SCIENCE

NASA SHOEBOX GLIDER

INTRODUCTION

Teams will join NASA in a unique design challenge that explores the world of aeronautical engineering.

OBJECTIVES

What makes an aircraft fly? There are four forces that act on an aircraft in flight: lift, drag, gravity and thrust. **Lift** is produced by a difference in air pressure on the upper and lower surfaces of an airplane's wing (or **airfoil**). **Weight** is a force that is always directed towards the center of the earth and the **magnitude** of the force is determined by the **mass** of the plane, its passengers and any baggage or freight. **Drag** is created as the air resists the motion of the aircraft. **Thrust** is a force used to overcome drag. Aircraft typically use a propulsion system (like an engine and propeller) to generate thrust. You can learn more about these forces at NASA's Glenn Research Center.

Aeronautical engineers design and construct aircrafts by considering the impacts of these four forces. Changes in aircraft design can help overcome or enhance the forces in play during flight.

In this challenge, teams will take on the role of aeronautical engineers by planning, designing, constructing and testing a shoebox glider.

Upon completing this challenge, participants will have…

(1) Researched the dynamics of force and flight;
(2) Applied the dynamics of force and flight to the design, construction and flight testing of a shoebox glider;
(3) Collected, analyzed and evaluated glide-slope ratios

STEP-BY-STEP CHALLENGE

In order to successfully complete this challenge, teams must adhere to the

following guidelines:

(1) **Prior to the competition**, teams should use digital literacy resources to research the dynamics and forces of flight. Teams should have a basic understanding of the four forces in play during flight (**lift, drag, weight and thrust**) as well as an understanding of **glide-slope** ratios. The level of research completed should be developmentally appropriate for each age group (i.e. a higher quality and caliber of research is expected as age increases).

(2) **During the competition**, teams will be provided with a variety of materials to construct a working shoebox glider. The glider must meet the following **criteria**:

   a. The glider must move forward at least 3 meters or approximately 10 feet.
   b. The glider must demonstrate a positive glide slope ratio.
   c. The glider must not break upon landing.
   d. Teams must calculate the glide-slope ratio.

(3) **During the competition**, teams will be under the following **constraints**:

   a. The glider must include an intact shoebox in its design.
   b. Teams may only use the materials provided at the event.
   c. The glider must be complete and ready for flight testing in 30 minutes.
   d. The glider will be launched from a height and location determined by the challenge coordinator.

RESOURCES PROVIDED

All teams will be provided with shoe boxes and miscellaneous supplies.

JUDGING

All teams will be judged using an identical rubric. Allowances have been made for age differences during the challenge. Judging will be completed by trained volunteers.