ENGINEERING DESIGN CHALLENGE – Polar Cooking

1. Identify Problem or Need

Researchers at the Polar Environment Atmospheric Research Laboratory in the Arctic Circle on Ellesmere Island, Canada want to conserve and reduce cooking fuel. It is difficult to transport this fuel to the Research Lab. Researchers also want to reduce the pollutants they are releasing into the air in this environment.

2. Design Brief

Statement

With your team, design a solar oven model for use at the Polar Environment Atmospheric Research Laboratory. Label how the oven is designed to direct sunlight, absorb sunlight and convert to heat, and retain heat. Remember DARE (Direct, Absorb, Retain, Eat)

Specifications

- The oven must utilize reflectivity to gain as much sunlight as possible at low angle.
- The oven must include an insulated cooking space so it does not lose thermal energy to the outside.
- The oven must cook at temperatures that are safe for food.
- The oven must be made of materials that are durable and sturdy.
- The oven must withstand windy days and occasional wind gusts.

3. Investigate and research

List some topics or ideas you and your team will need to investigate and research. Take notes as you conduct your research and investigation*. Terms to understand:*

4. Generate Alternative Solutions

Use your investigation and research to brainstorm ideas with your team for a passive solar oven. Include materials needed.

5. Choose a Solution

Evaluate the pros and cons of each idea and then your team will choose the best solution. It is often helpful to create a matrix to compare alternative solutions.

6. Model and Prototype

With your team, design a passive solar oven model that can be built. Label how the oven is designed to direct sunlight, absorb sunlight, convert light to heat, and retain heat.

7. Test and Evaluate

Build your team's passive solar oven prototype. Once built, ovens can be tested on a sunny day. Data and observations can be recorded here.

8. Redesign and improve

After testing, brainstorm with your team to determine what changes can be made to improve the oven. Identify any malfunctions and ways to deal with them.