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AEROSPACE IN CLASS LEARNING SCENARIO

How Things Fly: You are today's Leonardo Da Vinci!

Funded by the **Airbus Foundation** and coordinated by **European Schoolnet** (EUN – the network of 34 European Ministries of Education), the **Aerospace in Class Project** is about piloting STEM resources from the **Airbus Foundation Discovery Space**, a digital portal for aerospace exploration, connecting students, parents and educators across the globe with professionals in the field, bringing today's research and technology to life. The creation of this Learning Scenario is supported the **STEM Alliance** (an initiative that brings together industries, Ministries of Education, and education stakeholders to promote STEM education and careers to young Europeans) and by **Scientix**, funded from the European Union's H2020 research and innovation programme – project Scientix 4 (Grant agreement N. 101000063). The content of the document is the sole responsibility of the organizer and does not represent the opinion of the European Commission (EC), nor is the EC responsible for any use that might be made of the information contained.

European Schoolnet

How Things Fly: You are today's Leonardo Da Vinci!

By Eirini Siotou

Abstract

Through this learning scenario students will have the chance to investigate the forces of air resistance and weight as well as design and produce their own airplane.

Keywords

Historical review; Science of flight; Engineering of flight; STEM Learning; Inquiry-Based Learning

Table of summary	
Subject	Science, Natural Science, Physics, STREAM (Science, Technology, Reading, Engineering, Arts, Mathematics)
Topic	- Science of flight - 10,000 airplanes in the Sky Greek Curriculum of Primary School: Forces
Age of students	11-12 years old
Preparation time	Ca. 60 min
Teaching time	80 minutes (2 lessons of 40 min each)
Online teaching material	Airbus Foundation Discovery Space: https://www.airbus.com/company/sustainability/airbus-foundation/discovery-space/kids/science-of-flight.html#Airpl Tinkercad: https://www.tinkercad.com/things/7ak19dkeYfq-passenger-plane-template Flat airplanes: "Make a Paper Airplane That Floats and Glides - The UFO - Fold 'N Fly": https://www.youtube.com/watch?v=EoZQn6Nzi5g&feature=emb_logo Streamline airplanes: "A Spy Plane that flies smoothly - The V-Wing - Fold 'N Fly": https://www.youtube.com/watch?v=iiYK3cNtP3w&feature=emb_logo
Offline teaching material	Papers, glue, a pair of scissors If available, option to use: 3D printer, 3D printer's filament
Airbus Foundation Discovery Space resources used	"The history of flying" "How to design an airplane?" "3 ways an airplane can turn"

Integration into the curriculum

The learning scenario can be implemented in grades 5 and 6 of Greek Primary school, in the chapter of the “Forces”.

Aim of the lesson

In this learning scenario, students will be able to:

1. Carry out simple experiments to investigate forces of weight and air resistance
2. Apply their knowledge about these forces on designing their own airplane

Outcome of the lesson

Students will have the chance to design their own paper airplane and, if available, a 3D printed airplane.

Trends

- **STE(A)M Learning:** An increased focus will be given to Science, Technology, Physics and Arts will be incorporated into the educational process.
- **Collaborative Learning:** A strong focus on group work.
- **Lifelong Learning:** The learning process does not stop when leaving school.
- **Cloud Based Learning:** data, tools, software is all online and can be reached and modified from different devices.
- **Edutainment:** Students learn while having fun.
- **Visual Search and Learning:** Images and multimedia are more powerful than verbal stimuli as the main part of the communication process happens non-verbal.
- **Assessment:** the focus of assessments is shifting from “what you know” to “what you can do”.
- **Peer Learning:** Students learn from peers and give each other feedback.

21st century skills

Learners will enhance their:

- **Experimental skills** through the labs (Worksheet 2)
- **Critical thinking** through **inquiry-based learning** (Worksheet 2). Students pose questions, make hypotheses, conduct experiments, and collect data in order to answer their research questions.
- **Collaborative work, communication, and responsibility** by working in teams.
- **Information, media, and technology skills** as well as **creativity** by creating their own airplane using Tinkercad and, if available, a 3D printer (Worksheet 3)

Activities

Activity	Procedure	Time
	1st Lesson	**40 min**
Trigger: Historical Review	Students watch the video “The History of Flight” (in chapter “10,000 Airplanes in the Sky” on the Airbus Foundation Discovery Space) and answer the questions on Worksheet 1 – The History of Flight.[1]	10 min

[1] 4.As extra activities, teachers could be asked to make a Kahoot game for the historical first video, and also ask students to make a timeline using *Time Graphics* https://time.graphics/ to better understand the information in the first lesson.

Activity	Procedure	Time
Experimental Work	Students will investigate the Science of Flight in groups of four following instructions on Worksheet 2 - Investigating Flight.	30 min
	2nd Lesson	**40 min**
Designing	On Worksheet 3 – Designing an Aircraft, students work in groups to design their own airplane in Tinkercad, or any similar software applying the knowledge of weight and air resistance they gained.	40 min
	3rd Lesson (optional)	***40 min***
Testing	*Students print their airplane using a 3D printer.*[2] *Students test their airplane following the experimentational work of Worksheet 2.*	*40 min*

Assessment

Students will be assessed by:

1. The experimental laboratory: Learners will conduct an experiment, collect data and make conclusions according to the instructions given in their worksheet. Teachers will provide feedback to enhance students' understanding.
2. The designing and testing of their airplane: Learners will be peer assessed on their airplanes. Teachers will provide feedback to enhance students' understanding.

About the Aerospace in Class Project

The "Aerospace in Class" Project is about integrating STEM resources from the Airbus Foundation Discovery Space in classes for 8- to 12-year-old students. The project is funded by the **Airbus Foundation** which is committed to bringing together the products and people of the global aerospace company Airbus to help address the challenges of today's society. Youth development is one of the pillars upon which the Airbus Foundation is built, empowering young people for the challenges of tomorrow. The **Airbus Foundation Discovery Space** is a digital portal for aerospace exploration, connecting students, parents and educators across the globe with professionals in the field, bringing today's research and technology to life. **European Schoolnet** is coordinating this project. EUN is the network of 34 European Ministries of Education, based in Brussels, which aims to bring innovation in teaching and learning to its key stakeholders: Ministries of Education, schools, teachers, researchers, and industry partners.

The "Aerospace in Class" Project has also been supported by the STE(A)M Partnerships programme of Scientix, funded from the European Union's H2020 research and innovation programme – project Scientix 4 (Grant Agreement N. 101000063), coordinated by European Schoolnet (EUN). The content of the document is the sole responsibility of the organizer and it does not represent the opinion of the European Commission (EC), and the EC is not responsible for any use that might be made of information contained.

[2] 3D printing your digital airplane is an extension of this learning scenario, for the schools that have this option and would like to try the 3D digital design. 3D printing is optional and not necessary for understanding the topic. Alternatively, students can complete the 3D design without printing their artifact. Through 3D designing students get the chance to apply the knowledge gained from the learning scenario in a free digital environment, such as Tinkercad. Another free environment for digital design is Algodoo. Both environments need extra time for students to explore them if they are not already familiar with them.

Annex 1: Worksheet 1 – The History of Flight

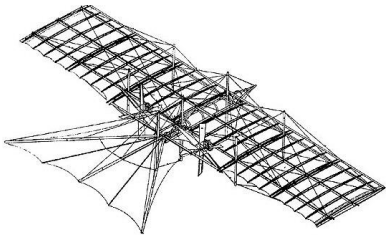

Figure 1 taken from http://www.wright-brothers.org/History_Wing/History_of_the_Airplane/Century_Before/First_Airplanes/First_Airplane_images/1843%20Patent%20drawing%20Aerial.jpg

1ST WORKSHEET

THE HISTORY OF FLIGHT

Name: _____ **Date:** _____

In this project you would be investigating the history of flight. Read the instructions carefully and answer the questions.

Travelling in air has been one of the most exciting things to do in this world. It is also the fastest mode of travel in the world. Planes which are used to fly from one place to another can carry people to other continents, countries and across the oceans within hours. There was a time when such long distances were travelled in days and weeks via ships on water or road trips. With the advancement in technology, there are planes that take only minutes to reach their destination.

Watch the video 'The history of flight' (from the chapter: "10,000 airplanes in the sky" on the Airbus Discovery Space) and answer the questions:

1. Who designed the first flying machines? When? _____
2. In 1919, the first all metal airplane was built. How many passengers could it carry? _____
3. The Junkers Ju aircraft in 1931 had three engines. How many people could it carry? _____
4. How many hours did it take for the supersonic Concorde aircraft in 2002 to fly 100 people from Paris to New York? _____
5. Today, the Airbus A380 is the world's largest passenger airliner, a wide-body aircraft manufactured by Airbus. How many people can it carry? _____

Video: https://www.airbus.com/virtual.html?uuid=2be38e63-7e2c-4677-84da-4e746aaf53a5&title=The-history-of-flying

1ST WORKSHEET

THE HISTORY OF FLIGHT

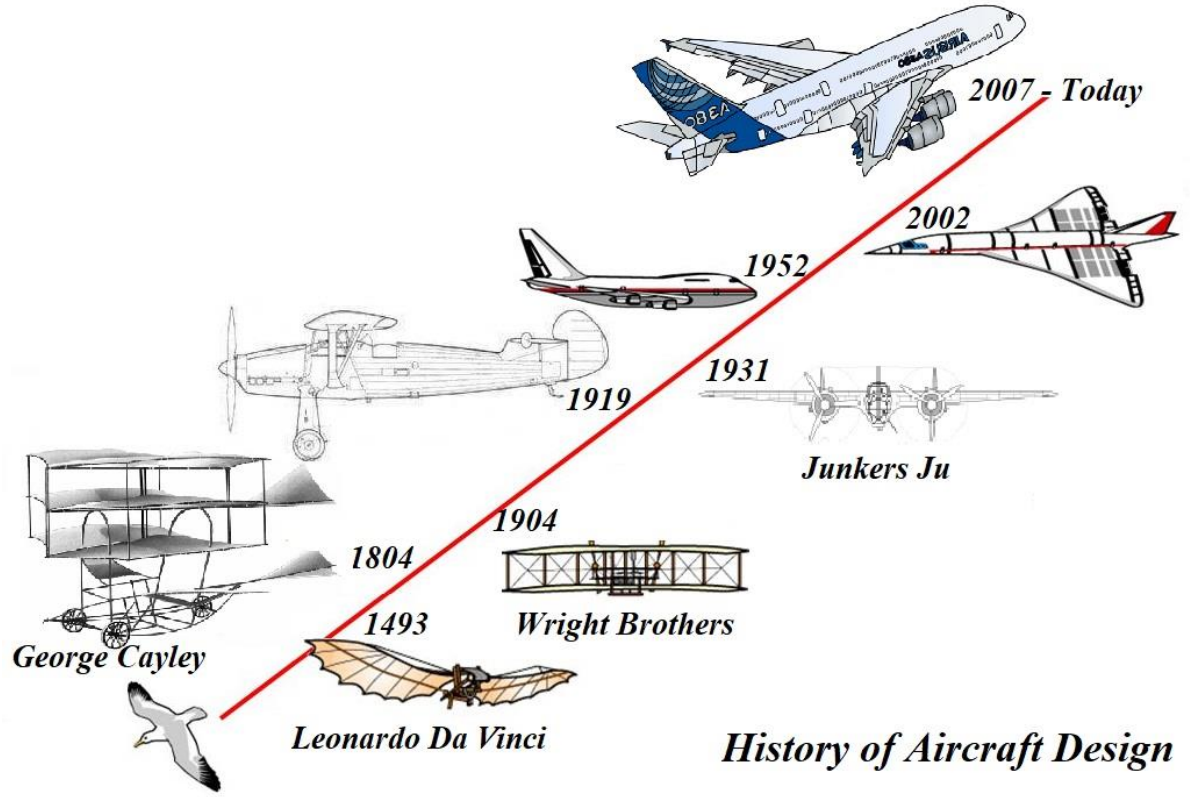

Figure 2: History of Aircraft Design by Eirini Siotou
Images taken from:
1. 1493: https://www.timetoast.com/timelines/80068
2. 1804: http://www.wright-brothers.org/History_Wing/History_of_the_Airplane/Century_Before/First_Airplanes/First_Airplanes.htm
3. 1904: http://www.wright-brothers.org/Information_Desk/Help_with_Homework/Wright_Plans/Wright_Plans.htm
4. 1919: https://www.sarikhobbies.com/product/focke-wulf-fw-56-stosser-hawk-line-drawing-2869/
5. 1931: https://el.wikipedia.org/wiki/Junkers_Ju_52
6. 1952: https://mediacentre.britishairways.com/
7. 2002: https://www.sciencedirect.com/science/article/abs/pii/S0376042116301002
8. 2007: https://www.airbus.com/

Annex 2: Worksheet 2 – Investigating Flight

Figure 3: A regular paper plane (left) and a plane with flaps added to the back to increase drag (right) taken from https://cdn.sciencebuddies.org/Files/12708/6/aero-plane-design-cut-flaps.jpghttps://cdn.sciencebuddies.org/Files/12708/6/aero-plane-design-cut-flaps.jpg

2ND WORKSHEET

INVESTIGATING FLIGHT

Name: _____ Date: _____

In this project you will be investigating the science of flight. Read the instructions carefully and answer the questions.

Hypothesis:

Which are the factors that affect flight? What do you think?

_____

_____

_____

_____

Materials/Equipment:

1. Paper
2. Tape
3. Measuring tape

Experimental procedure:

1. Determine an indoor location such as a gym or auditorium to let the planes fly. Flying the planes inside will keep the wind from being a factor.
2. Create your own paper airplane (Design 1). Throw your airplane from a specific height. All airplanes should be thrown from the same height.
3. Measure the distance your plane flew and record it in your data table.
4. Repeat five times and calculate the average distance.

5. Fold the papers and create four new airplanes according to the instructions given.

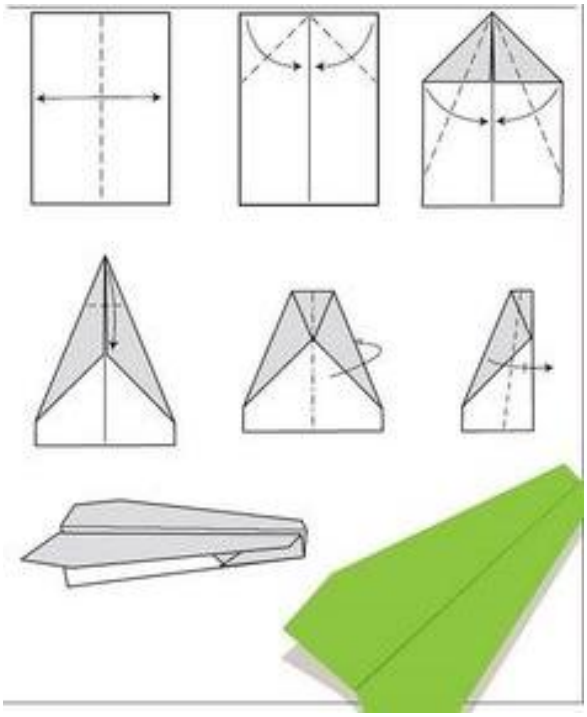

Figure 5: Instructions for a paper plane taken from http://www.nuttinbutpreschool.com/paper-airplanes/

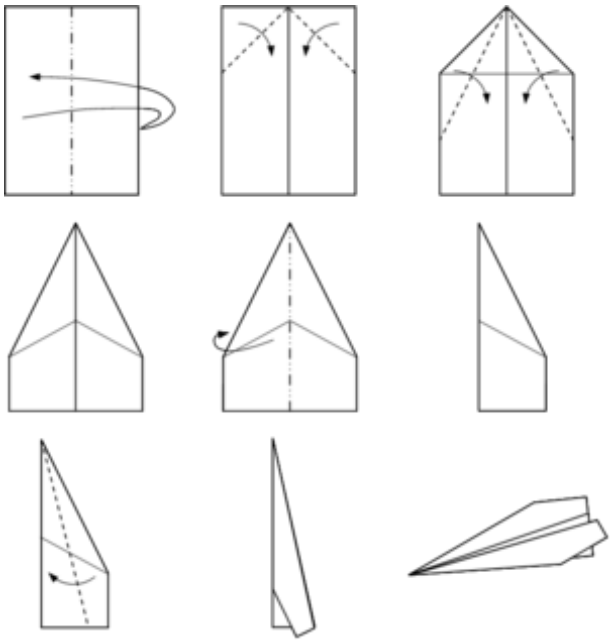

Figure 4: Instructions for a traditional paper plane taken from https://upload.wikimedia.org/wikipedia/commons/c/c4/Paper_Airplane.png

6. Complete the data table.

	PAPER AIRPLANE DISTANCE (m)					
	Design 1	**Design 2**	**Design 3**	**Design 4**	**Design 5**	**Design 6**
Throw	Your own	- 1 A4 paper - Flat in front	- 1 A4 paper - Streamline	- 3 A4 papers - Flat in front	- 3 A4 papers - Streamline	Redesign your own (Have different material)
Throw 1						
Throw 2						
Throw 3						
Throw 4						
Throw 5						
Adjusted Average						

7. Which design travelled faster?

_____
_____
_____

8. Why?

_____
_____
_____
_____
_____
_____

9. Watch the videos "How to design an airplane" and "3 ways an airplane can turn" and answer the questions below:

   a. Name two factors that are important when we design an aircraft.

   _____
   _____
   _____
   _____

   b. Is it dangerous when wings wobble a bit?

   _____
   _____
   _____
   _____

   c. Why does that happen?

