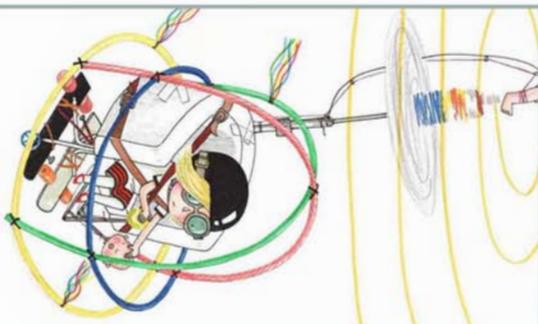


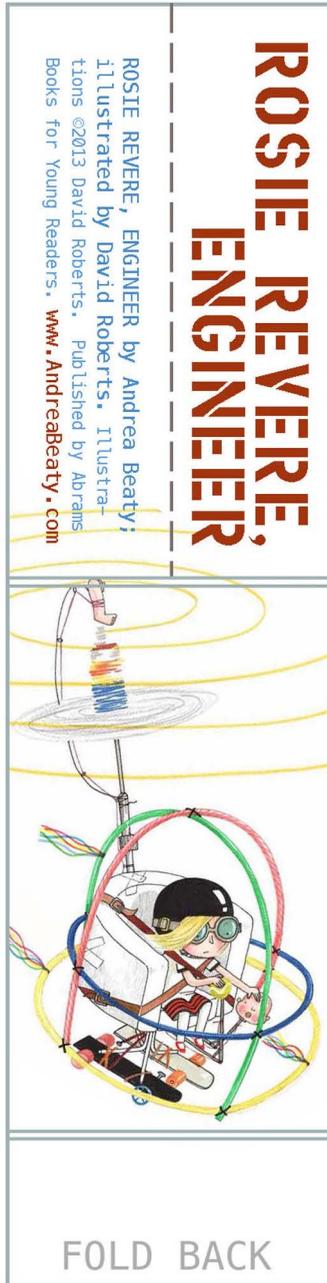
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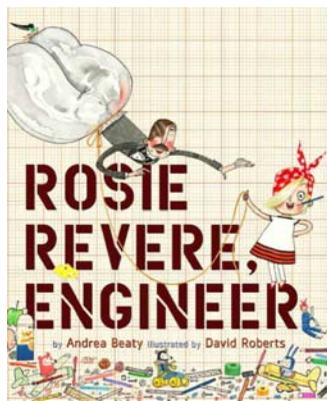
LOCATION:

ROSIE REVERE, ENGINEER *Template*

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ROSIE-COPTER



ROSIE-COPTER

Can you help Rosie Revere engineer a set of copter blades so she won't crash land?

YOUR CHALLENGE: Change the blades on Rosie Revere's copter to make it fall to the ground as slowly as possible.

WHAT TO DO

1) OBSERVE Rosie's original copter in action. First, though, you will have to make it!

- Cut out a Rosie-Copter template.
- Cut along the dotted line to make the copter blades.
- Fold on bottom double line to make the cockpit.
- Secure the fold with a paperclip (straight up and down and centered).
- Fold one blade forward and one blade back perpendicular to the cockpit.
- Holding the copter at the clip, reach your hand as high as you can and drop it. Observe how fast it falls.

2) BRAINSTORM some changes to the copter blades that you think might make it fall slower. How long or short? What shape? Folds? Holes? What else?

TIP Engineers often use familiar things as inspiration. Do you get any ideas if you think of things that fall and glide—like balls, leaves, parachutes, flat paper, birds, or crumpled paper?

3) CONSTRUCT a copter according to your own plan with the Your-Copter template.

