Baltimore Museum of Industry

Maryland Engineering Challenges
2020 Paper Airplane Challenge

Elementary Level – Grades 1 to 5

Each grade will be judged separately.

Supported By:
American Institute of Aeronautics and Astronautics,
Mid-Atlantic Section

Engineer Contact:
Tom Milnes thomas.milnes@jhuapl.edu

Important Dates

Coaches' Information Session

⇒ **Wednesday, November 13, 2019** **4:00 p.m. to 7:00 p.m.**

This "drop-in" event is designed for adults interested in coaching a team to stop by and chat with engineers. Find out if a particular Challenge is a good fit for your students. The Information Session is not required and there is no cost. Registration is strongly encouraged. Contact Jessica at jcelmer@thebmi.org

Registration and Written Report Due

⇒ **February 7, 2020** **Prior to 4:00 p.m.**

In order to be a registered team, each team must have their adult Coach do the following:

- Register online at https://forms.gle/Sq9ZFXhqLXjC9wj76
- Submit the team's Written Report via email in Word or PDF format to the Baltimore Museum of Industry (jcelmer@thebmi.org), include electronic images of planes in report
- AND pay a $5 Coach's Fee, details at https://48278.blackbaudhosting.com/48278/MEC-Coach-Fee

Paper Airplane Competition

⇒ **February 22, 2020** **Doors open at 9:00 a.m.**

Full details about the Challenge will be emailed to Coaches after the registration deadline. Should we include minimum 15 teams for challenge to take place?

Questions about Challenge specifications or judging should be sent to the Engineer Contact:
Tom Milnes thomas.milnes@jhuapl.edu

Other questions?
Jessica Celmer jcelmer@thebmi.org

THE CHALLENGE

The Lilliputians, a race of tiny people first discovered by that intrepid traveler Gulliver, guard BWI airport from the dreaded Gremlins, a mischievous sort of tiny creature who delight in jinxing pilot, plane, and traveler alike (see the Bugs Bunny classic, "Falling Hare").

Lilliputians subdue Gulliver

The Dreaded Gremlin.

The Lilliputians are looking for a reliable paper airplane that their human handlers can use to send them where needed to defend the airport. The Lilliputians are looking for a design that can be manufactured quickly but reliably by assembly line techniques. The planes must be easy enough to be thrown far, fast, and accurately by elementary school students. Paper clips will serve as surrogate Lilliputians for testing purposes.

ENGINEERING TEAM REQUIREMENT

Each team should consist of at least four students. Only 4 pre-chosen students may construct and throw planes at the competition. Teams may share students at the same grade level or use younger grade students if needed to have at least 4 students on a team. There is no limit to the number of teams a school may have.

DESIGN AND CONSTRUCTION STANDARDS

At the competition, each team must use the piece of 8.5" x 11" paper (*20-pound or 75 grams/meter^2*) and jumbo paper clip (*Acco Premium Silverette Jumbo Paper Clips #72503, or equivalent*) provided by the sponsors.

- Only one piece of paper and one paper clip allowed per plane (unlimited number of scraps).
- No tools or construction materials other than the paper and paper clip provided.
- Three minutes will be given for four students to construct four identical paper airplanes by assembly line method.
- All four students must be involved in the manufacturing process.
- No coaching or other adult help fabricating the paper airplane will be allowed during the performance competition.
- Paper clip must remain attached to or inside the airplane for flight to count. One re-throw allowed for lost passenger.

PERFORMANCE DEMONSTRATION GUIDELINES

Each of the four students must fly a plane. Individual score is Length x Speed x Accuracy. Team score is sum of individual scores.

- L = Length = Length of Flight (along Reference Line to tip of plane)
- S = Speed = Length of Flight / Time of Flight = L/T
- A = Accuracy = 1 - Distance from Reference Line / Length of Flight = 1 – D/L

See Figure 1 for an illustration of scoring terms in practice.

