

AEROSPACE IN CLASS
LEARNING SCENARIO

How Things Fly:
Air Density



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.

How Things Fly: Air Density

By Jennifer McGarry

Abstract

Students consider the relevance of science through retelling of myths/legends concerned with flight. Students then expand upon their knowledge of the history of flight, before watching an Airbus Foundation Discovery Space video on how hot air balloons fly. An experiment will then be conducted to bring to life the concepts discussed in the video.

Keywords

Myths, Aviation History, Flight, Air Density, STEAM

| Table of summary | |
|--|---|
| Subject | History, English, Science, STEAM |
| Topic | <i>“Things that Fly”</i> History - evolution of flight English - oral language Science - heat transfer, flight |
| Age of students | 10 – 12 years old |
| Preparation time | Ca. 20 mins - print of timeline worksheets - make ice cubes |
| Teaching time | 80 mins (one lesson) If extra activity is added, then an extra 30-40 minutes should be added to the LS. |
| Online teaching material | Real-time voting / feedback app (like, for instance, Mentimeter.com) |
| Offline teaching material | Materials for one group of two: - one balloon - one 2-litre empty plastic bottle - two large containers - hot tap water ¹ Print material: - Annex 3: Walking Debate Strategy Instructions - Annex 4: Walking Debate Sample Questions / Science Statements |
| Airbus Foundation Discovery Space resources used | Balloons: Why do they float? |

¹ Use of hot water will need to be supervised by the teacher in the classroom, or parents if at home.

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Integration into the curriculum

History (5th/6th Class)

- **Strand:** Story
- **Strand Unit:** Stories from the lives of people in the past; Myths and Legends
- **General learning outcomes:**
 - Listen to, discuss, retell and record a wide range of stories from the lives of people who have contributed to local and/or national life and to the lives of people in other countries to technological, scientific, cultural and artistic activities as well as those who have contributed to social and political developments
 - Discuss the attitude and motivation of characters in their historical context
 - Listen to, discuss, retell and record a wider range of more complex myths and legends from different cultural, ethnic and religious backgrounds in Ireland and other countries

Science (5th/6th Class)

- **Strand:** Energy and Forces
- **Strand Unit:** Heat; Forces
- **General learning outcomes:**
 - Know that heat energy can be transferred
 - Identify and explore how objects and materials may be moved

English (5th/6th Class)

- **Strand:** Oral Language
- **Strand Unit:** Communicating; Understanding; Exploring and using
- **General learning outcomes:**
 - Actively listen and attend for extended periods of time, to include other languages where appropriate, listening for more details and nuanced meanings
 - Listen and speak with increasing confidence, independence and skill in order to work collaboratively with others and to share feedback, ideas, decisions and outcomes in a range of contexts and familiar and unfamiliar audiences
 - Respond creatively and critically to what they have heard and experienced
 - Express personal needs, opinions and preferences, explaining and justifying their perspective

Aim of the lesson

I would like to have achieved the following with my students in this lesson:

- Discussed some myths/legends regarding flight
- Conducted an experiment to demonstrate that hot air rises

Outcome of the lesson

Students will be enabled to:

- Develop an appreciation for the technological and scientific achievements of people from the past,
- Discover that heat is transferable and that hot air rises,
- Describe how molecules move differently in hot/cold air,
- Conduct an experiment to investigate the properties of hot/cold air

This lesson plan takes into consideration 3 of the 4Cs under the umbrella term of Learning and Innovation Skills (critical thinking, communication and collaboration). Creativity is also required in this lesson, but more so in the context of critical thinking as opposed to creatively constructing something tangible, which is why I have stated that 3 of the 4Cs are considered.

Students engage in critical thinking through, first, looking at fictional images and being asked to recognise past assumptions on how flight was once explained through recognising/remembering certain myths and legends. The students are then presented with a factual timeline, highlighting some of the main achievements in the field of aviation. Students will be asked to identify some of the skills that these early engineers needed and will be encouraged to critique some of the past aviation models.

The science concept of hot/cold air rising is introduced through the Airbus Foundation Discovery Space video. Students will also be introduced to more specific scientific terminology (how the molecules move/what molecules are). Furthermore, students are encouraged to reach a conclusion of their own on the importance of such scientific developments through a walking debate. Afterwards, students will be given a demonstration of a science experiment to show that hot air rises, before they must apply their understanding to test the experiment themselves. They will also be encouraged to use the scientific terminology when analysing their experiment.

On completion of the experiment, students will be asked to relate the experiment back to the Airbus Foundation Discovery Space video. This will be held through discussion/teacher-to-student chats, the purpose of it being to check if the experiment helped make the concepts in the video more relatable and understandable to them.

Trends

- Inquiry-Based Science Education
- Project-Based Learning
- Collaboration Learning
- Student-Centred Learning
- Peer Learning
- STEM Learning
- Visual Search and Learning
- Open Source Learning

21st century skills

Learning Skills: **Critical Thinking, Creativity, Communication**

Literacy Skills: **Information, Media**

- Discuss myths in relation to flight and flying objects with the aim of identifying positive/negative aspects of how people in the past explained concepts of flight -

(positives: they thought creatively which led to new inventions, negatives: they did not understand the science underpinning flight) - and consider what effects such assumptions/lack of knowledge might have had on the people at that time. Also consider the phenomenon of UFOs as a discussion point.

Learning Skills: **Critical Thinking, Communication**

Literacy Skills: **Information, Media, Technology**

- Watch Airbus Foundation Discovery Space video to develop science specific vocabulary to allow students to have the ability to infer information about a topic/situation. Inferring allows the students to draw conclusions about something and they will use the science specific vocabulary to do this at various stages in this lesson and subsequent ones.

Learning Skills: **Critical Thinking, Creativity, Collaboration, Communication**

Literacy Skills: **Information**

Life Skills: **Flexibility, Leadership, Initiative, Productivity, Social**

- Observe an experiment being carried out before working in small groups to test the experiment themselves. Communication and problem solving are key skills here, as are the skills of being social and flexible to work together as a team to troubleshoot any issues that arise and successfully carry out the experiment.

Activities

| Activity | Procedure | Time |
|---|--|--------|
| Introduction - KWL chart | <p>Open lesson with the use of a KWL chart² like the one provided in Annex 1 as example. This will establish your students' prior knowledge and will also give you useful information on what your students know to help make later content in the lesson more relevant.</p> <p>Provide your students with post-it notes so that they may stick their notes to the whiteboard to enable the discussion.</p> <p>Alternatively, open the lesson with the use of a real-time voting / feedback app (like, for instance, Mentimeter.com). This is an alternative method to the use of the KWL Chart to help establish your students' prior knowledge.</p> | 5 min |
| Introduction - discuss images on presentation | <p>Open lesson with a discussion on some various myths and legends with regards to flying around the world. The aim of this is to spark the students' curiosity and also give them an idea of how important understanding science is as it explains concepts and gives explanations to things that in past times that people could only explain through myths/legends.</p> | 10 min |

² A KWL Chart is an active reading strategy that can start students thinking about what they already know about a topic. The acronym stands for "**Know already – Want to know/Wonder – Learned**". It can be used as an assessment for learning because a teacher can quickly tell what students already know and understand about a topic.

| Activity | Procedure | Time |
|---|--|------------|
| Timeline: History of Aviation - Read timeline aloud | Discuss the "Timeline of Aviation". Teachers may access extra online videos of, for instance, the Wright brothers first flight or the Airbus A380 landing at Ireland West Airport to add another dimension to the discussion of the " Timeline of the History of Aviation provided in Annex 2 ". | 10 min |
| Video: "Hot Air Balloons" - Walking debate - Watch video | We will recall how humans relied on myths/legends to make sense of the world around them at one stage. However, we will now briefly consider two scientists that helped us in understanding factors that affect flight - Leonardo DaVinci and James Prescott Joule. Engage students in a walking debate (Annex 3) , using the science statements walking debate resources: Annex 4: Sample Questions/Science Statements and Annex 5: Signs for the Classroom , as to the value of these scientific endeavours. Afterwards, watch the Airbus Foundation Discovery Space video on how hot air balloons float . | 15 min |
| Hot Air Balloons Experiment | <ol style="list-style-type: none"> 1. Blow the balloon up to stretch it and help make it more flexible and let the air out. 2. Place the balloon over the mouth of the empty plastic bottle. 3. Stand the bottle in the centre of the container filled with hot water. Wait a few minutes and notice the balloon start to inflate and expand. 4. Remove the bottle from the hot water and place it in the container with cold water and ice. Wait a few moments and notice that the balloon starts to deflate and contract. 5. Repeat step 3 and 4 again. <p>If unable to do this hands-on experiment in class, or if the teachers wants to expand more, students can also interact with this online tool:</p> <ul style="list-style-type: none"> • Brain Pop: https://www.brainpop.com/games/hotairballoon/ | 35 min |
| Exit ticket | Students fill out the exit ticket (Annex 6) and may stick this into their science journal when complete (if they keep one). It helps the students to consolidate what they learned in the lesson and can also be a useful starting point for the next lesson. | 5 min |
| Extra Activity | Students can do one more activity to learn and discuss Archimedes' fluid buoyancy conditions. Students take two cans of cola (one can with regular cola and the other can with zero calories cola). Students must then Notice how both of the cans are identical in shape and weight. Drop both of the cans in a container filled with water. Notice that even though both of the cans are identical, the can with zero | 30-40 mins |

| Activity | Procedure | Time |
|----------|---|------|
| | calories (no sugar) is floating while the can with regular cola (sugar added) sinks. That result relates only in density differentiation. This specific experiment could be done in the first phase of the scenario so as to lead students in by asking them “How can we use this phenomenon to fly?” | |

Assessment

- **Teacher questioning** – KWL chart ([Annex 1](#)), talk and discussion
- **Teacher observation** – Conduction of experiment
- **Self-assessment** – Exit Ticket ([Annex 6](#))

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.

Topic: Things that Fly

| What I know... | What I want to know... | What I have learned |
|----------------|------------------------|---------------------|
| | | |

Annex 2: Timeline of the History of Aviation Handout

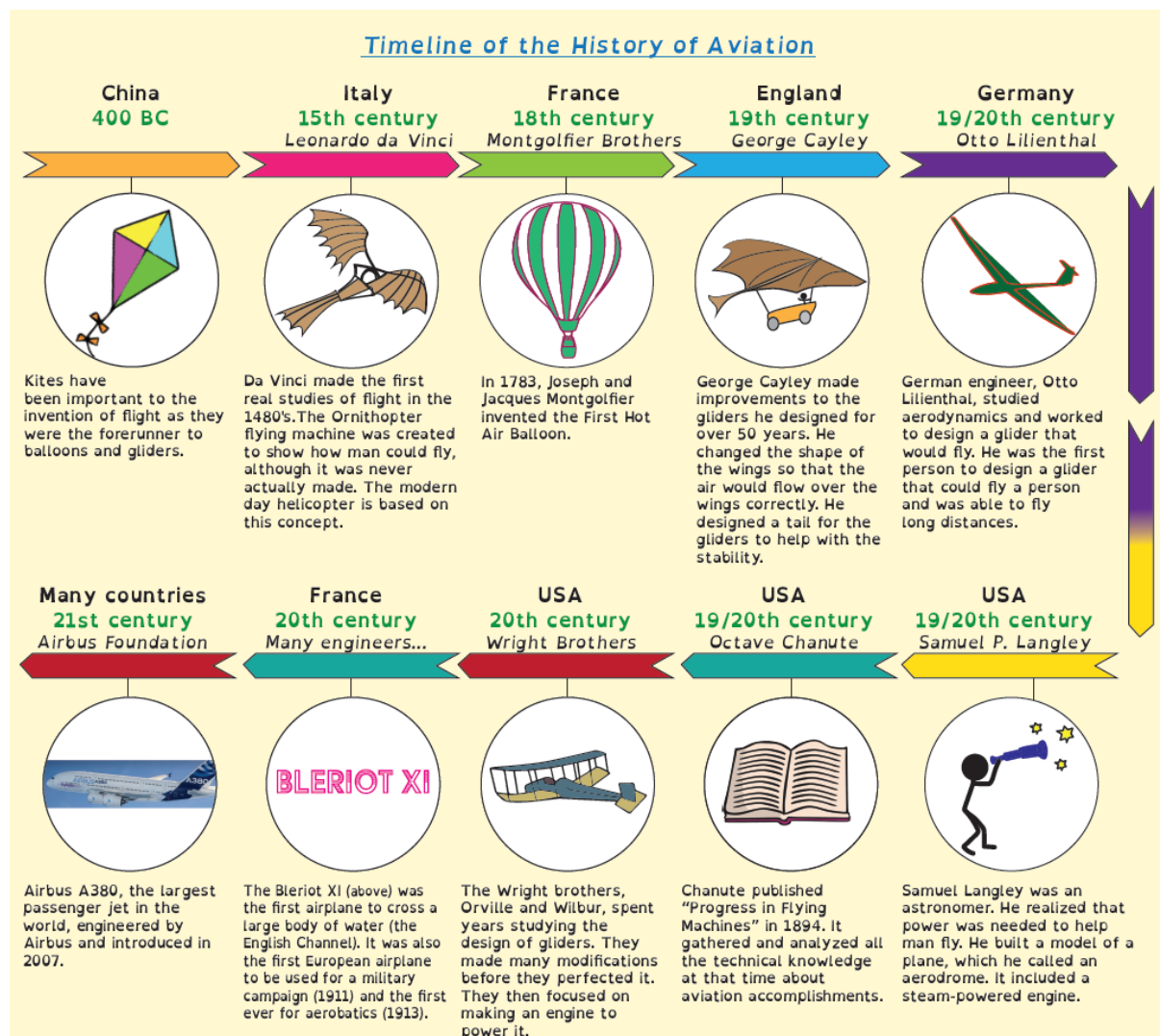


Figure 1: Timeline of the History of Aviation CC-BY Jennifer McGarry

Annex 3: Walking Debate Strategy Instructions

What is a walking debate?

A walking debate is an effective and fun strategy to engage students in communication and develop their critical thinking skills.

How to organize a walking debate in your classroom?

1. Pin the [agree/disagree/unsure signs](#) to the classroom wall at equal intervals.
2. Teacher reads out the [question/statement](#) to be debated and students go to the sign that they feel best fits the question/statement.
3. Students are then called upon/asked to volunteer the reason they choose agree/disagree/unsure.
4. A student can switch between the agree/disagree/unsure areas if they are swayed by another student's opinion.

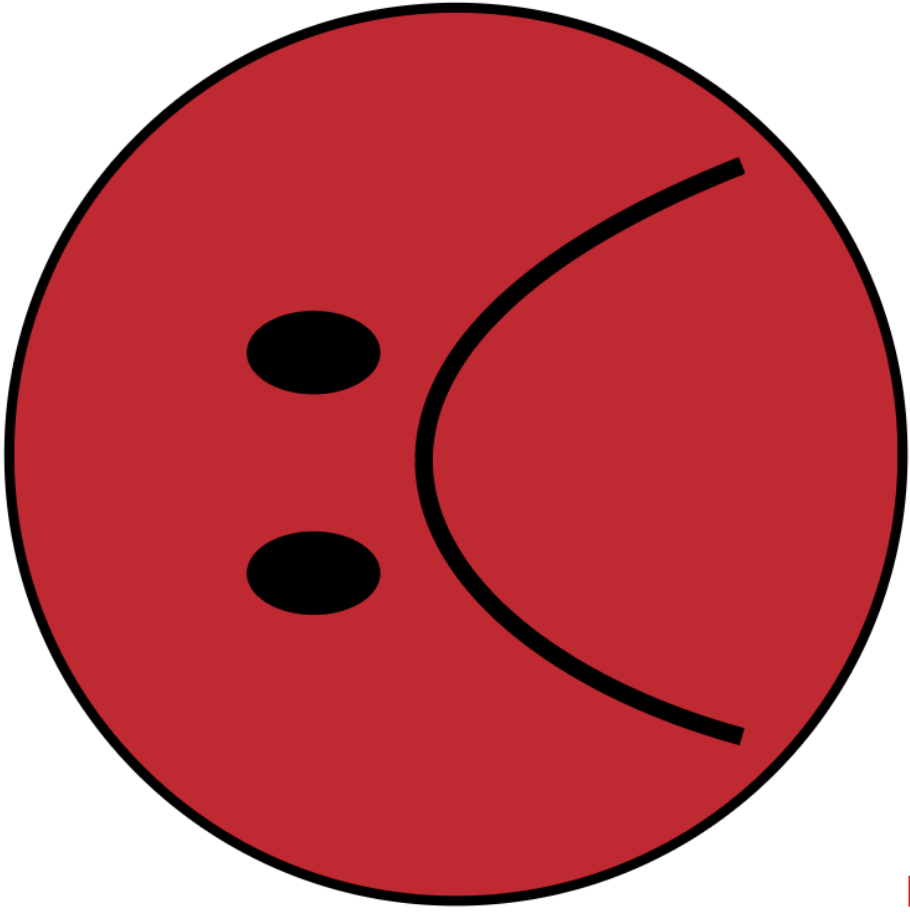
If students are unfamiliar with this, it might help them develop their thinking by assigning them into small groups when at the agree/disagree/unsure signs.

Annex 4: Walking Debate Sample Questions / Science Statements

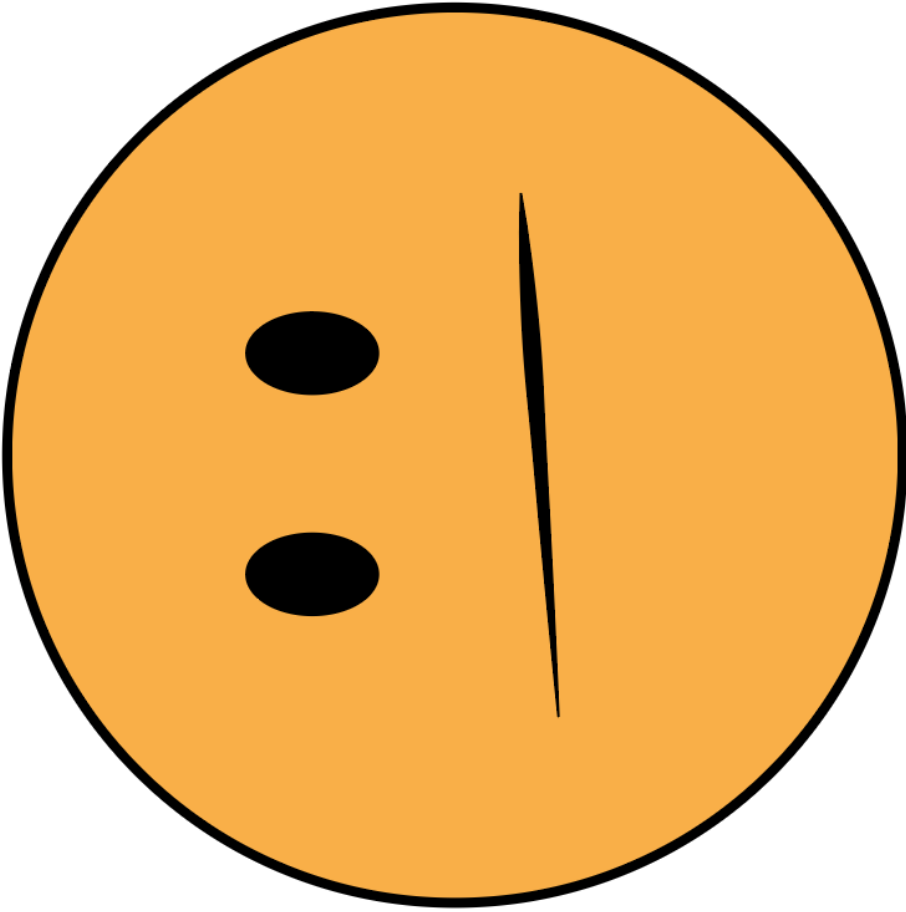
1. The telling of myths and legends was pointless.
2. The Wright brothers displayed a growth mindset.
3. Testing concepts of flight and aerodynamics was a very safe thing to do in the 18th and 19th centuries.
4. Octave Chanute, who published "Progress in Flying Machines" in 1894, believed it was not important to share knowledge of flying experiments.
5. Hot air balloons float, I think it is magic.
6. We can see all types of energy.
7. Just because you can't see something, doesn't mean that it doesn't exist.
8. When working on an experiment, it is very important to communicate and share your findings.
9. Scientists know all they possibly can about flight.
10. Nuclear powered flights should be banned.



Agree



Disagree



Unsure

3-2-1 Exit Ticket

3 things I learned from this workshop:

2 questions I still have:

1 idea that stuck with me...
