Coach Guide | **Elementary Level**

Design Packet for OPSPARC Missions

Be the spark to a new NASA spinoff!

https://opsparc.gsfc.nasa.gov/

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Design Process Steps

1. ASK

- What is the problem?
- What have others done?
- What are the criteria and constraints?

2. IMAGINE

- What are some solutions?
- Brainstorm ideas.
- Choose the best.

3. PLAN

- Make a plan or draw a diagram.
- Make a list of materials you will need.

4A. BUILD/CREATE

- Follow your plan and build it.

4B. TEST AND EVALUATE

- Test it out!
- Record results.

4C. REFINE DESIGN

- If necessary, make changes to improve it.

4. CREATE

5. SHARE

- Explain your ideas to others.

Coach Project Checklist

1. Assist students with registration. All students need parent/guardian consent.

REGISTRATION OPTIONS:

- Students sign up individually online. They will need to know their parent/guardian email or have their parent/guardian present.
- Coach sends home "Letter to Parent."
- Coach initiates registration. Parent consent still required. See Forms & Materials at OPSPARC website.
- For those not able to register and/or give permission online, use the Online Registration form. See Forms & Materials at OPSPARC website.

2. Carefully review rules, timeline, and guidelines found at the website.

3. Use this Guide to help students complete OPSPARC tasks. Review the rubric with students to help students understand how their work will be assessed.

4. Help students submit their final projects by the due date *.

5. Three individuals or teams will be selected as semifinalists. The top two semifinalists will have the chance to work with a scientist from the Mad Science Research and Development team to design and practice a 5-minute presentation showcasing and selling their spinoff design. Students will deliver the presentations virtually to a panel of NASA and industry researchers.

6. The winning individual or team will be selected based up the virtual presentations and invited to NASA's Goddard Space Flight Center for workshops and an award ceremony.

* See website for dates

Coaches:

Use this step-by-step guide to support elementary students (grades 3-6) through the OPTIMUS PRIME Spinoff Promotion and Research Challenge.

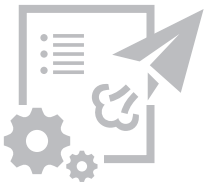
Students will:

- Create a Mission Patch through a team-building activity;
- Discover spinoffs in the world around them through research and a scavenger hunt;
- Think like engineers and design a spinoff that solves a problem; and
- Organize and share their thinking through text, graphics, video, and their own website using Adobe Spark tools.

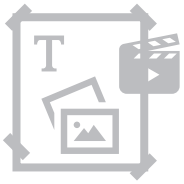
Your students have access to the Adobe Spark suite of production tools. The final product for this mission, a website, will be created within Adobe Spark Page. Tasks described within this guide may be created using Adobe Spark Post (for graphics) and Adobe Spark Video (for video production). You and your students may choose to use other graphics and video editors, but the final product, the website, must be developed within Adobe Spark Page.

Introduce the Mission using this Mission Scenario

Your Mission:
OPTIMUS PRIME wants you to search for NASA spinoff technology in your world and test your skills at changing an everyday object into something that will make your world a better place!



Just like an engineer, you will use an Engineering Design Process to take an everyday object and creatively use it in new ways to solve a problem.



You will need to use text, images, and videos to create an Adobe Spark Page webpage to help explain your ideas. This final product will be shared with NASA.

Help students work through the following tasks to complete their Spark Page.

TEAM BUILDING TASK

Design Team Mission Patch

Background: Teamwork is an important component to any successful NASA mission. Each crewed mission into space requires a hand-picked team of astronauts. One of the first tasks for the crew is to work with a graphic designer to create a patch that represents the unique talents of the crew and the challenges of their mission. The mission patch includes all of the crew names and the graphic design depicts aspects of the mission and important attributes of each team member.

Share this example with students:

Space Transportation System (STS) - 114 (July 2005)
The STS 114 patch design signifies the return of the Space Shuttle to flight and honors the memory of the STS-107 Columbia crew.

- The blue Shuttle rising above Earth's horizon includes the Columbia constellation of seven stars, echoing the STS-107 patch and commemorating the seven members of that mission.
- The crew of STS-114 will carry the memory of their friends on Columbia and the legacy of their mission back into Earth orbit.
- The dominant design element of the STS-114 patch is the planet Earth, which represents the unity and dedication of the many people whose efforts allow the Shuttle to safely return to flight.
- Commander Eileen Collins and Pilot James Kelly are named at the top of the insignia, with Mission Specialists Wendy Lawrence and Charles Camarda named below.
- Against the background of the Earth at night, the blue orbit represents the International Space Station (ISS).
- Mission Specialists Soichi Noguchi, Stephen Robinson and Andrew Thomas, who worked on the Station during spacewalks, are named on the orbit.
- The red sun on the orbit signifies the contributions of the Japanese Space Agency to the mission and to the ISS program.
- The multi-colored Shuttle plume represents the broad spectrum of challenges for this mission, including Shuttle inspection and repair experiments, and International Space Station re-supply and repair.

Task.
Production Tool: Adobe Spark Post or other graphic editor .
Use the Elementary Student Design Packet to guide students through the design of their OPSPARC team mission patch.

Their mission patch must:

- Include images that reflect something about EACH member of the team.
- Include images that represent NASA OPSPARC.

The team must also write or record an audio or video message for others that uses the mission patch to introduce the team.

Resources:
To help students better understand the process, share this NASA eClips video,
Our World: Mission Patches -- https://nasaeclips.arc.nasa.gov/video/ourworld/our-world-mission-patches
This video chronicles how Space Shuttle astronauts designed their mission patches to tell the story of each shuttle mission.

Tip:
Teams are often most successful when each member of the team takes an active role to support the team.

For this mission patch project AND for all OPSPARC tasks, consider assigning roles for the students. Some possible roles are listed below:

- Task Manager -- responsible for making sure the tasks are completed
- Researcher -- responsible for gathering information and research
- Recorder -- responsible for taking notes and recording ideas
- Graphic Designer -- responsible for creating images
- Materials Manager -- responsible for gathering and returning materials

Be sure each team posts these items in their Adobe Spark Page:

- An image of the team mission patch; and
- The description and team introduction in text, audio, or video.

TASK Spinoff Scavenger Hunt[2]

Help students follow the directions found in the Student Design Packet. For this task, students conduct scavenger hunts through:

- Spinoff resources gathered in the Resource Section on the Website. One engaging resource is the NASA Home & City website (https://homeandcity.nasa.gov/)
- In their home or community.

- Help students use Adobe Spark Post to create the Spinoff Collage that will be included in their team's Adobe Spark Page.
- Be sure students label the collage and give a brief explanation of what is represented in the image.

TASK Engineering a New Innovation

Use the Student Design Packet to guide students through these design steps.

ASK

Choose an everyday object that may be used in a new way to make the world a better place. Help students consider these questions:

- What problem will the spinoff design solve?
- What everyday object will be used?
- What criteria (requirements) must be followed in the design of the spinoff?
- What constraints (limitations) may need to be followed?

IMAGINE

Help students brainstorm new ways that they may use the object so that it can solve an identified problem. At this stage, students should discuss and sketch multiple ideas, recording their thinking in their Student Design Packet.

Tip:
Ask students to begin this step with individual brainstorming. Then, once students have their own ideas, ask each student to report their ideas to the group. As a team, the group should piece together ideas from EVERYONE's initial ideas and develop a TEAM solution.

PLAN AND CREATE

Ask students to work as a team to develop a plan to build their model. Once the plan is in place, encourage students to build a model of their team solution.

IMPROVE

Facilitate a Design Review session. Ask students to present their models and ideas to other groups. Ask each group to:

- Demonstrate how your model works. Did it do what you expected?
- Explain why you selected the materials for the model. What other materials might be better?
- What changes might improve the model?

Ask students to make changes to their model based upon the Design Review.

***Note:** The work the students complete in their Design Packets guides them through an engineering design process. Their ideas will be synthesized in a video within the next task (Share the Innovation) and posted to their Adobe Spark Page.

TASK

Share the Innovation

SHARE

Production Tool: Adobe Spark Page; Adobe Spark Video or another video editor.
Ask students to create a video (<3 minutes) that includes the work they've completed in their Design Packet. Students may use Adobe Spark Video to edit and produce this video.

These items must be included in the video:

- An explanation of the problem and why it needs to be solved.
- A description of how the spinoff works and how it will solve the problem.
- A discussion of the strengths and weaknesses of the spinoff model.
- A description of how the design has been improved from the original prototype.
- A description of what the team has learned through trial and error.

Tip:
Prior to students submitting their final product, ask each team to review their own work using the RUBRIC. This rubric will be used to select the semifinalists.

Help students include this video in their Adobe Spark Page:

- Be sure students post the problem statement and video.
- Ask them to include a brief introduction to the video, in text, for their viewers.

RUBRIC

Elementary Level

NASA OPSPARC Final Product	
Category	**Score**
Team Building Task: Mission Patch (8 pts)	
• Image of an original mission patch.	(__ /4)
• Introduction of each team member and description explaining the mission patch in text, audio, or video.	(__ /4)
Spinoff Scavenger Hunt[2] (8 pts)	
• Collage includes 8 - 10 spinoffs	(__ /4)
• The images are real (not from the Internet)	(__ /4)
Share Your Designs (20 pts)	
• A video (<3 min) includes these components:	
◦ The problem and why it needs to be solved.	(__ /4)
◦ How the spinoff invention works.	(__ /4)
◦ Strengths and weaknesses of the spinoff.	(__ /4)
◦ Ways to improve the design.	(__ /4)
◦ What was learned through trial and error.	(__ /4)
	_____ /36
***Note: Judges may award up to 8 additional points for unique and exceptional work. (__/8)	Total: _____ /44

Assessment

4 (Excellent) = All criteria (procedures, steps, and details) are met or followed.
3 (Good) = Most criteria are met with only a few errors.
2 (Fair) = Many criteria are met, but work has significant errors.
1 (Poor) = Most criteria are not met.
0 (No effort) = No effort to meet criteria.

Semifinalists Selected for "Live" Presentations

Using the rubric included in this packet, three individuals or teams will be selected as semi-finalists. TWO of the THREE semi-finalists will work with a scientist from the Mad Science Research and Development team to design a 5-minute presentation showcasing and selling their spinoff to a panel of NASA and industry partners.

The teams will be introduced to the Mad Science scientist by email. You will be included in all email correspondence. Please encourage the students to communicate and work with this scientist.

The Mad Science scientist will share expectations for the presentation and the rubric that will be used to evaluate this work with you and the semifinalists.

The winning team will be:
- Selected based upon these presentations; and
- Invited to NASA's Goddard Space Flight Center for tours, workshops and an award ceremony.