Science and Innovation
A Boeing/Teaching Channel Partnership
CUBESATS
Teacher Handbook
### Grade Level
Grade 5

### Lesson Length
Two 50-minute sessions

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### Lesson Overview

On Days 9 and 10, students develop, refine, and deliver mock proposals to NASA. Students develop an oral presentation that is augmented with visuals, including their CubeSat model, the model drawings, and any other visuals desired. The presentations should answer the Presentation Questions.

### Presentation Questions

Each presentation should answer the following questions:

- **What is the payload for your team's CubeSat?**
- **What does the payload measure, and how did your team determine its components?**
- **How have you refined the design of your CubeSat to optimize its productivity and power?**
- **What new learning and information did you incorporate into your overall design and presentation?**

On Day 9, students write the proposal in their engineering team pairs, and on Day 10, using their own CubeSat models and diagrams, they present their proposals. Ideally, presentations are given to a panel of parents or other invited adult guests. The panel should provide specific feedback on the presentations, including the Presentation Feedback Criteria shown below.

### Presentation Feedback Criteria

Feedback should include how well each team:

- **Describes their CubeSat technology**
- **Addresses their engineering design challenge**
- **Configures their choice of payload**

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### Helpful Tip

Consider providing a student handout with the Presentation Questions for each student team.

### Helpful Tip

Consider providing a handout for panel members that includes the Presentation Questions and Presentation Feedback Criteria.
Connecting to the Next Generation Science Standards

On Days 9 and 10, students demonstrate understanding of the performance expectations and three dimensions developed throughout the entire module. This lesson serves as a performance assessment in which all of the performance expectations and dimensions are addressed in the final presentation. Refer to the performance expectations, disciplinary core ideas, science and engineering practices, and crosscutting concepts referenced in the front matter of this module.

Basic Teacher Preparation

The culminating project assumes that students present their proposals to an authentic audience. Ideally, this would include adults from outside the classroom. Audience members could be other teachers, parents, or volunteers (engineers) from the community. Secure the participation of audience members in advance.

<table>
<thead>
<tr>
<th>Required Preparation</th>
<th>Links/Additional Information</th>
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<tbody>
<tr>
<td>Gather or purchase all required materials for the lesson</td>
<td>Refer to the Materials List below</td>
</tr>
<tr>
<td>Make arrangements to have a panel of guests in attendance for student presentations</td>
<td></td>
</tr>
<tr>
<td>Review suggested teacher preparation resources</td>
<td>Refer to the Suggested Teacher Resources at the end of Day 10</td>
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Materials List

<table>
<thead>
<tr>
<th>Item</th>
<th>Description/Additional Information</th>
<th>Quantity</th>
<th>Where to Locate/Buy</th>
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<tbody>
<tr>
<td>Science notebooks or loose-leaf paper</td>
<td></td>
<td>1 per student</td>
<td>Available in most schools</td>
</tr>
<tr>
<td>Artifacts from the module’s earlier design tasks</td>
<td>Students will have created these artifacts already</td>
<td>Several items for each team</td>
<td>Previously created by students</td>
</tr>
<tr>
<td>Presentation Rubric</td>
<td></td>
<td>1 per student</td>
<td>CubeSats Teacher Handbook, Appendix C</td>
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Day 9: NASA Proposal

Introduction (10 minutes)

Today (Day 9), students use technology to optimize their CubeSat models based on the criteria of each team’s specific mission. Students received this information on Day 7.

Announce that NASA offers a “free ride” into space for CubeSats that serve an educational purpose. During the next and final lesson (Day 10), each design team presents their NASA proposal to a panel of engineers, teachers, and/or parents who are qualified to evaluate each team’s CubeSat and determine if it should qualify for a free ride into space.

The panel members use the Presentation Rubric (Appendix C), which is based on ELA Speaking and Listening standards. Panel members and students should receive a copy of the Presentation Rubric ahead of time.

Design Work: Final Presentation (40 minutes)

Students have the rest of the class session to refine their physical CubeSat model and diagrams, and to create a small informational poster with the name of their mission and an explanation of what their mission will accomplish. This piece gives students a bit of freedom and creativity within the constraints. Student teams should also prepare a brief presentation explaining their process, the hopes they have for the mission, and the design choices they made.

Review the CubeSat Presentation Guidelines below, which lists presentation expectations. Also distribute the CubeSat Presentation Rubric (Appendix C) so students understand the evaluation criteria.

CubeSat Presentation Guidelines

Your team’s presentation must:

- Explain why your CubeSat mission will be a success
- Include a 3-minute oral presentation that explains your engineering process, the design features of your CubeSat (matched to its mission), and an overview of the CubeSat payload
- Include a role for each person on your team in the presentation
- Include the actual model of your CubeSat
- Include samples of the model or blueprints used by your team
- Provide any other visuals that would make the presentation interesting

Be sure that your presentation answers the following:

- What is the payload for your team’s CubeSat?
- What does the payload measure, and how did your team determine its components?
- How have you refined the design of your CubeSat to optimize its productivity and power?
- What new learning and information did you incorporate into your overall design and presentation?
Day 10: NASA Proposal

Whole Group Discussion: Final Presentations (50 minutes)

Each pair of students has a maximum of 5 minutes to give their presentation to a panel of parents, teachers, and community members. This “NASA Board” will provide students with feedback after each presentation. Also consider having students provide feedback to each other.

Assessment

The final presentation can be used as a summative assessment for the module. Reference Appendix B for suggestions for meeting the needs of all learners.

Community Connections

Professionals from the community can be invited to serve as part of the NASA panel of experts. If community members are able to participate in the panel, be sure to give them the Presentation Questions (Day 9), Presentation Feedback Criteria (Day 9), and Presentation Rubric (Appendix C) ahead of time. A set of 5 to 10 scaffolded questions would also be appropriate to give to the community members to guide the Q&A session after each group’s presentation. Be sure to limit the Q&A feedback time to 2 minutes per group so every group can present during one class period.

Suggested Teacher Resources

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<th>Meeting the Needs of All Learners</th>
<th>CubeSats Teacher Handbook, Appendix B</th>
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<td>Presentation Rubric</td>
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<td>Presentation Questions</td>
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<td>Presentation Feedback Criteria</td>
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