

DESIGN A CREW EXPLORATION VEHICLE

OBJECTIVE

To demonstrate an understanding of the Engineering Design Process while utilizing each stage to successfully complete a team challenge.

CHALLENGE

The teams' challenge is to design and build a Crew Exploration Vehicle (CEV) that will carry two cm-sized passengers safely and will fit within a certain volume (size limitation). The CEV will be launched in the next session.

PROCESS SKILLS

Measuring, calculating, designing, evaluating.

MATERIALS

General building supplies and tools
2 small plastic people

STUDENT WORKSHEETS

Imagine and Plan
Experiment and Record



MOTIVATE

- Show the NASA BEST video titled "Repeatability":
<http://svs.gsfc.nasa.gov/goto?10515>
- Ask the students why it is important to test their own designs.

SET THE STAGE, ASK, IMAGINE, PLAN

- Share the *Design Challenge* with the students.
- Remind students to *imagine* and *plan* before building. . Ask them to list the challenges they face in meeting the design constraints. Why should they not tape or glue the people in place?

CREATE

- Challenge the teams to build their CEVs based on their designs. Remind them to keep within specifications.

EXPERIMENT

- Each team should conduct two drop tests from about 1 meter. The students can simply hold the CEV model over their heads and drop it. They should record their results after each test, and note what changes they plan to make as a result of the drop test.

IMPROVE

- After each drop test, the students should *improve* the CEV models based on the results of the experiment.

CHALLENGE CLOSURE

- Ask the students, *What was the greatest challenge for your team today?*

PREVIEWING NEXT SESSION

Ask teams to bring back their CEV model for use in next session's challenge. You may want to store them in the classroom or have one of the facilitators be responsible for their safe return next week.

Ask teams to think about potential launch mechanisms during the next week. Tell them they will be building a launcher out of the standard materials that have been available to them, including large rubber bands.

DESIGN CHALLENGE

Taking humans back to the Moon...40 years later!

NASA needs a vehicle to take people to the Moon. The Space Shuttle cannot do that, because it was never designed to leave the Earth's orbit. NASA scientists and engineers are working on a space vehicle that can take astronauts to the Moon, Mars, and beyond. This spacecraft is called the Crew Exploration Vehicle (CEV). The CEV is a vehicle to transport human crews beyond low-Earth orbit and back again. The CEV must be designed to serve multiple functions and operate in a variety of environments.

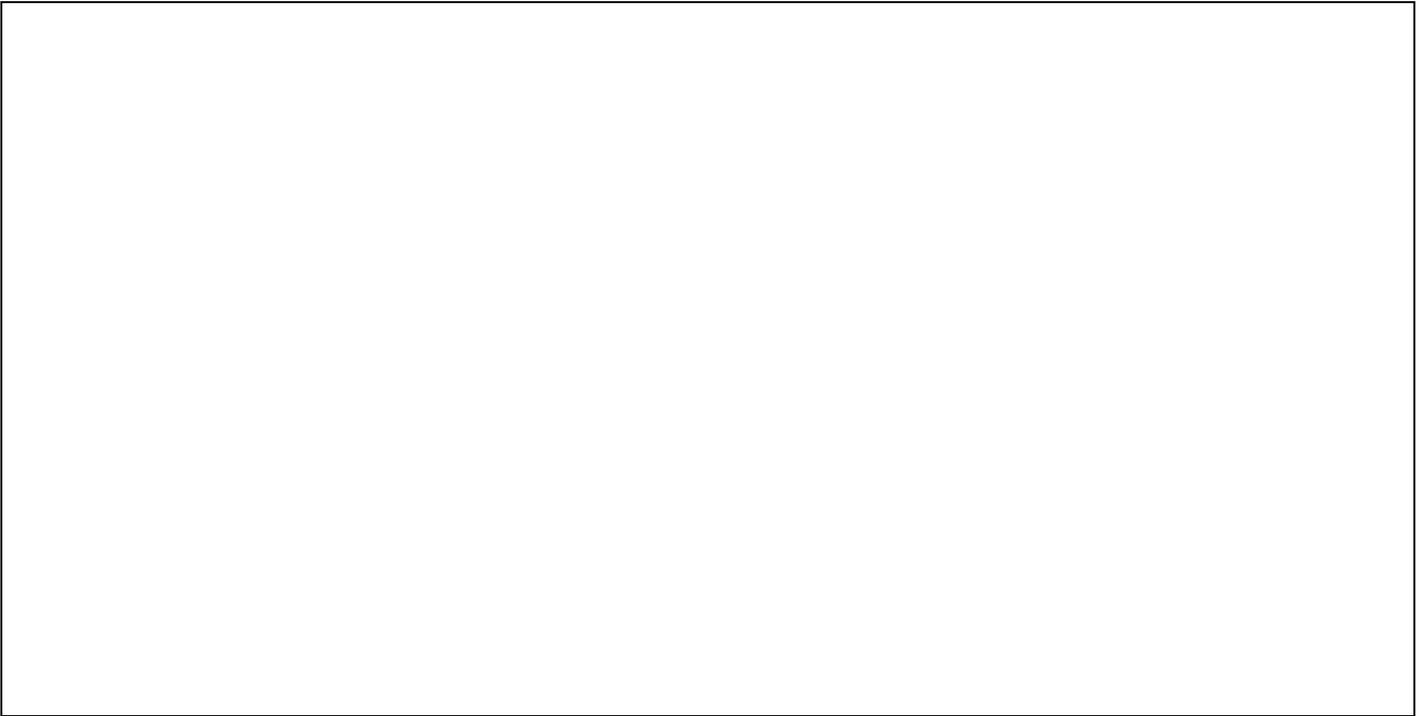
The Challenge: Design and build a *Crew Exploration Vehicle* to meet the following constraints:

1. *Safely carry two little plastic people. You must design and build a secure seat for these people, without gluing or taping them in place. The people should stay in their seats during a Drop Test from over your head.*
2. *Create a hatch that can open and close on your vehicle.*
3. *Fit within the 4" mailing tube provided (or the size constraints as indicated).*

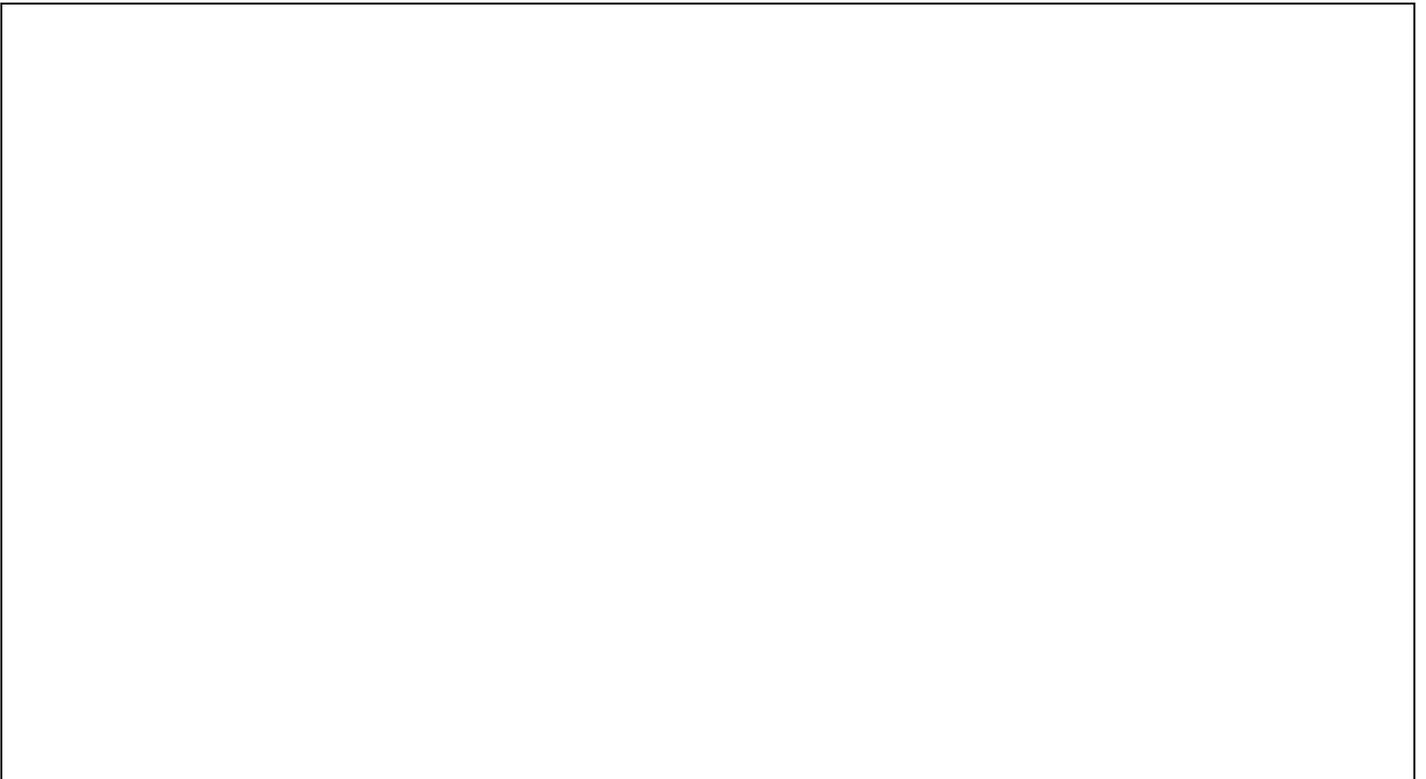


IMAGINE AND PLAN

Draw a picture of the top of your Crew Exploration Vehicle (CEV):



Draw a picture of the inside of your CEV to show where the people sit:



IMAGINE AND PLAN (continued)

Review your team's design. Answer the questions in the table.

Vehicle components	Use	Measurement or Calculation
Little plastic people	Crew	How many?
CEV	Carries crew to Moon	Does it meet the size restrictions?
Hatch	Allows entry and exit	How many people wide? How many people tall?

EXPERIMENT AND RECORD

Drop your CEV from over your head. Answer the questions in the table.

Trial Number	Results
1	Did the people stay in their seats? Did the door fly open?
2	Did the people stay in their seats Did the door fly open?

Suggest some ways you could improve your design of your CEV:
