Satellite Engineering Design for Mission: Hawai‘i

**ABSTRACT**

*Mission Hawai‘i* is a satellite research mission designed by student teams to study one of the species featured in lessons “Sharing the Biosphere in Hawai‘i” and “Sharing the Hydrosphere in Hawai‘i.” Students engage in the engineering design process to build a model of a satellite that would gather Earth system science data about Hawai‘i related to the study and protection of a Hawaiian species. Students use their science notebooks and “Engineering Design Journal” and participate in the engineering design process with their team. After discussion and planning of their *Mission: Hawai‘i*, students design, draw and construct a scale model of their satellite using household and recycled materials. Two short videos produced by NASA Goddard inspire students to design towards specific criteria and to produce the best product with the resources available. At the end of the lesson, students plan for an oral presentation to share their *Mission Hawai‘i*.

**BACKGROUND INFORMATION FOR TEACHERS**

The Next Generation Science Standards (NGSS) pursue the Engineering Design Process as a foundational structure of science education from Kindergarten through grade 12. This lesson has distilled the process into a manageable three session lesson that can be accomplished by small group teams. This culminating lesson asks students to synthesize what they have learned and look at Hawai‘i as an Earth system science laboratory for their design of *Mission Hawai‘i*.

This culminating lesson requires students to apply their knowledge gained about Earth system science, NASA Satellite Data, and Hawai‘i into a research mission we are calling *Mission Hawai‘i*. The entire three-part lesson is guided by the progression of the “Engineering Design Journal.”

Student teams will select a from a studied species:

- Hawaiian tree snail
- Bristle-thighed curlew
- Silversword
- Hawaiian monk seal
- Hawksbill sea turtle

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- Tiger shark

They will define the problem they plan to study and use their research Fact Sheets from lessons 5.2.4 and 5.2.5 to do background research on the problem. Student teams will brainstorm solutions and choose the best one to pursue with their Mission Hawai‘i satellite design. Teams will apply their collaborative brain power to select data to collect to study and protect their species. Their action task is to design a research mission, Mission: Hawai‘i, that involves using a satellite to collect data that can help solve the problem they have chosen. Then, students will use the engineering design process to design and build a scale model of their satellite.

The “Engineering Design Journal” has been based on a combination of the NGSS engineering design process at the upper elementary level and the NASA engineering design process. The NASA simplified process includes five steps:

- Ask: Understand the problem, state the conditions and limitations, obtain information from prior knowledge
- Imagine: Brainstorm ideas
- Plan: Choose a testable idea, draw a usable prototype, use attainable, affordable, and safe materials
- Create: Follow the plan, build a prototype and make it work
- Experiment: Collect, record, and analyze data accurately
- Improve: Review data, Repeat EDP process to optimize

The NGSS Science and Engineering Practices of focus during this lesson are:
1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Using mathematics and computational thinking
4. Designing solutions (for engineering)
5. Obtaining, evaluating, and communicating information

Students share oral presentations In the final lesson of this unit. Lesson 5.2.7 presentations include an overview of their research mission, a description of their satellite model, and highlights from their engineering design process. Providing an “authentic audience” for students is a powerful motivator. Bring
in an engineer, scientist, the principal, the librarian, or parents to show students the value and importance of their work with Earth system science.

Collaboration may challenge student communication skills in your class. These are real world problems. Encourage students to work through problems themselves and find ways to cooperate and compromise when necessary. The assessment rubric has an area to grade teamwork. Refer groups to this for self evaluation. Establish teamwork and ground rules early at the beginning of the lesson to avoid classroom management issues later.

Students will be simulating how NASA develops missions and pairs their mission with one or more satellites to collect needed data. The NASA Earth System Science Mission website has examples of actual Earth system science missions with satellite data collection embedded within them. The website explains that there are thousands of satellites in space and thousands of various scientific missions that utilize their data:


Invest in your own professional development as a teacher by learning about the engineering design process and watching the following seven part NASA professional development series. This series of NASA videos will guide you through the steps involved. Just one viewing and your classroom will run more smoothly throughout this lesson:


You will be a facilitator in both this lesson and the next, helping students to synthesize learning that has occurred throughout the Celestial Islands curriculum. Encourage students to use what they have learned in the past and help them incorporate more than one sphere of Earth system science in their research question for Mission: Hawai‘i. Ethical questions may emerge regarding use of geolocators on species. Speak directly with students to think of the ethical implications of science and the possible positive and negative consequences of scientific study. How can our scientific instruments be improved? As a facilitator, circulate around the room to help direct teamwork and refocus students to working through each page of the “Engineering Design Journal”.

