



SAMPLE PAGES

MainSTREAM Science

Grades 5–6

SCIENCE

TECHNOLOGY

READING

ENGINEERING

ART

MATH



Challenging students to
create innovative solutions
to real-world problems
using a STREAM approach!

PROMOTING GLOBAL CITIZENSHIP

ECO-FRIENDLY TRANSPORTATION

In this project promoting humanitarian efforts, students will use *Egg Drop STEM Starters* as a stepping-stone to developing a humanitarian airdrop.



THE CHALLENGE: Design and build a model of an airdrop system that can deliver relief supplies to people in need following a natural disaster.

WHAT DOES MainSTREAM Science REALLY OFFER?

A stress-free approach to bringing STREAM into the classroom by using a **project-based learning platform** that incorporates the **engineering design process** and establishes **clear criteria and constraints!**



FOR TEACHERS:

- guidance on how to serve as project-based learning coaches and facilitators
- step-by-step lessons that provide scaffolding for students
- suggestions for best practices regarding project-based learning
- an efficient way of connecting multiple disciplines and meeting content standards




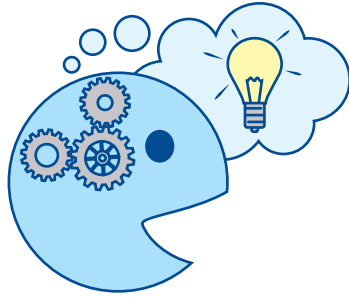
FOR STUDENTS:

- the ability to apply STREAM-based practices to real-world solutions global issues
- the opportunity to grow intellectually and emotionally using a collaborative, problem-solving mindset
- exciting and engaging activities that enhance critical and creative-thinking skills

USING THE RIGHT TOOLS TO ENSURE SUCCESS

The Teacher's Guide

 A project-based learning method organized into 8 easy-to-follow steps!



1. Building a Team
2. Learning the Facts
3. Making Real-World Connections
4. Conducting Investigations
5. Building Prototypes
6. Preparing Presentations
7. Presenting to Peers
8. Reflecting

HUMANITARIAN AIRDROPS

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HUMANITARIAN AIRDROPS

IMPLEMENTATION (cont.)

TEACHER'S GUIDE (cont.)

UNIT 1	Getting Started	Students are introduced to the content and structure of the project. They are placed into groups and will get to know their team members through various activities and exercises.
UNIT 2	Learning the Facts	Teams learn about the science behind the topic as well as the topic itself. They will research, read, and share their knowledge regarding Newton's laws and airdrop systems. Teams will also conduct a brief science demonstration to stir up excitement for the project.
UNIT 3	In the Real World	Teams will connect the project to the real world. Through real-life examples, they will come to understand how and why airdrops are used today and what lies ahead for humanitarian airdrops in the future.
UNIT 4	Practice Makes Perfect	Teams delve into the engineering aspects of the project as they work with the STEM Starters packs to devise an egg-drop device. They will learn the importance of trial and error, and will come to see that there is often more than one way to solve a problem. They will make educated guesses and come to understand why taking risks can be a good thing.
UNIT 5	Here We Go!	Teams brainstorm and develop their proposed solutions to the problem. They will plan, test, retest, and problem-solve as they develop their airdrop prototypes.
UNIT 6	Preparing for the Show	Teams will plan and create their presentations. This will include slide-show presentations, which may include videos, diagrams, animations, etc. Encourage teams to be creative and employ the technology that is available to them.
UNIT 7	Showtime!	Teams will present their proposed solutions to the class, receive feedback, make modifications, and then present once more to a larger audience.
UNIT 8	Let's Reflect	The class will come together to debrief and discuss the project and its takeaways. Students will write about and discuss their personal growth during the project, the pros and cons of the project, and how what they have learned along the way will help them in the years to come.

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Teachers as Coaches—A Guided Plan for Every Unit

GETTING STARTED HUMANITARIAN AIRDROPS

UNIT 1: GETTING STARTED

THE PLAN

SUMMARY
In this unit, an entry event will kick off the project to help spark students' interest. Students will then learn the content and structure of the project and will be placed into teams. Once in their teams, students will be given roles and will learn the rules for this project. They will get to know their team members through various team-building activities and will begin completing activity sheets together.

TEAM GOALS	CONTENT OBJECTIVES	MATERIALS
<ul style="list-style-type: none"> understand the objectives and steps of the project learn the team roles and rules get to know team members 	<ul style="list-style-type: none"> Students will engage effectively in discussions, listening to others speak, and expressing their own thoughts and ideas clearly. Students will use knowledge of the English language and its conventions when speaking and listening. 	<ul style="list-style-type: none"> guest speaker or YouTube video (see Step 1, page 15) 20 sticks of spaghetti, 1 yard of string, 1 yard of tape, and 1 large marshmallow (per group, see Step 8, page 16) chart paper, marker, blindfold, and a picture of an object (per group, see Step 8, page 16) colorful markers sheet of cardstock (1 per group, see Step 8, page 16)

SUPPORTIVE SUGGESTIONS
When introducing and explaining the project, be enthusiastic. Speak with gusto! This project is a big undertaking. You want your students to feel eager and excited rather than overwhelmed and apprehensive.
Encourage questions and be available to answer them. You may choose to set aside class time to answer group questions or make yourself accessible through email.
Monitor group interactions as much as possible to ensure that everyone is participating and fulfilling their individual group roles.

DRIVING QUESTION
How can we design, and present to the public, a plan for a humanitarian airdrop system that delivers relief supplies safely and effectively to people in need?

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HUMANITARIAN AIRDROPS GETTING STARTED

THE PLAN (cont.)

STEP-BY-STEP

ENTRY EVENT

- Launch the humanitarian airdrop project-based learning challenge by engaging students in the topic. A great way to do this is to have a guest speaker (an engineer, scientist, or humanitarian aid worker) come to speak with the class about his or her job. If no such speakers are available, consider showing a video of a humanitarian airdrop followed by a lively class discussion on the topic. An excellent video on humanitarian airdrops can be found at https://www.youtube.com/watch?v=pJ_CETe0Byo. It is titled "Humanitarian Air Drop News Story" and was uploaded by U.S. AFCENT. (Note: If this particular video cannot be found, there are numerous videos of humanitarian airdrops available on YouTube. Be sure to watch the video in its entirety to check for grade-level appropriateness before sharing it with the class.)

PROJECT NOTEBOOKS

- Distribute a Project Notebook to each student. Have students write their names on the first page. Explain that they need to keep careful track of their notebooks. They should be with them at all times in class (unless they are with the teacher to check work). Stress the importance of not losing them or damaging them because they will include all the notes, thoughts, and assignments pertaining to this project.

OVERVIEW

- Before explaining the project they are about to embark on, give students a couple of tips on how to take notes in a dot journal. The notes and journaling pages in the Project Notebooks are dot-journal style. Dot journals are easy to use, help with organization, boost creativity and productivity, and are fun to customize. Share some of the images and ideas from page 18 with students to help get them excited about taking notes.
- Have students turn to pages 4 and 5 in their Project Notebooks. Tell them you will be going over the Project Overview sheet (page 19) with them and you would like them to take notes on the Getting Started Notes sheet (page 20). Explain to students that they will be placed into teams and will work with their team members, over an extended period of time, to design a humanitarian airdrop system. Read the driving question out loud to students. Tell them that during the course of the project, they will engage in research, conduct experiments, engineer contraptions, design prototypes, create tech-driven presentations, and present their findings to their peers. Share the diagram from page 7 with the class.
- At this time, go over each rubric in the appendix with the class (pages 90–92). You may wish to make copies for students or teams to keep. It is important that students understand what is expected of them throughout the course of the project. Refer back to the rubrics repeatedly.

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Step-by-step guidance for both teachers and students!

GETTING STARTED HUMANITARIAN AIRDROPS

THE PLAN (cont.)

STEP-BY-STEP (cont.)

GETTING INTO GROUPS

- You have enough STEM Starters materials and Project Notebooks for six groups of five students. When placing students into groups, take into consideration students' social-awareness skills, personalities, work ethics, and leadership abilities. After students have been placed into their groups, go over the Team Roles & Rules sheet (page 21). Ask a volunteer to read the rules written on the gears. Ask a different volunteer to read the roles and descriptions. You can either assign students roles or let the teams decide amongst themselves. Once the roles have been decided, ask each team to come up with a team name and a team motto. Have each team write the following on a sheet of paper and turn it in: team name, team members' names and roles, and the team's motto.

GETTING TO KNOW ONE ANOTHER

- Have students fill out the Meet Me sheet (page 22). You may consider filling out one yourself to help students get to know you a little better and to serve as an example to students. Allow students time to complete the sheet either in class or at home. Next, have students take turns sharing the information from their sheets with their team members. Make sure they also share their contact information. Have them record notes about their team members and contact information on the Meet My Team Notes sheet (page 23). Encourage teams to have a friendly discussion about likes, dislikes, and things they have in common with one another. At this time, ask the team diplomat to share their team's name and motto with the class. If time permits, also have the diplomat share a little bit about each team member.

TEAM BUILDING

- Have teams engage in one or more of the following team-building activities.

Build It!	Draw It!	Fly It!
Distribute 20 sticks of spaghetti, one yard of string, one yard of tape, scissors, and one large marshmallow to each team. Each team must build a self-standing tower with the marshmallow on top. The tallest tower wins!	Distribute a sheet of chart paper, a marker, and a blindfold to each team. One team member (the drawer) is blindfolded. Another team member (the informant) stands with their back to the drawer, not looking at the paper. Give each informant a different picture. The informant must describe the picture to the drawer without naming it. As the drawer draws, the other team members try to guess the picture. The first team to guess correctly wins.	Give each team a sheet of cardstock. Challenge them to create the best paper airplane they can. Have them decorate the airplane and give it a name. Then, go outside and have each team fly its airplane. The team whose paper airplane flies the farthest wins!

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HUMANITARIAN AIRDROPS GETTING STARTED

THE PLAN (cont.)

STEP-BY-STEP (cont.)

WORKING AS A TEAM

- Following the team-building activities, have students complete the Working Together and Solving It Together sheets (pages 24–25) independently. Then, have them share their sheets and discuss their answers with one another. If time permits, have each team's diplomat provide a quick summary of what their group discussed with the class.
- Have the students complete the Pre-Project Questionnaire sheet (page 26). This is a great opportunity to assess group dynamics and catch any early signs of problems within the groups.

THINK, WRITE, DISCUSS
Have students complete the Think, Write, Discuss sheet (page 27). Have them think about all activities and assignments they completed in this unit.
How do they feel about embarking on this journey? How do they feel about working with a team? What do they like about this project? What do they hope to get out of it?
In the "Think" section, have students create a word cloud or generate a few doodles to help get their thoughts down on paper. In the "Write" section, have them put those thoughts into complete sentences. Lastly, have them discuss their thoughts and feelings with their team in one final team discussion for the unit. Encourage them to take notes during this discussion in the "Discuss" section of the sheet.

ODDS & ENDS

Timeline: Create a rough timeline for the project. Have a firm end date so you can schedule and prepare for the presentations. Would you like this project to be completed in a few months? A semester? A school year? Take into consideration how much class time can be devoted to the project. Will students need to work together outside of class to complete it on time? Once you have a timeline, share important dates with students and parents.

Tech Tips: Consider creating a Google Calendar for the project. Share it with students and parents. Add important due dates, project goals, and reminders to the calendar. This will help keep everyone informed and on the same page.

Note: If your school does not already have Google Classroom, consider looking into it. It is free and is excellent for projects such as this.
"Classroom helps students and teachers organize assignments, boost collaboration, and foster better communication."
<https://edu.google.com/products/classroom/>

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Students as Collaborative Learners and Problem Solvers

Collaboration • Cooperation • Communication • Creative and Critical Thinking









Project-Based Learning at its BEST!

PROJECT OVERVIEW

DRIVING QUESTION

How can we design, and present to the public, a plan for a humanitarian airdrop system that delivers relief supplies safely and effectively to people in need?