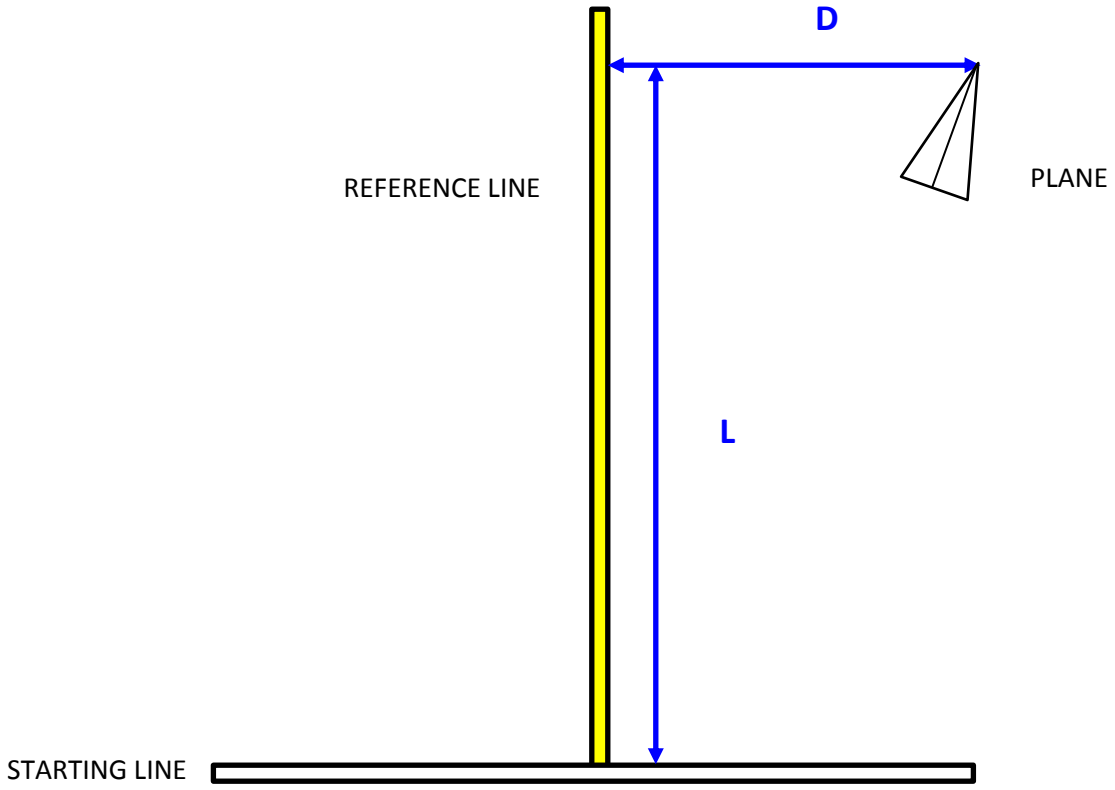

Figure 1 – Scoring Illustration

Paper clip must remain attached to or inside the airplane for flight to count. One re-throw allowed for lost passenger.

EVALUATION STANDARDS

This elementary school-level competition involves four main components: the design and construction of the project, a written report, an oral report, and the performance demonstration.

1. Design & Construction — Competition value: 20 points
2. Written Report — Competition value: 30 points
   Each TEAM should complete the "Student Design Report" at the end of this document.
3. Oral Interview — Competition value: 20 points
4. Performance Demonstration — Competition value: 30 points

An outline of what is required for each of these components, and general guidance on preparing for the competition, is given in the "Elementary School Guide to Entry" which should be read in connection with this document.

CURRICULUM TIES-- Maryland Engineering Challenges and the Next Generation Science Standards

PK-2nd Grade - S1.0 Skills and Processes - Topic A. Constructing Knowledge Raise questions about the world around them and be willing to seek answers to some of them by making careful observations and trying things out. ***3rd-5th Grade - S1.0 Skills and Processes - Topic A. Constructing Knowledge*** Gather and question data from many different forms of scientific investigations which include reviewing appropriate print resources, observing what things are like or what is happening somewhere, collecting specimens for analysis, and doing experiments.	**In preparing for the challenge, students will:** • Seek information through reading, observation, exploration, and investigations. Objective b • Use tools such as thermometers, magnifiers, rulers, or balances to extend their senses and gather data. Objective c • Participate in multiple experiences to verify that science investigations generally work the same way in different places. Objective e • Support investigative findings with data found in books, articles, and databases, and identify the sources used and expect others to do the same. Objective a • Recognize that the results of scientific investigations are seldom exactly the same, and when the differences are large, it is important to try to figure out why. Objective d • Follow directions carefully and keep accurate records of one's work in order to compare data gathered. Objective e
PK-2nd Grade - S1.0 Skills and Processes - Topic B. Applying Evidence and Reasoning People are more likely to believe your ideas if you can give good reasons for them. ***3rd-5th Grade - S1.0 Skills and Processes - Topic B. Applying Evidence and Reasoning***	**In designing their projects, students will:** • Provide reasons for accepting or rejecting ideas examined. Objective a • Develop reasonable explanations for observations made, investigations completed, and information gained by sharing ideas and listening to others' ideas. Objective b • Offer reasons for their findings and consider reasons suggested by others. Objective b • Keep a notebook that describes observations made, carefully

Seek better reasons for believing something than "Everybody knows that..." or "I just know" and discount such reasons when given by others.	distinguishes actual observations from ideas and speculations about what was observed, and is understandable weeks or months later. Objective d
PK-2nd Grade - S1.0 Skills and Processes - Topic C. Communicating Scientific Information Ask, "How do you know?" in appropriate situations and attempt reasonable answers when others ask them the same question. ***3rd-5th Grade - S1.0 Skills and Processes - Topic C. Communicating Scientific Information*** Recognize that clear communication is an essential part of doing science.	**In composing the written and oral reports, students will:** • Describe things as accurately as possible and compare observations with those of others. Objective a • Describe and compare things in terms of number, shape, texture, size, weight, color, and motion. Objective b • Have opportunities to work with a team, share findings with others, and recognize that all team members should reach their own conclusions about what the findings mean. Objective d • Make use of and analyze models, such as tables and graphs to summarize and interpret data. Objective a • Avoid choosing and reporting only the data that show what is expected by the person doing the choosing. Objective b • Construct and share reasonable explanations for questions asked. Objective d
PK-2nd Grade - S1.0 Skills and Processes - Topic D. Technology Design and make things with simple tools and a variety of materials. ***3rd-5th Grade - S1.0 Skills and Processes - Topic D. Technology*** DESIGN CONSTRAINTS: Develop designs and analyze the products: "Does it work?"	**In building their projects, students will:** • Make something out of paper, cardboard, wood, plastic, metal, or existing objects that can actually be used to perform a task. Objective a • Recognize that some kinds of materials are better than others for making any particular thing. Objective d • Realize that there is no perfect design and that usually some features have to be sacrificed to get others. Objective b • Identify factors that must be considered in any technological design-cost, safety, environmental

"Could I make it work better?" "Could I have used better materials?" DESIGNED SYSTEMS: Investigate a variety of mechanical systems and analyze the relationship among the parts.	impact, and what will happen if the solution fails. Objective c • Explain that something may not work as well (or at all) if a part of it is missing, broken, worn out, mismatched, or misconnected. Objective b

GOOD LUCK TO YOUR TEAM!

STUDENT DESIGN REPORT

Team Name

We are (please check one):

Grade One: ___ Grade Two: ___ Grade Three: ___ Grade Four: ___ Grade Five: ___

Team Members

Team's School Name (if applicable) and County

Adult Coach

Coach's Email

DESIGN REPORT DIRECTIONS

Make a copy of the "Student Design Report" pages for each TEAM. Team members should complete each part by clearly printing the requested information. Additional pages may be inserted as needed. The information in this booklet must be the work of student team members, as certified on the final page.

Written reports must be submitted, by email in Word or PDF format to jcelmer@thebmi.org prior to 4:00 p.m. on February 7, 2019

Explain why you chose your first design for an airplane. *Include a picture of this design.*

What problems did you encounter with your first design?

Explain the improvements or changes made to your design after testing. *Include pictures of improved designs*, and explain how they were better

Explain which design is the best.

How successful is your best plane?

What math skills were needed in this challenge?

What science skills were needed in this challenge?

List the safety rules you followed to make sure no one got hurt:

What did you learn by taking part in this project?

What did you enjoy most about taking part in this project?

List dates of important milestones in your project and describe those milestones:

Resources: List all the information resources used to solve the challenge problem. Include books, pictures, and websites.

List the materials used in constructing your project:

Materials	Cost	Tools Used

Explain what help adults gave your team:

Name	Type of Assistance

Team Members: List the team members, with a short description of how each person helped to make the project a success. What special skills were learned or demonstrated by each person?

TO BE SIGNED BY ALL STUDENTS, ADULT HELPERS, AND TEAM COACH.

We hereby certify that the majority of the ideas, design, and work was originated and performed by the students, with limited assistance by adults, as described above.

Printed Name Signature Date