### PLANNING

**Essential Questions**
- In what ways can Earth system scientists use satellite data to study and solve problems in Hawai‘i?
- How can satellites study and protect threatened and endangered species in Hawai‘i?

**Instructional Objectives**

Students will:
- Apply their knowledge of Earth system science in Hawai‘i by developing a new research mission.
- Collaborate to design and plan a research mission that meets set criteria.
- Use the engineering design process to build a scale model of a satellite to collect data for their research mission.

**Key Vocabulary**
- Research mission
- Engineer
- Engineering design process
Materials
- One “Engineering Design Journal” per student
- “Mission: Hawai‘i Action Task Poster” to hang in classroom

Satellite Model supplies: (have students bring in these prior to the lesson)
- Cardstock paper
- Cardboard
- Aluminum foil
- Bamboo skewers and chopsticks
- Pipe cleaners
- Paper towel/toilet paper roll holders
- Recycled water bottles and bottle caps
- Straws
- Circuit boards from broken electronics
- Cell phones and electronics (use your judgement on this)
- Tape, glue, scissors
- Miscellaneous supplies

Preparation
- Make copies and assemble the Engineering Design Journal (one per student)
- Familiarize yourself with the engineering design process and Engineering Design Journal.
- Set ground rules for group work and team expectations.
- Collect satellite model supplies.
- Watch the BEST: Engineering Design Process Professional Development Series (recommended)
- Preview So You Want to Build a Satellite on PBS Learning Media:

Resources
NASA:
- Satellite images and data to elicit student interest from the NASA Earth Observatory website:
  http://www.earthobservatory.nasa.gov/
- NASA Science Earth, Missions website: http://science.nasa.gov/earth-science/missions/
- NASA: What is a Satellite? Website:
  http://www.nasa.gov/audience/forstudents/5-8/features/what-is-a-satellite-58.html#.VYtO7fVi kp
Session One:
1. Share the NASA Science Earth, Missions website to show the diversity of scientific missions NASA satellites pursue. Inform the class that NASA is interested in having students from Hawaii design scientific research plans on endangered and threatened species in Hawai‘i. NASA requests student teams to:
   ● Develop an ESS Research Mission called Mission: Hawai‘i
   ● Design a satellite prototype that would collect data to study and protect a threatened or endangered species from Hawai‘i

2. Pass out the “Engineering Design Journal” and provide students a quiet moment to look through the journal. Teams will use this journal to design and construct an Earth orbiting satellite to study one of the following threatened or endangered species from Hawai‘i: Hawaiian monk seal, hawksbill sea turtle, bristle-thighed curlew, silversword, Hawaiian tree snails, tiger shark.

3. Inform students that this is a research mission to study a problem that faces a threatened or endangered species. Students will work with their team to follow the steps in this journal and take quality notes along the way as engineers. Engineers work collaboratively to design, build, refine, and communicate their project. Encourage students to work with their team to be sure they are using all the brainpower and personal strengths their team has to offer.

EXPLORE

1. Give students five minutes to sit with their teams and read through the first two pages of the “Engineering Design Journal” with their team. Project the Engineering Design Process on the board.

2. Begin a class exploration of what these steps mean, what is involved in this process? Have students think-pair-share for each step and find what they believe the process to be. Have students share out to explain what they would do if they were engineering something at their home.

3. Provide students with details they may have missed, here is a quick list to supplement their ideas.
   ● Ask: Understand the problem, state the conditions and limitations, obtain information from prior knowledge, use their species fact sheets
   ● Imagine: Brainstorm ideas, discuss the problems and possible data they could gather
   ● Plan: Choose a testable idea, draw a usable prototype, use attainable, affordable, and safe materials
   ● Create: Follow the plan, build a prototype and make it work
   ● Experiment: Collect, record, and analyze data accurately
   ● Improve: Review data, Repeat EDP process to optimize

4. Once students have understood the Engineering Design Process, have the whole class read through the Mission: Hawai‘i Engineer Team Action Task:
   ● Define a problem affecting your species that can be studied with satellite data.
   ● Identify what data would be helpful to gather and how frequent the satellite would gather the data points.
   ● Design, plan and draw three satellites with your team. Include all the parts of a satellite.
   ● Discuss the three designs and choose one for your building project and oral presentation.
- Construct a prototype of the satellite (model) using household and recycled items.
- Discuss problems in construction and process and areas that could be improved.
- Present the satellite research mission and engineering design process to your audience.

5. Go over the information in [NASA: What is a Satellite?](#) for further background.

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**EXPLAIN**

1. Direct students to work through page 5 of their “Engineering Design Journal”. Encourage teams to use the questions on pages 2 and 3 of the journal to guide their team discussions. They can read the questions out loud to see how they apply to their mission.

2. Give teamwork time in timed increments to help with time management. A suggested timeline for page 5 is:
   - Define the problem - 12 minutes
   - Do background research, brainstorm solutions, choose the best solution - 15-20 minutes

3. Close the day by revisiting the “Mission: Hawai‘i Engineer Team Action Task” poster.

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**EXTEND**

Session Two:

1. Reassemble teams and as a group read through the Action Task Poster. Conduct a quick check to see where different teams are in the Engineering Design Process. Ask students to describe how they were able to collaborate on their mission so far and describe there have been any challenges.

2. Mention that teams will be giving an oral presentation at the end of the mission to an “authentic audience” and explain who you have invited to view their Mission: Hawai‘i projects.

3. Have a discussion about criteria for the project. What do students know? Discuss how criteria are guidelines or specifications that are set before designing. If you keep these in mind throughout the design process, you will create a design that meets the requirements. Every time engineers make a design decision, they can measure them against criteria. Criteria are generally written as: “the ___, the better”. NASA has set the criteria for Mission: Hawai‘i. These criteria are: addresses research mission question, easy to build, cost, and durability.

4. Have each team member do one quality drawing of a satellite plan. Within a team, students should copy another design until each team member has three different drawn plans in their journal. Remind them to meet the criteria and include all the parts of the satellite. This is all included in the “Engineering Design Journal”. Foster collaboration by suggesting that in order for a satellite to work effectively, several different subsystems must work together and many different engineers and technicians must collaborate to launch a successful satellite. Students will need to choose one design to build OR merge their designs into a group plan.

5. Have students get approval from their entire team and the teacher for their model satellite design before construction begins.

6. Give teamwork time in timed increments. A suggested timeline for pages 6-10 is:
   - 3 satellite plans - 20 minutes
- Satellite construction time - 30 minutes
- Prepare the group presentation - 20 minutes

7. Some students may want to construct the model satellite at home with household and recycled materials, allow this if possible to promote family involvement and kindle student interest. Some teachers may find it helpful to only have one construction work time dedicated to the building of the models, this may make cleanup easier.

8. Give time for the students to test and and revise their model satellite as the steps: experiment and improve are important parts of the engineering design process.

**EVALUATE**

Session Three:
1. Begin with a class check-in to see how teams are progressing with *Mission: Hawai‘i*. Revisit the “Mission: Hawai‘i Engineer Team Action Task” poster as needed.

2. Before teams begin to prepare their oral presentation, bring the whole class together to preview the scoring rubric. Explain that the rubric is included for both teacher scoring and self-scoring purposes and that students will be asked to score themselves after their team oral presentation.

**Engineering Design Journal - Design a Satellite Mission Rubric:**

<table>
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<td>Team generally worked together but had a few problems collaborating</td>
<td>Team worked collaboratively and solve internal problems independently</td>
</tr>
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<td><strong>Engineering Design Process</strong></td>
<td>Team could not follow the steps of the engineering design process outlined in the journal</td>
<td>Team followed the steps of the engineering design process outlined in the journal</td>
<td>Team followed the steps of the engineering design process outlined in the journal and produced quality work</td>
<td>Team followed the steps of the engineering design process outlined in the journal and produced quality work and helped other teams succeed</td>
</tr>
<tr>
<td><strong>Satellite Prototype</strong></td>
<td>No satellite prototype was built</td>
<td>Satellite prototype is complete but rushed and sloppy</td>
<td>Satellite prototype is complete and well made</td>
<td>Satellite prototype is complete and of excellent quality and construction</td>
</tr>
<tr>
<td><strong>Team Presentation</strong></td>
<td>Presentation not complete, not all members participated, very limited information</td>
<td>Limited presentation with satellite mission and engineering information shared</td>
<td>Complete presentation with satellite mission and engineering information shared</td>
<td>Excellent presentation with satellite mission and engineering information shared</td>
</tr>
<tr>
<td><strong>Student interest</strong></td>
<td>Does not show interest in the <em>Design a Satellite Mission</em> activity</td>
<td>Shows some interest in the <em>Design a Satellite Mission</em> activity</td>
<td>Puts effort into the <em>Design a Satellite Mission</em> activity and making a quality product</td>
<td>Shows maximum interest in the <em>Design a Satellite Mission</em> activity and making a quality product</td>
</tr>
</tbody>
</table>

3. Have student teams work on page 9 of the Engineering Design Journal where they will plan their oral presentation. Reinforce the questions with students and circulate through the teams to be sure each member is having a chance to participate.

4. Prepare Group Presentation and have students use the questions below to guide their 3-5 minute presentation. All group members need to contribute and participate in the presentation.

© Bishop Museum, 2015.
• What species did you choose to study?
• What problem does your research mission address?
• What is your research question?
• What data have you chosen to gather from the satellite?
• What instruments are you using, or have you “invented”?
• What materials did you use to construct your satellite?
• Give an example of how your team collaborated.
• Give an example of a challenge your team encountered.
• What changes or improvements would you make to your research mission?
• As a team what did you learn from going through the design process?

5. Optional closing activity: as a way to evaluate if the lesson met the instructional objectives have each student create a reflective entry in their science notebook. Write the two essential questions on the whiteboard. Have students write quietly and independently in their science notebooks for ten minutes to answer at least one of the following questions:

• In what ways can Earth system scientists use satellite data to study and solve problems in Hawai‘i?
• How can satellites study and protect threatened and endangered species in Hawai‘i?

6. Students will share their writing with a neighbor and then select a few students to read their writing to the class as time permits.
‘Ōlelo No‘eau

A collection of Hawaiian proverbs, translated and annotated by Mary Kawena Pukui, offers a unique opportunity to savor the wisdom, poetic beauty, and earthy humor of finely crafted expressions.

*Ma ka hana ka ‘ike. (Hawaiian proverb)*

*In working one learns. (English translation)*

Welina mai! Welcome! The Bishop Museum collections curators pictured above are experts in their fields. They have embodied this ‘Ōlelo No‘eau of “Ma ka hana ka ‘ike” as they worked with the Bishop Museum collections to build their knowledge base and their experience. This proverb connects with *Mission: Hawai‘i* because by doing hands-on work, building something, or designing a solution, one learns more deeply. In this lesson students engage in the engineering design process to build a satellite prototype, and in so doing, they will learn substantially.

**DIFFERENTIATION**

**Emerging Learners**
- Arrange student groups with different skill levels so student help is given by peers. Partner emerging learners with students who will support their success.
- Review the engineering design process step by step, and check in with these students after each and every step to ensure they have support.
- Read with the student and adjust the workload to suit the learner’s needs.

**Advanced Learners**
- Encourage advanced students to take the Mission: Hawai‘i project home for family involvement and to continue research at home.
- Allow these students to go through multiple iterations of the design process to perfect their prototype.
- Ask advanced learners to write invitations to the *Mission: Hawai‘i* Oral Presentations for an engineer, scientist, the principal, the librarian, or parents to show the importance of their work with Earth system science.

**English Language Learners**
- Arrange student groups with different skill levels so student help is given by peers. Partner ELL students with students who will support their success.
- Review the engineering design process step by step, and check in with these students after each and every step to ensure they have support. Read with the student and adjust the workload to suit the learner’s needs.
• Allow students to verbally share their answers to the *Engineering Design Journal* sections with a peer prior to writing it down. Encourage use of diagrams along with written notes in their science notebooks.
• This lesson is very hands-on and allows ELL students to engage with fewer language barriers.

### EXTENSIONS

• Video tape students making their satellite models and interview them for brief clips as they work and discuss. These can later be made into a quick class movie with snippets from the design process, the building, and the oral presentations.
• Allow groups to use recycled cardboard to build a larger scale model of their prototype. Have them research what the instruments for data collection really look like and challenge them to create these as well. Be sure students measure and build to scale from their original prototype.
• “There’s an app for that!” Have students find or create an app to go with their satellite design that matches the data they have chosen to collect (ex. surf, temperature, rainfall, ocean currents, seismic activity, etc.)

### STANDARDS

**Next Generation Science Standards**

**Crosscutting Concepts:**
• Systems and System Models - In grades 3-5, students understand that a system is a group of related parts that make up a whole and can carry out functions its individual parts cannot. They can also describe a system in terms of its components and their interactions.
• Scale and Proportion - students recognize natural objects and observable phenomena exist from the very small to the immensely large. They use standard units to measure and describe physical quantities such as weight, time, temperature, and volume.

**Science and Engineering Practices:**
• Asking questions (for science) and defining problems (for engineering)
• Developing and using models
• Using mathematics and computational thinking
• Designing solutions (for engineering)
• Obtaining, evaluating, and communicating information

**Disciplinary Core Idea:**
• 5-ESS2-1 Earth’s system
  Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.
• 5-ESS3-1 Earth and Human Activity
  Obtain and combine information about ways individual communities use science ideas to protect the Earth’s resources and environment. The performance expectations above were
• 5-ESS3-1 Engineering Design
  - 3-5-ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
  - 3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- 3-5-ETS1-3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

**Common Core**

**English Language Arts:**
- 5.RI.4 Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 5 topic or subject area.
- 5.RF.4 Read with sufficient accuracy and fluency to support comprehension.
- 5.W.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

**Hawaii Content & Performance Standards III**

**Science:**
- SC.5.2.1 Use models and/or simulations to represent and investigate features of objects, events, and processes in the real world.

**Social Studies: Geography:**
- Standard 7 World in Spatial Terms-Use geographic representations to organize, analyze, and present information on people, places, and environments and understand the nature and interaction of geographic regions and societies around the world

**General Learner Outcomes**
- Community Contributor
- Complex Thinker
- Quality Producer
- Effective Communicator
- Effective and Ethical User of Technology

**ADDITIONAL RESOURCES**


**REFERENCES**


So, You Want to Build a Satellite: Part Two. (n.d.). Retrieved June 24, 2015, from: https://www.youtube.com/watch?v=Ti-4sB3mEb8


BACK TO TOP
Mission: Hawai‘i

Engineer Team Action Task:

- Define a problem affecting your species that can be studied with satellite data.

- Identify what data would be helpful to gather and how frequent the satellite would gather the data points.

- Design, plan and draw three satellites with your team. Include all the parts of a satellite.

- Discuss the three designs and choose one for your building project and oral presentation.

- Construct a prototype or model of the satellite using household and recycled items.

- Discuss challenges in construction and process and areas that could be improved.

- Present the satellite research mission and engineering design process to your audience.
**ENGINEERING DESIGN JOURNAL**

*Design a Satellite Research Mission*

Use this journal to design and construct an Earth orbiting satellite to study one of the following threatened or endangered species from Hawai‘i.

- Hawaiian monk seal
- Hawksbill sea turtle
- Bristle-thighed curlew
- Silversword
- Hawaiian tree snails
- Tiger sharks

This is a *research mission* to study a problem that faces your threatened or endangered species. Work with your team to follow the steps in this journal and take quality notes along the way to act like an engineer. Remember, engineers work collaboratively to design, build, refine, and communicate their project. Work with your team to be sure you are using all the brainpower and strengths your team has to offer.

**Zoom in on Hawaii**

For this journal you will act like both an engineer and an Earth system scientist. What data can you gather from a satellite to study and possibly solve a problem that affects your species? Put together all you know so far about the four spheres (atmosphere, geosphere, hydrosphere, and biosphere) and choose data to collect that will study and protect your species.

**Engineer Team Action Task:**

- Define a problem affecting your species that can be studied with satellite data.
- Identify what data would be helpful to gather and how frequently the satellite would gather this data.
- Design, plan and draw three satellites with your team.
- Discuss the designs and choose one to building and explain in an oral presentation.
- Construct a prototype (model) of the satellite using household and recycled items.
- Note and discuss challenges during the construction and group design process that could be improved.
- Present the satellite research mission and engineering design process to your audience in an oral presentation.
This is a chance to use your CREATIVITY. The sky is the limit! Use your imagination to solve problems and think outside of the BOX.
Here are some questions to get you thinking. These questions are based on the engineering design process and will help guide your team discussion and give you prompts to help you explain your thinking.

**Ask Questions to Define the Problem**
- What kinds of problems affect your species?
- Which problem will your team focus on for the project?

**Make Observations and Do Background Research**
- What patterns can you observe?
- What factors influence these patterns? (weather, humans, predators, habitat, food sources…)

**Gather information about the situation**
- How can you get more information? (Use the fact sheet, discuss and research more with your team.)

**Imagine and Create: Brainstorm and Create Solutions to Address the Problem**
- How can you study this problem with a satellite?
- What would your team need?
- What information do you still want to know?
- What data do you need to collect?
- What is your research mission question?
Design, Plan, and Engineer your Solution
• What materials and technology do you want to use and why?
• How can you create an invention to measure something new?
• What instruments will you include on your satellite and why?
• Draw your plan and label the parts with your team.
• Have another team review your plan and give your team feedback.
• Improve your team plan together.

Build Your Satellite Prototype
• Test out the satellite. Experiment and Improve.
• How does it work to address your mission question?
• What improvements would you like to make and why?

Share the Results
• Which species did you choose to study?
• What problem does your research mission address?
• What is your research question?
• What data have you chosen to gather from the satellite?
• What instruments did you use, or have you “invented”?
• What materials did you use to construct your satellite?
• Give an example of how your team collaborated.
• Give an example of a challenge your team encountered.
• What improvements would you make to your research mission?
• As a team, what did you learn from going through the design process?

Criteria for Satellite Success
• Addresses research mission question
• Durability
• Easy to construct
Define The Problem

What species will you be studying? (common name, Hawaiian name, scientific name)
___________________________________________________________________________
___________________________________________________________________________

List some reasons this species is endangered.
___________________________________________________________________________
___________________________________________________________________________

What are 2 key issues facing this species? (list 2 big issues)
___________________________________________________________________________
___________________________________________________________________________

List some problems that this species faces: (problems are more specific than issues)
___________________________________________________________________________
___________________________________________________________________________

Do Background Research, Brainstorm Solutions, Choose the Best Option

Choose one problem to study and possibly solve with your satellite research mission.
___________________________________________________________________________
___________________________________________________________________________

What data will you collect?
___________________________________________________________________________
___________________________________________________________________________

How long will you collect the data?
___________________________________________________________________________
___________________________________________________________________________

What question do you want to answer?
___________________________________________________________________________
___________________________________________________________________________
Design, Plan, and Engineer Your Prototype

You are designing a Satellite Research Mission to study one question about your chosen species. Work with your team to draw out three plans and incorporate all the needed parts of a satellite.

**Satellite Parts to Include:**
- Solar Panels
- Batteries
- On-board instruments and processors
- Rocket Motors
- Antennas and transceivers
- Fuel Tanks

**Design criteria:**
- ☐ Addresses research question
- ☐ Easy to build
- ☐ Durable
**Design #2**

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<td>Rocket Motors</td>
<td>Fuel Tanks</td>
</tr>
</tbody>
</table>

Design criteria:

- [ ] Addresses research question
- [ ] Easy to build
- [ ] Durable
Design #3

Satellite Parts to Include:
- Solar Panels
- Batteries
- On-board instruments and processors
- Rocket Motors
- Antennas and transceivers
- Fuel Tanks

Design criteria:
- [ ] Addresses research question
- [ ] Easy to build
- [ ] Durable
Build Your Satellite
A prototype is a model of an engineering design. You will construct a prototype of your selected satellite plan. Use household and recycled items with your team and build for the criteria:

- Addresses research mission question
- Durable
- Easy to build

Take notes about the challenges during construction.

______________________________
______________________________
______________________________

Prepare Group Presentation
Share your satellite research mission with your audience. Use the questions below to guide your 3-5 minute presentation. All group members must participate in the presentation. A rubric is included for scoring and self-scoring purposes.

- Which species did you choose to study?
- What problem does your research mission address?
- What is your research question?
- What data have you chosen to gather from the satellite?
- What instruments did you use, or have you “invented”?
- What materials did you use to construct your satellite?
- Give an example of how your team collaborated.
- Give an example of a challenge your team encountered.
- What improvements would you make to your research mission?
- As a team what did you learn from going through the design process?
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<td><strong>Team Presentation</strong></td>
<td>Presentation not complete, not all members participated, very limited information</td>
<td>Limited presentation with satellite mission and engineering information shared</td>
<td>Complete presentation with satellite mission and engineering information shared</td>
<td>Excellent presentation with satellite mission and engineering information shared</td>
</tr>
<tr>
<td><strong>Student Interest</strong></td>
<td>Does not show interest in the Design a Satellite Mission activity</td>
<td>Shows some interest in the Design a Satellite Mission activity</td>
<td>Puts effort into the Design a Satellite Mission activity and making a quality product</td>
<td>Shows maximum interest in the Design a Satellite Mission activity and making a quality product</td>
</tr>
</tbody>
</table>

Student self score in pencil. Total Points: Teacher score in pen. Total Points: