

NASA/US DEPARTMENT OF EDUCATION STEM CHALLENGE
2013

EXPLORATION DESIGN CHALLENGE
RADIATION SHIELDING

OBJECTIVE

STUDENTS WILL USE THE ENGINEERING DESIGN PROCESS TO BUILD A PROTOTYPE RADIATION SHIELD THAT EFFECTIVELY BLOCKS SIMULATED SPACE RADIATION ON A SPACECRAFT THAT WILL CARRY ASTRONAUTS BEYOND LOW EARTH ORBIT AND ON TO AN ASTEROID OR MARS.

STEPS OF THE DESIGN PROCESS

- 1.IDENTIFY THE PROBLEM
- 2.IDENTIFY CRITERIA AND CONSTRAINTS
- 3.BRAINSTORM POSSIBLE SOLUTIONS
- 4.SELECT A DESIGN
- 5.BUILD A MODEL OR PROTOTYPE
- 6.TEST THE MODEL AND EVALUATE
- 7.REFINE THE DESIGN
- 8.SHARE THE SOLUTION

STEP 1: IDENTIFY THE PROBLEM

- STATE THE PROBLEM CLEARLY

STEP 2: IDENTIFY CRITERIA AND CONSTRAINTS

- *IDENTIFY THE CONDITIONS THAT MUST BE MET TO SOLVE THE PROBLEM
- *IDENTIFY ANYTHING THAT MIGHT LIMIT A SOLUTION, SUCH AS COST, AVAILABILITY OF MATERIALS, SAFETY, ETC.
- BE SPECIFIC

STEP 3: BRAINSTORM POSSIBLE SOLUTIONS

- CONSIDER WHAT OTHERS HAVE DONE TO SOLVE THIS PROBLEM AND INCLUDE PRIOR RESEARCH
- GENERATE NEW IDEAS FOR SOLUTIONS

STEP 4: SELECT A DESIGN

- MAKE A DETAILED SKETCH OF EACH DESIGN
- LABEL EACH SKETCH WITH DIMENSIONS AND INCLUDE THE MATERIALS NEEDED TO BUILD A MODEL
- SELECT ONE DESIGN TO CONSTRUCT
- JUSTIFY YOUR CHOICE BY LISTING THE REASONS YOU SELECTED THIS DESIGN
- CHOOSE 2 OR 3 OF THE BEST IDEAS FROM THE BRAINSTORMED LIST

STEP 5: BUILD A MODEL OR PROTOTYPE

- WRITE A DETAILED PROCEDURE FOR BUILDING THE MODEL
- LIST THE MATERIALS ACTUALLY USED TO CONSTRUCT THE MODEL
- FOLLOW YOUR PROCEDURE AND BUILD THE MODEL

STEP 6: TEST THE MODEL AND EVALUATE

- WRITE A HYPOTHESIS ABOUT YOUR DESIGN'S PERFORMANCE DURING TESTING
- DECIDE ON A TEST FOR THE MODEL AND TRY IT OUT
- RECORD THE RESULTS OF YOUR TESTS
- EVALUATE-LIST THE STRENGTHS/WEAKNESSES OF YOUR DESIGN
- DISCUSS WHAT CHANGES IN YOUR DESIGN HAD TO BE MADE DUE TO CONSTRAINTS
- DECIDE IF YOUR DESIGN SOLVED THE PROBLEM IDENTIFIED IN STEP 1.

STEP 7: REFINE THE DESIGN

- BASED ON THE RESULTS OF YOUR TESTS, MAKE IMPROVEMENTS ON YOUR DESIGN
- IDENTIFY THE CHANGES YOU WOULD MAKE
- GIVE REASONS FOR THE CHANGES

STEP 8: SHARE THE DESIGN

- ORGANIZE YOUR FINDINGS
- PRESENT YOUR FINDINGS TO YOUR TEAMMATES FOR FEEDBACK
- COMPARE YOUR DESIGN TO THOSE OF YOUR TEAMMATES
- IF YOU WERE TO BUILD THIS MODEL AGAIN, WHAT WOULD YOU DO DIFFERENTLY AND WHY?

MATERIALS LIST

FOR EACH GROUP OF 4-6 STUDENTS:

- Assorted materials to test, such as: construction paper, card stock paper, copy paper, tissue paper, cotton and fabric (30 pieces cut into 6 inch squares).
- 8-10 foam cups
- 1 LED or bright flashlight
- 1 Metric ruler
- Copy of Ray Shielding student data sheets/Copy of Design Packet
- Balance or scale for the classroom as well as small paper clips

GO TO EDC WEBSITE :

[HTTP://WWW.NASA.GOV/EDUCATION/EDC](http://www.nasa.gov/education/edc)

GO TO *START THE CHALLENGE NOW AND FOLLOW DIRECTIONS*

TEAM BUILDING ENGINEERING CHALLENGE

LET'S DO THE RADIATION SHIELDING
CHALLENGE AND JOIN THE CREW OF ORION
AS VIRTUAL, HONORARY CREW MEMBERS
WHEN IT LAUNCHES IN SEPTEMBER 2014

THE BENEFITS TO COMPETING IN THE NASA/US
DEPARTMENT OF EDUCATION 21ST CCLC STEM CHALLENGE
PILOT PROGRAM INCLUDE:

MEDIA COVERAGE FROM ALL THREE LOCAL TV STATIONS
AS WELL AS COVERAGE IN THE LOCAL PAPER
INTERACTION WITH TOP NASA/US DEPARTMENT OF
EDUCATION OFFICIALS
RECOGNITION FROM LOCAL SCHOOL BOARD
INVITATION TO TOUR KENNEDY SPACE CENTER
A 25% INCREASE IN AFTER SCHOOL ATTENDANCE
OUTSTANDING RESEARCH AND THE OPPORTUNITY TO BE A
VIRTUAL, HONORARY CREW MEMBER ON ORION

CONTACT INFORMATION:

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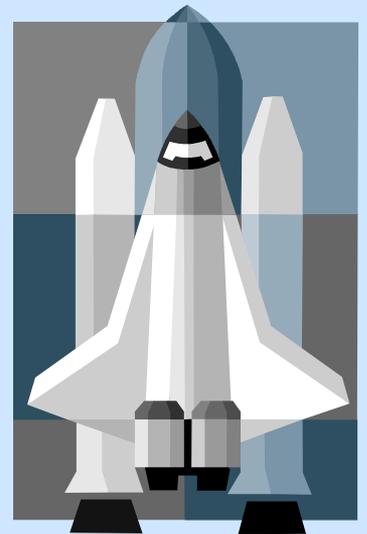
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Take this challenge back to your schools and have your students complete it and you will be able to join us as we travel over 20,000 miles an hour into space aboard the spacecraft Orion!!



FOOTNOTE:

NASA and the US Department of Education chose Virginia and two other states to participate in a challenge designed to launch student excitement in NASA STEM (Science, Technology, Engineering, and Mathematics)content as part of 21st CCLC programs. As part of the challenge, students had opportunities to connect with NASA scientists and engineers to get feedback on their work, ask questions and learn what it's like to work at the space agency. The US Department of Education will use the results of this successful pilot program to learn how they can better support STEM learning based in part on high quality partnerships between 21st CCLC programs and groups such as the Department's Math and Science Partnership programs and NASA.