

Major Project: Engineering Design Challenge  
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Phase I– Research & Planning

1. Big Concept: Design & build an air-powered rocket that can hit a distant target.
  - a. In this challenge, kids follow the engineering design process to: (1) design and build a rocket from a straw; (2) launch their rocket using a balloon; (3) improve their rocket based on testing results; and (4) try to consistently hit a target with their rockets.
2. Learning Standards:
  - a. MS-ESS1-3 Analyze and interpret data to determine the scale properties of objects in the solar system.
  - b. MS-ETS1-4 Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
3. Students will need procedural knowledge of how rockets are supposed to work & look like, they'll need to know what materials they're allowed to use and the limitations of the design prior to making prototypes/designing the model & then building it. Students will also need to know the problem solving process of trial & error when they begin building the model, and how to adapt their model to address problems that are occurring upon launch.
4. The objective of this design challenge is to design, build, launch, improve, and then try to hit a target with their rocket **consistently**. The ancillary concepts covered by this project include scale models, trial & error, the role of rockets in space exploration, the need for funding for programs like NASA, etc.
5. Possible Activities beyond designing, testing, modifying, and hitting targets consistently- we could change materials of the rocket or have students design other models using different materials explaining their reasoning for doing so. We could add weight to the rocket to see how much weight their model could hold, we could extend the distance from the rocket to the target to see how they could modify their models to reach greater distances, we could change the gas in the balloon to see if helium changes the distance the rocket goes, the options are limitless!
6. In my classroom, beyond having students design, build, modify, and launch their rockets, I think having a competition for the rocket that goes the farthest would be interesting. Putting 6th graders in competition with each other generally promotes participation within **most** students, and for those that aren't motivated by competition, we could have them suggest modifications to those who are competing.