Flying Start Challenge

Log Book

Glider Name:

_____

Designer:

_____

This Log Book is for you to fill out, keeping everything you complete and achieve throughout the Flying Start Challenge in one place.

AIRBUS ATKINS Member of the SNC-Lavalin Group BAE SYSTEMS INSPIRED WORK FLEET AIR ARM MUSEUM

LEONARDO MBDA SAFRAN

What is Flying Start Challenge?

A regional competition to design a hand launched glider which will fly as far and as straight as possible.

What do you get out of it?

Have fun and win prizes!

Help subject choices for KS3

Develop key skills

Learn about engineering

What is your log book for?

To keep a record of the project and detail important information in one place

Student Guide to the 2020-2021 Flying Start Challenge

The Challenge:

Your objective is to design a glider that can fly as **far** and as **straight** as possible.

Lesson packs are available on the Flying Start Challenge website and cover: The Basics of Flight, Theory of Lift & Drag and other details that will help you to design and your glider.

To enter the competition you will need to submit a poster showing your glider design.

Your poster will be judged on the quality of the design as well as the effort you put into the appearance of the poster and also how creative you are with you designing.

Your poster can be hand drawn or made on a computer and submitted in any of the following formats:

- Word file
- PowerPoint file
- PDF
- Picture

Flying Start Rules:

1. General Rules

- One entry per person.
- It must be the students' work only – **teachers cannot help**.

2. Glider Rules

2.1. Flight

- Gliders must be designed to be **unpowered**.

2.2. Design

- You must consider how your design would be manufactured and explain this on your poster.
- You must annotate your design with:
  - Dimensions
  - Proposed manufacturing methods
  - Materials
  - Key design features – explain why your glider would fly the furthest!
- Previous years gliders may not be reused.
- Gliders must have **minimum dimensions of 30cm wingspan** and **40cm length**.
- Additional marks will be given if the fuselage, wings and tail of the glider are made using different materials.
- The glider must **resemble fixed wing aircraft**.

2.3. Manufacture

- You don't have to actually build your glider this year to take part in flying start, however there is a separate competition if you want to build a glider.
- The details of this competition are given at the end of this logbook.

Your Poster:

Your poster should reflect:

1. A demonstration of the knowledge of flight dynamics you have gained from lesson packs
2. Details of the design process
3. The manufacturing processes that would be used if someone was to make your glider
4. How you would go about testing your glider to improve the design
5. Consideration of sustainability and environmental impact

Poster Mark Scheme:

Your poster will be scored from 1-20 in 3 areas:

- Quality of Engineering Design
- Poster Overall Artistic Quality
- Creativity and Innovation

Best Engineered		
Knowledge of Flight Dynamics		/10
Manufacturing Methods Described		/5
Environmentally Friendly and Sustainable		/5
Best Artistic Design		
Glider Illustration Quality		/10
Overall Poster Aesthetics		/5
Creativity of Artistic Methods (e.g. paint/colours/collage etc…)		/5
Best Innovative Design		
Novelty of Design (how different from other entries)		/10
New Techniques/Design Features (not mentioned in lessons)		/5
Evidence of Own Research		/5
Total		**/60**

Here are some tips on how to score the most you can.

Presentation Quality

This is all about how your poster looks and how you submit it to the judges. Make sure that your poster is clear and shows what you want to get across.

Knowledge of Flight Dynamics

To score highly in this area you will need to show off what you have learnt during your lessons (hint: look back in the logbook!). Some specifics to include are the basic principles of flight such as:

- How a wing creates lift
- The forces acting on an aircraft
- Control surfaces/flight control

Design and Testing

You won't only get high marks here for designing a good glider. It is key to make sure you show that you have thought about your design process and how someone could manufacture your design, and also how you could test your glider to improve the design. You will be assessed on the following:

- How well the glider has been built
- Consideration of materials used in design
- Whether you have taken into account the glider's re-usability & durability

- Reasons why their glider was designed the way it is (displaying knowledge of flight and materials gained through lessons)
- Extra points awarded for innovative design
- Would the proposed testing make sure your glider would fly as far as possible

Environmentally Friendly and Sustainability

You can gain points here by showing that you have a design which is both environmentally friendly and sustainable. Consider:

- The sustainability of the materials that you have used
- Have recyclable materials been used
- Have you considered the effect of the material on the environment

Testing:

Showing how you would test your glider and talking about any changes you could make as a result will help gain you points on the poster and presentation elements of the competition.

Materials

Your log book **does not** need to be handed in but will help you with your poster.

Waste has a huge negative impact on the natural environment. Rubbish in landfill sites releases harmful chemicals and greenhouse gasses into the environment.

Designing using recyclable materials as much as possible helps to reduce this pollution caused by waste.

The use of recycled materials for your gliders is encouraged in order to reduce the negative impact on the environment.

What counts as a recyclable material?

For the purpose of this competition, recyclable materials are those materials that would normally be thrown away, but that you can re-use for the purpose of building your gliders.

Examples of recyclable materials:

Carrier bags

Scrap paper including used envelopes, old newspapers and magazines

Packaging such as plastic casing, cereal boxes, foil containers, egg cartons, bubble wrap

Plant material such as fallen leaves and twigs

Textiles such as scrap material, old clothing and shoe laces

If you are not sure what counts as a recyclable material, please check with your Flying Start Challenge representative.

Example Materials:

Material	Example Use
Balsa wood	Wings
Other types of wood	Wings/Fuselage/Control Surfaces
Plastics	Wings/Fuselage/Control Surfaces
Foam board	Fuselage
Polystyrene	Fuselage
Papier-mâché	Fuselage
Cling film	Wings
Tin foil	Nose
Fabrics/Textiles	Wings
Paper	Testing
Toilet Roll tubes	Fuselage
Plastic bottles	Fuselage
Newspapers	Joining (e.g. paper mache)
Cardboard boxes	Wings/Fuselage/Control Surfaces
Sellotape/Duct tape	Joining Method
Adhesives/ Permanent bonding	Joining Method
String/Thread	Joining Method
Non-Metal fasteners	Joining Method
Blu-Tac	Joining Method
Elastics	Joining Method
Standalone Friction Joints	Joining Method
Paint	Aesthetics

Flying Start Challenge

Lesson 1: Introduction

Make sure to read through the Lesson 1 pack before completing the below section.
Pack available on https://www.flyingstartchallenge.co.uk/

What are the 5 lessons you will cover?

1.

2.

3.

4.

5.

What are the <u>Minimum</u> dimension for your glider?

Wingspan: cm
Length: cm

Circle what you think are engineered:








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List 5 attributes which engineers portray:

1.

2.

3.

4.

5.

Flying Start Challenge

Lesson 2: Basics of Flight

Make sure to read through the Lesson 2 pack before completing the below section.
Pack available on https://www.flyingstartchallenge.co.uk/

Learning Objectives

Forces on an Aircraft

- Understand what forces act on an aircraft in flight

Balance Activity

- To understand how centre of gravity effects an aircraft

Parts of a Glider

- Learn the key components of a glider

Aircraft Mobility

- Understand how aircrafts move

Different Aircraft Types

- Learn the different types of aircraft and their individual characteristics

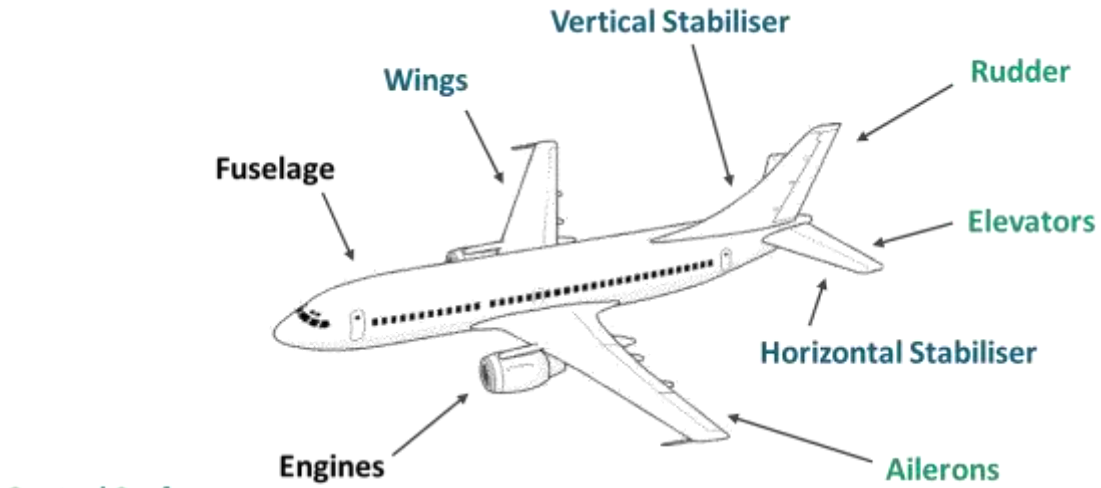
What is the difference between a regular aircraft and a glider?

Show the forces acting on an aircraft:

Match the force on the left with its correct statement

Lift	Caused by gravity
Thrust	Generated by the wings; this force counteracts weight
Weight	Caused by air resistance
Drag	Generated by the engines (or by throwing your gliders!)

Flight Dynamics



(You will **not** have control surfaces or engines on your glider)

Match the glider part with its role

Wing	**Gives glider stability in pitch**
Fuselage	**Provides the lift which counteracts the weight of the glider. Long and thin shape.**
Vertical Stabiliser (Fin)	**Separates the "tailplane" from the wing and the centre of gravity. Also carries payload (passengers or cargo) in a large aircraft.**
Horizontal Stabiliser (Tailplane)	**Gives glider stability in yaw**

Complete the sentences below to show how you might control the flight of your glider using the following answers:

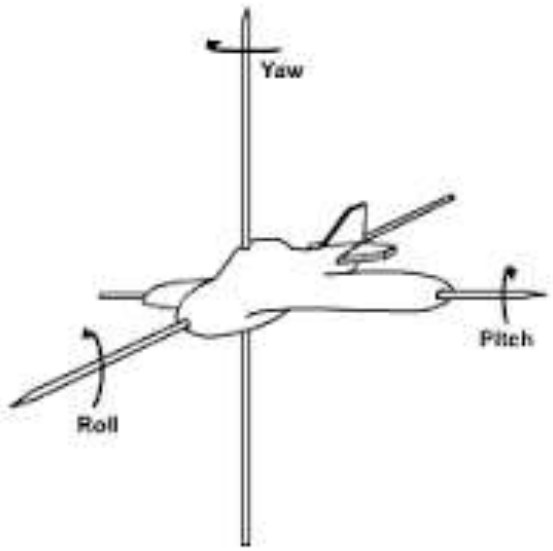
Pitch, Balanced, Horizontal Stabiliser, Symmetrical, Roll, Vertical Stabiliser

Making sure that your wings are _____ and _____ will help to prevent _____.

In order to control _____ you need a _____ and a good weight balance

A _____ helps to prevent yaw.

<u>Important for maintaining straight and level flight!</u>



Learning Highlights

Forces on an Aircraft

- Thrust, Drag, Lift, Weight

Balance Activity

- Centre of Gravity

Parts of a Glider

- Fuselage, Wing, Tailplane, Fin, Ailerons, Rudder, Elevator

Aircraft Mobility

- Rolls, Pitch, Yaw

Different Aircraft Types

- Jet Fighter, Airliner, Glider

Flying Start Challenge

Lesson 3: Lift & Drag

Make sure to read through the Lesson 3 pack before completing the below section.
Pack available on https://www.flyingstartchallenge.co.uk/

Learning Objectives

How is Lift Created?

- Learn how air flow over a wing creates lift

Drag

- Learn how drag is produced and good/bad designs

Drag Activity

- Understand the size of drag on different aircraft

Show how a wing creates lift

When the smooth air flow is disturbed, you get drag. The shape of your glider determines how much the air flow is disturbed.

What effect does drag have on your glider in flight?

How can drag be reduced?

Learning Highlights

How is Lift Created?

- Low pressure on top and high pressure on bottom of wing creates lift

Drag

- Shape determines drag, smooth shapes assist cutting through the air

Drag Activity

- Larger and bulkier aircrafts create more drag

Flying Start Challenge

Lesson 4: Materials & Manufacturing

Make sure to read through the Lesson 4 pack before completing the below section.
Pack available on https://www.flyingstartchallenge.co.uk/

Learning Objectives

Material Properties

- Understand different material properties and how they affect weight and strength

Your Materials

- Learn which materials you will use for your gliders

Industry Materials

- Learn the modern materials aircrafts are manufactured with and why

Manufacture

- Understand what manufacturing techniques are used

Structure

- Understand different designs to create strong structure for aircrafts

Sustainability

- Learn how to make your glider sustainable

Quality & Cost

- Learn how to build a successful glider within a budget

Match the material qualities with their definitions.

Material Quality	Definition
Low Density	Easily Shaped (at High Temperatures
Ductile	Very strong
Malleable	Low weight for a given size
Corrosion Resistant	Bends and stretches before breaking
Design Flexibility	Long life and requires minimal maintenance
High strength	Does not Rust
Durable	Can be formed into very complex shapes

Which of the above material qualities do these materials have?

Composites:

Aluminium:

What should you consider when choosing your materials?

Describe methods you might use for shaping and joining your materials.

Why would you want to use different types of joining methods on your glider?

Learning Highlights

Material Properties

- Balancing strength and weight of materials

Your Materials

- Balsa Wood, Hardwood, BluTack, Rubber bands, Glue & Recyclable materials

Industry Materials

- Aluminium, Composites, Alloys

Manufacture

- Material Usage, Shaping, Joining

Structure

- Strong, Light, Durable, Weight Saving Designs

Sustainability

- Recycled Materials, Bio-degradable, Modular Design

Quality & Cost

- Planning, Testing

Flying Start Challenge

Lesson 5: Flight Testing

Make sure to read through the Lesson 5 pack before completing the below section.
Pack available on https://www.flyingstartchallenge.co.uk/

Learning Objectives

Why Testing is Critical

- Learn what can happen if you don't test

Why we test?

- Understand the design & testing cycle

Experimenting with Design

- Learn how you can test your glider to improve it's flight

Why is testing so important?

Without testing you cannot know how your glider will _____

Testing allows you to make _____

What are the best ways to test your glider?

Give examples of what you will be looking to check when performing tests on your glider.

Learning Highlights

Why Testing is Critical

- Safety is paramount

Why we test?

- Every time we test, we learn how to improve

Experimenting with Design

- Change centre of gravity, symmetry, throw and throw again

Flying Start Challenge

What Have You Learnt?

Why is engineering important?

What are the most important considerations you must take into account when designing and building a glider?

What do you think is the best thing about Flying Start Challenge?

Designing Phase

Explain your plan for designing your glider:

Manufacturing

Describe the manufacturing processes used to build your glider.

How would you change this for larger scale production (e.g. making 100+ gliders).

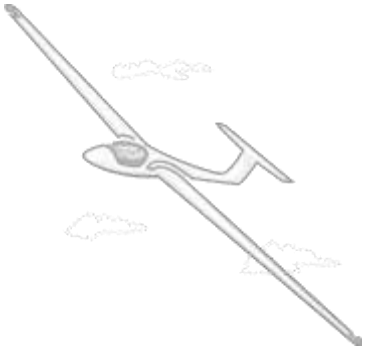
Sustainability

List the materials in your glider that are sustainable and/or environmentally friendly.

List the materials in your glider that are not sustainable and/or environmentally friendly.

Test Phase

Explain why your glider is designed the way it is.



Explain how testing could improve your glider. What changes would be made after testing?

The Challenge and Requirements Reminder

The Challenge

- To Design a hand launched glider which will fly as **far** and as **straight** as possible
- Then create a poster to present your glider design

Requirements

- The wingspan of the glider must be a minimum of 30cm
- The length of the glider must be a minimum of 40cm

EXTRA: Build a Glider Competition!

As an optional extra competition this year you can build a physical glider and submit a picture to be judged for a chance to win extra prizes!

The following are the rules and helpful tips for the Build a Glider Competition:

Design

- You **do not** have to build the glider you designed in the main Flying Start Challenge poster competition. If you don't have the materials or tools you would need to make your design it is fine to just create something completely different from scratch.
- Gliders must have minimum dimensions of **30cm wingspan** and **40cm length**.
- The glider must resemble fixed wing aircraft.
- The following materials **may not be used**: Metal, Glass, Ceramics and sharp objects.

Safety

- For your own safety only use scissors for cutting up materials. You should not be operating any saws, knives or heavy machinery. If these are required, ask a parent or guardian to do it for you.
- Do not throw your glider indoors. Only throw your glider in a clear open space when no one else is in a close vicinity of you.

Manufacture

Judges will be looking to see the design and manufacturing process you have utilised to design/create your glider. They will also be looking for gliders that exhibit creative, “thinking outside the box” ideas, as well as those who have taken into account environmental considerations.

Your glider will be judged on the following categories:

Physical Glider Competition		
Flight Dynamics (does design suggest thought from theory lessons)		/10
Manufacturing Methods Shown (robust, adaptable etc.)		/10
Glider Aesthetics		/5
Creativity of Materials (inventive use of household items)		/10
Total		**/35**