**STEM – AEROSPACE EXPLORATION Design a New Paper Airplane**

**Design a New Paper Airplane**

Group members \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_ Class \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Score \_\_\_\_\_\_ out of 100

In this lesson we will explore the Aerospace pathway. We will simulate it by doing a paper airplane contest. The plane design that carries the most paper clips and lands within the 10’ to 15” landing zone will be the winner.

**Terms**

* **Criteria -** what the design or product must do and will be graded/judged on
* **Constraints -** what can be used and what cannot be used
* **Variables -** one thing can be changed at a time in an experiment to see what happens; does it get better or worse? Then another variable can be changed to see that does.

**Investigation**

Current runways and air systems cannot handle the growing number of people and goods that need to travel by air. We can change the airports but a more affordable solution is to change the airplanes themselves.

Your job is to design a paper airplane model that can carry the maximum amount of cargo (paper clips) and land within the 10’ to 15” landing strip area. You will get a 5’ circle to land in. You will need to research different types of airplane designs and then test them. You will then select the best design and use it for your final design. The paper clips can be carried or attached anywhere you would like on the airplane, but you cannot use any tape or glue in making your model or attaching the paper clips.

Your model may be made out of the material of your choice, but must not be larger than standard paper size (8 1/2” x 11”). When flying your airplane, you must hand launch it from ground level. You may use your own design, or you can research other paper airplane designs and try them.

You will get to test and refine your model, but remember to only make one change at a time, so that you know for sure which change caused a particular result. Be sure to collect data on your results so that you can report your results and recommendations to NASA. Good luck and thank you for your help with this problem!

**Instructions**

1. Research different types of paper airplane designs and pick three to try; one can be your own unique idea if you wish
2. Test your ideas, changing one variable at a time, to see what the best idea is
3. Pick your best idea and use it for your final test, for the grade

**Paper Air Plane Construction and Setup**Use any airplane design you like.

**Materials**

* Any type of foldable material (not larger than 8 1/2” x 11” sheet of notebook paper)
* Scissors
* Paper clips
* Landing area laid out by the teacher using tape.
* Handouts

**STEM-Aerospace Exploration**

**Design a Paper Airplane, continued**

**Step #1: Define the problem**

To be able to solve a problem, you must first clearly define the problem and what the desired outcome is. Your CRITERIA(s) will be what your design must be able to do. Your CONSTRAINT(s) are what limits your design or what you can do. List what your criteria and constraints are for this problem in the table below.

|  |  |
| --- | --- |
| **Criteria**  Carry as many paper clips as possible | **Constraints**  Foldable 8-1/2” x 11” material Maximum |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

**Step #2: Come up with ideas (more than 1)**

To be able to solve a problem, you must next brainstorm and come up with ideas for things that might work, create a basic design, sketch it, and write to explain what you are thinking. Then your team will select the best one. List ideas for your possible airplane designs in the table below.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Design 1** | **Design 2** | **Design 3** |
| **Airplane Shape** (sketch and describe it) |  |  |  |
| **Material**  (list what you will use  to make it) |  |  |  |
| **Where will you place the paper clips and how?** (remember you can’t tape, glue, etc... they must be detachable) |  |  |  |

**STEM-Aerospace Exploration**

**Design a Paper Airplane, continued**

**Step #3: Select the best solution**

Now look at all of the different factors to your possible design solutions. Take the three best solutions and combine them into a final prototype. Circle or highlight the best airplane shape, material, and where you will place the paperclips. Sketch your final design and explain how it will carry the paper clips, how well it will work, etc., in the blank space below or on additional paper and attach it.

**Step #4: Test and modify as needed**

Now you need to test your best idea. Make ONE variable change and test it again. Record how it performs, is it better or worse? Change and test again. At the end of testing make changes you need for the final design that you will test fly for your grade. Test fly your airplane at least three time and record the results, make one variable change and record it in the table below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | **Description of  what you  did/used** | **Flight Test #1** | **Flight Test #2** | **Flight Test #3** |
| **Design #1** | **Airplane Shape** |  |  |  |  |
| **Material to use** |  |  |  |  |
| **Where will you place the paper clips?** |  |  |  |  |
| **Design #2** | **Airplane Shape** |  |  |  |  |
| **Material to use** |  |  |  |  |
| **Where will you place the paper clips?** |  |  |  |  |
| **Design #3** | **Airplane Shape** |  |  |  |  |
| **Material to use** |  |  |  |  |
| **Where will you place the paper clips?** |  |  |  |  |

**STEM-Aerospace Exploration**

**Design a Paper Airplane, continued**

**Step #5: Final Test**

Now your team will present your final design to the class. The class has to agree as a whole that, yes, each team’s design meet the criteria and constraints. Once it does, then the whole class gets to test the airplanes to determine who the winner is.

**Teacher Notes**

1. Teacher should have researched possible airplane designs. Have those available for the students to look at and use. Otherwise they will need Internet access to research on their own. Have students work in groups of two to three on this.
2. Airplane must fly 10’-15’ and land within the 5’ landing area that the teacher has laid out with tape.
3. Provide the students with the paper clips, so that they all are equal.
4. Paper clips cannot be taped, glued etc. They must be removable so another class can use them. Clips can be placed wherever they work.
5. Foldable material used should not be bigger than 8 1/2” x 11”.
6. Teacher selects the different types of material to be used, such as plain paper, notebook paper, card stock, construction paper, aluminum foil, and poster board. Have it already cut to maximum size and give the same amount of materials to each team.
7. Give students one day to test, then 10-15 minutes of the next day class to build final prototype. Then set aside 10-15 minutes to test them. Discuss at the end why some designs did better than others.
8. Advise that best team gets 100, then 98, 96, etc.