MISSION BREAKDOWN

<p>1 Meet Your Team</p>  <p>Get to know your team and learn how to work together as a group.</p>	<p>2 Find the Facts</p>  <p>Learn about Newton's laws of motion and gravity along with humanitarian airdrops. Conduct a mini experiment involving Newton's First Law of Motion.</p>	<p>3 Make Real-World Connections</p>  <p>Your team will read about the current technology being used in humanitarian airdrops and will set out on a research mission to find more real-world connections.</p>	<p>4 Don't Break the Egg</p>  <p>Your team will be given supplies that you will use to design, build, and test an egg-drop device. You will keep building and rebuilding until your system is successful.</p>
<p>5 Apply Your Knowledge</p>  <p>Now it's time for your team to apply all its research, knowledge, and skills into creating a model of an airdrop system.</p>	<p>6 Polish Your Prototype</p>  <p>Put your team's creativity and technology skills to the test as you work together to create a show-stopping presentation.</p>	<p>7 Present Your Ideas</p>  <p>Teams will take turns presenting their ideas and models.</p>	<p>8 Pause for Reflection</p>  <p>Reflect on what you have learned and how you have grown throughout the course of this project.</p>

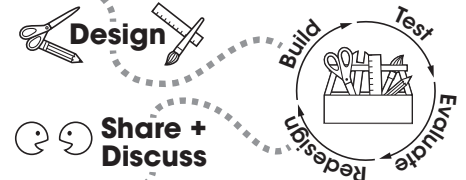
PBL

Opening Event

Driving Question

Get to Know Your Group

Gather Information + Deepen Knowledge



Reevaluate

Present

Reflect

SUCCESS through TEAMWORK!

Team-building activities support Social-Emotional Learning throughout the program!

TEAM ROLES & RULES

ROLES

Moderator

The moderator keeps the group focused and on task by leading and directing discussions and activities.

Diplomat

The diplomat serves as spokesperson to the class and as liaison between other groups and the teacher.

Time Manager

The time manager keeps track of time consumed for activities and discussions, and is also in charge of managing the team's deadlines and due dates.

RULES

Be positive and polite.

Be inclusive.

Participate.

Show respect.

Stay on task.

Recorder

The recorder takes notes, records data, and keeps track of any loose paperwork.

Wild Card

The wild card fills the role of any team member out for the day or any team member that needs additional assistance. The wild card also serves as the team's motivator by encouraging team members to do their best.

WORKING TOGETHER

Directions: Think of the activity you completed with your partner or team. Write and draw what you think working together looked like, sounded like, and felt like. Then, share this information with your team members.

LOOKED LIKE

SOUNDED LIKE

FELT LIKE

Rubrics—Defining Expectations

APPENDIX HUMANITARIAN AIRDROPS

COLLABORATION RUBRIC

	3 (exceeds standard)	2 (at standard)	1 (approaching standard)	0 (below standard)
Takes Responsibility for Self	<ul style="list-style-type: none"> does more than is asked to do consistently stays focused and completes tasks 	<ul style="list-style-type: none"> does what is required often stays focused and completes tasks 	<ul style="list-style-type: none"> does some of what is required stays somewhat focused and completes most of the tasks when reminded 	<ul style="list-style-type: none"> rarely does what is required does not stay focused and does not complete tasks
Participates and Contributes	<ul style="list-style-type: none"> encourages team members to share ideas is a leader on the team and helps manage conflicts that arise 	<ul style="list-style-type: none"> willingly shares ideas with team members actively helps the team solve problems 	<ul style="list-style-type: none"> sometimes shares ideas when asked to do so helps the team when asked to do so 	<ul style="list-style-type: none"> does not share ideas rarely helps the team
Works Well with Others	<ul style="list-style-type: none"> encourages team members to be respectful reminds team members to listen is consistently kind and sympathetic 	<ul style="list-style-type: none"> is respectful of team members' ideas and feelings listens attentively is often kind and sympathetic 	<ul style="list-style-type: none"> is respectful most of the time mostly listens to team members is sometimes kind and sympathetic 	<ul style="list-style-type: none"> shows little respect for team members rarely listens and repeatedly interrupts hurts others' feelings

Three types of rubrics provide teachers and students with specific expectations.

HUMANITARIAN AIRDROPS APPENDIX

CRITICAL & CREATIVE THINKING RUBRIC

	3 (exceeds standard)	2 (at standard)	1 (approaching standard)	0 (below standard)
Inquire & Evaluate	<ul style="list-style-type: none"> consistently seeks out new information to help solve the problem is successful at analyzing and evaluating arguments and evidence 	<ul style="list-style-type: none"> often seeks out new information to help solve the problem is effective in analyzing and evaluating arguments and evidence 	<ul style="list-style-type: none"> sometimes seeks out new information to help solve the problem is not comprehensive when analyzing and evaluating arguments and evidence 	<ul style="list-style-type: none"> rarely seeks out new information to help solve the problem does not analyze or evaluate arguments or evidence
Logic & Reasoning	<ul style="list-style-type: none"> consistently uses sound logic employs various types of reasoning that are appropriate for the given situation 	<ul style="list-style-type: none"> often uses sound logic uses reasoning skills that are suitable for the given situation 	<ul style="list-style-type: none"> sometimes uses sound logic uses reasoning skills that may or may not be fitting for the given situation 	<ul style="list-style-type: none"> rarely uses logic attempts to use some reasoning skills
Curiosity & Risk Taking	<ul style="list-style-type: none"> actively seeks out new and untested ways of solving a problem is not constrained or fearful of the risk of failure 	<ul style="list-style-type: none"> willingly considers new and untested ways of solving a problem is somewhat apprehensive and slightly fearful of the risk of failure 	<ul style="list-style-type: none"> hesitantly considers new and untested ways of solving a problem is apprehensive and fearful of the risk of failure 	<ul style="list-style-type: none"> unwilling to try new and untested ways of solving a problem prefers an option with little to no risk of failure

APPENDIX HUMANITARIAN AIRDROPS

GROUP PRESENTATION RUBRIC

	3 (exceeds standard)	2 (at standard)	1 (approaching standard)	0 (below standard)
Preparedness	<ul style="list-style-type: none"> extremely well prepared, showing signs of multiple rehearsals presentation stays within the time constraints 	<ul style="list-style-type: none"> well prepared, shows signs of rehearsal presentation is very close to meeting the time constraints 	<ul style="list-style-type: none"> somewhat prepared, but could have used more rehearsal time presentation is roughly within the time constraints 	<ul style="list-style-type: none"> not prepared, showing obvious signs of little rehearsal presentation is noticeably too short or clearly exceeds time constraints
Content	<ul style="list-style-type: none"> skillfully addresses all components proficiently explains the story, engineering, and science behind the prototype 	<ul style="list-style-type: none"> includes all components explains the story, engineering, and science behind the prototype 	<ul style="list-style-type: none"> includes almost all components attempts to explain the story, engineering, and science behind the prototype 	<ul style="list-style-type: none"> includes none of the required components does not attempt to explain the story, engineering, and science behind the prototype
Performance	<ul style="list-style-type: none"> members speak very clearly and confidently members are enthusiastic and at ease with being in front of a crowd members consistently maintain eye contact 	<ul style="list-style-type: none"> members speak clearly and confidently for most of the presentation members are mostly cheerful and relaxed members establish eye contact often and hold the audience's attention most of the time 	<ul style="list-style-type: none"> members speak somewhat clearly and confidently members show signs of uneasiness members attempt to make eye contact with the audience 	<ul style="list-style-type: none"> members do not speak clearly members appear restless and distracted members do not attempt to make eye contact with the audience

REAL EGG DROPS & DATA

Project Notebooks help keep information organized and in one place by offering students a place to record their notes and thoughts throughout the learning process.

THINK

WRITE

DISCUSS

MISSION NOTES

STEM Starters

With *STEM Starters*, students are given essential pieces of a much larger puzzle. They decide on additional materials to include in their build—a build that is limited only by their imaginations! Instructions are purposely left out of the building activity to create an entirely new and rewarding experience in which students learn the value of failure and risk-taking. Students will learn that there is often more than one way to solve a problem.