   _____
   _____
   _____
   _____
   _____
   _____

Videos:

- https://www.airbus.com/virtual.html?uuid=607c183b-e46f-4c2e-9339-7ef82fbc4b0a&title=How-to-design-an-airplane
- https://www.airbus.com/virtual.html?uuid=6f510071-a400-4180-a71c-53c3a8464ebe&title=3-ways-an-airplane-can-turn-

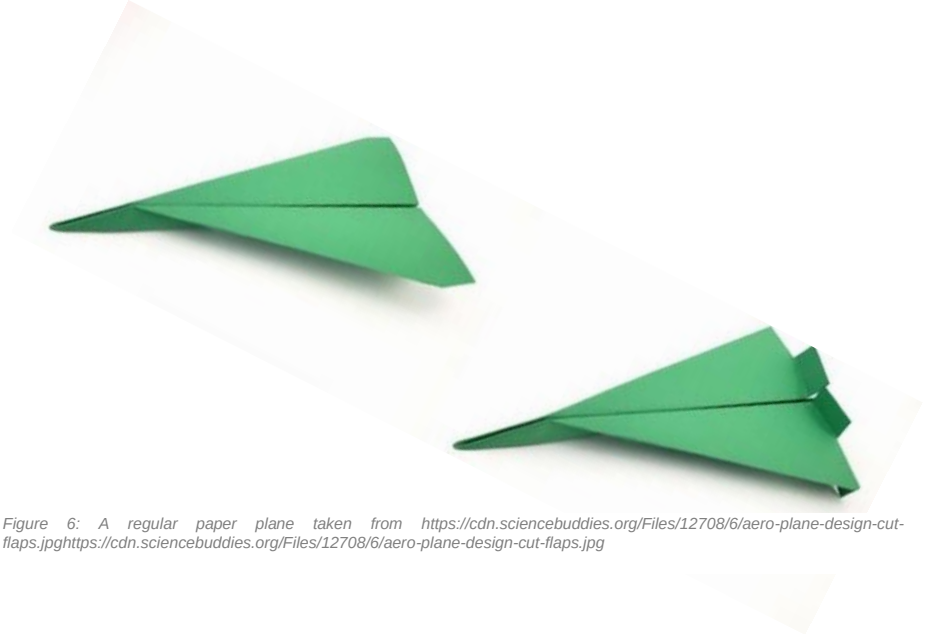

Figure 6: A regular paper plane taken from https://cdn.sciencebuddies.org/Files/12708/6/aero-plane-design-cut-flaps.jpghttps://cdn.sciencebuddies.org/Files/12708/6/aero-plane-design-cut-flaps.jpg

3RD WORKSHEET

DESIGNING AN AIRCRAFT

Name: _____ Date: _____

In this project you will design your own aircraft. Follow the instructions carefully.

Background Information:

Four forces are at work to make an airplane fly:

1. **Weight** or gravitational force is the force that pulls the airplane down.
2. **Lift** pulls the airplane up.
3. **Thrust** moves the airplane forward.
4. **Drag** pulls the airplane back.

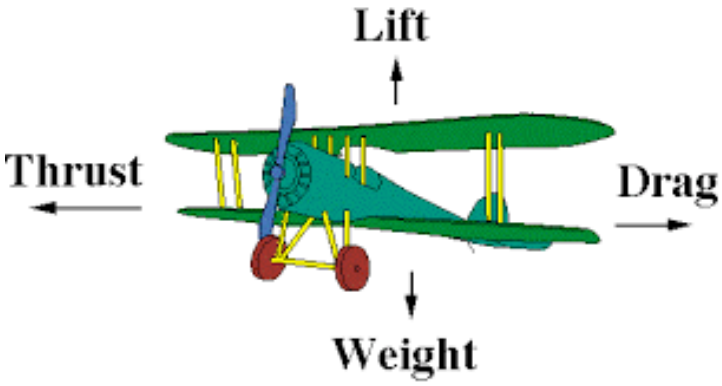

Figure 7: Forces on an aircraft taken from https://www.teachengineering.org/content/cub_/lessons/cub_airplanes/cub_airplanes_lesson05_header_image.gif

1. Design your aircraft.

2. Use Tinkercad (https://www.tinkercad.com/) to create your own aircraft.

3. Have a look at this template:
   https://www.tinkercad.com/things/7ak19dkeYfq-passenger-plane-template
   And print your model.

4. Test it!
   How much does it weigh?

   _____
   _____
   _____

   How far does it travel?

   _____
   _____
   _____