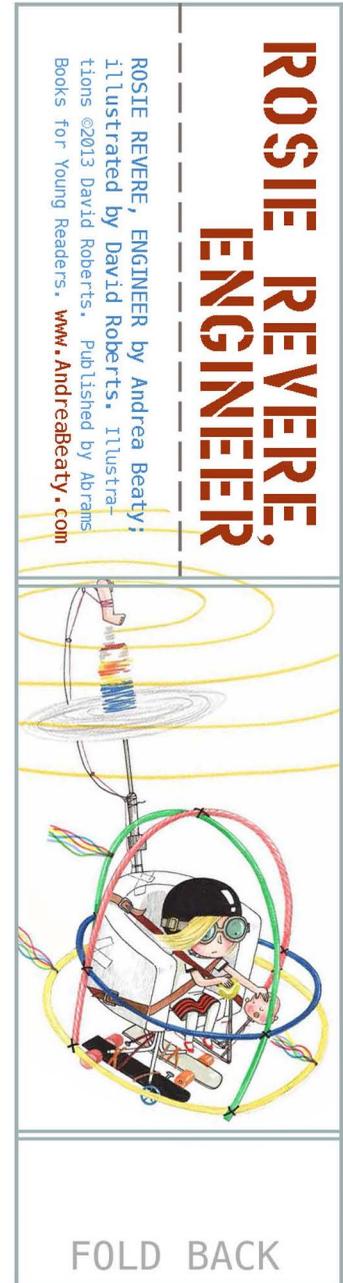
4) TEST Your-Copter design by comparing it the Rosie-Copter. Hold each copter at the clip, one copter in each hand. Reach both arms as high as you can. Drop the copters at the same time. Repeat a few times to be sure of your results. Does Your-Copter fall slower than the Rosie-Copter?

5) REDESIGN! Whether your design passed or failed the performance test, it can probably be improved. Give it a try!

CHEESY IDEA Once, Rosie made a heli-o-cheese- copter that used cheese squirted in a circle instead of copter blades!

Do you have a cheesy idea? Give it a try and see if it helps or hurts your copter performance!

6) SHARE your engineering ideas on the ROSIE REVERE, ENGINEER Facebook page if you like! (Facebook.com/RosieRevereEngineer)

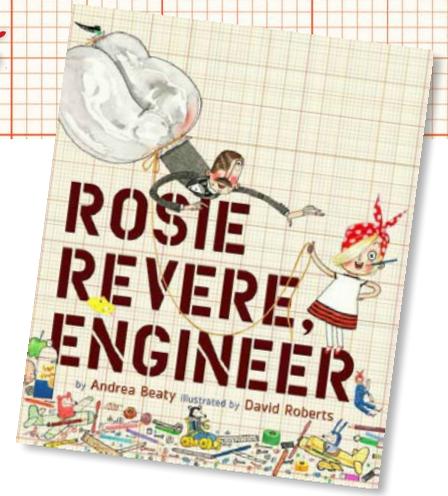


YOUR-COPTER



ROSIE REVERE, ENGINEER

Guide to Engineers



ENGINEERS

are people who design and build the things we use every day.

ENGINEERS...



- Solve problems.
- Brainstorm ideas and make a plan.
 - Experiment or try things.
 - Make mistakes.
- Learn from mistakes and improve their plan!

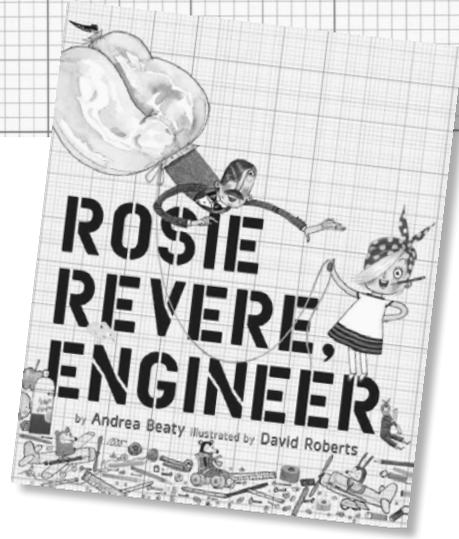
ROSIE REVERE, ENGINEER

NOTEBOOK



ENGINEERS!

Can you improve the Rosie-Copter? Imagine. Plan. Test. And redesign the Rosie-Copter. Remember, I would like my Copter to go a little bit slower so I don't crash land! Good luck!



DESIGN CHANGE:

RESULT:

DESIGN CHANGE:

RESULT:

NOTES: