FLIGHT OF FANCY · 7TH GRADE · DESIGN CHALLENGE

Planning Guide

Duration: ~10 Class Periods | Grade 7

Activity Overview and Pacing

Activity	Name	Day	Time	Essential Question
1	Introducing the Wing Challenge	Day 1	~50 min	What does the client need, and what are the rules of the design problem?
2	Ideation and Design Selection	Day 2	~50 min	How do we choose the best design idea from many possibilities?
3	3D Modeling the New Wing	Days 3–4	~100 min	How do we turn a design sketch into a precise 3D digital model?
4	Fabrication and Testing	Days 5–7	~150 min	Does our design actually work when we build it and fly it?
5	The Final Sales Pitch	Days 8–10	~150 min	How do we present our work in a way that persuades a client to choose us?

Activity Descriptions and Materials

Activity 1 — Introducing the Wing Challenge | Day 1 | ~50 min

Essential Question: *What does the client need, and what are the rules of the design problem?*

Students read the A+ Airways wing design RFP and review baseline data from the Data Challenge (standard glider average). They identify criteria and constraints, form design teams, and write a problem statement.

Materials:

- Printed RFP
- Baseline glider data (from Data Challenge)
- Engineering Design Logs

Activity 2 — Ideation and Design Selection | Day 2 | ~50 min

Essential Question: *How do we choose the best design idea from many possibilities?*

Teams sketch at least three distinct wing concepts and evaluate each against the design criteria using a decision matrix. They select a final concept and document their reasoning before moving to 3D modeling.

Materials:

- Concept sketch sheets
- Decision matrix (student activity sheet)
- Data from Data Challenge

Activity 3 — 3D Modeling the New Wing | Days 3–4 | ~100 min

Essential Question: *How do we turn a design sketch into a precise 3D digital model?*

Teams model their chosen wing design in TinkerCAD using precise measurements. They plan the wing's dimensions to fit the glider fuselage and export the model for reference during fabrication.

Materials:

- Computers with TinkerCAD access
- Student activity sheets
- Glider fuselage for measurement reference
- Digital calipers and rulers (to measure the fuselage)

Activity 4 — Fabrication and Testing | Days 5–7 | ~150 min

Essential Question: *Does our design actually work when we build it and fly it?*

Teams cut and assemble their wing from cardstock, attach it to the glider fuselage, and conduct 10 test flights using the class procedure from the Data Challenge. They record all flight distances, calculate their average, and compare it to the baseline to determine whether their design improved performance.

Materials:

- Card stock, 110 lb (1 sheet per team)
- Scissors, digital calipers, rulers, and painters tape
- Foam glider fuselages (from the Data Challenge)
- Cloth measuring tape
- Flight Data Recording Sheet

Activity 5 — The Final Sales Pitch | Days 8–10 | ~150 min

Essential Question: *How do we present our work in a way that persuades a client to choose us?*

Teams deliver a pitch to A+ Airways (the class or a panel of judges), integrating their wing design, 3D model, flight test data, and the interior design and profit analysis from the Systems Challenge. Judges or peers provide feedback using the Final Pitch Rubric.

Materials:

- Pitch Planning Sheet
- 3D model screenshots and physical wing prototype
- Final Pitch Rubric

Standards Alignment

This unit was designed to support the Next Generation Science Standards (NGSS) Engineering Design performance expectations and Science & Engineering Practices, and the Common Core State Standards for Mathematical Practice (SMP). The tables below summarize the strongest alignment points and where they show up in the challenge. The NGSS engineering design performance expectations map cleanly to most state engineering and technology standards. If your state uses different standards (e.g., Georgia Standards of Excellence, TEKS, NYS Next Generation Standards), align using the descriptions in the tables below.

NGSS Engineering Design Performance Expectations

Standard	Description	Where It Shows Up	Classroom Connection
MS-ETS1-1	Define the criteria and constraints of a design problem.	Activity 1	Students analyze the A+ Airways RFP to define the wing design problem, identifying criteria (beat baseline distance) and constraints (cardstock materials, wing dimensions).
MS-ETS1-2	Evaluate competing design solutions using a systematic process.	Activity 2	Teams use a decision matrix to score and compare at least three wing concepts against the design criteria before selecting one.
MS-ETS1-3	Analyze data to determine if a design solution works as intended.	Activity 4	Teams compare their average flight distance to the baseline to determine whether their design improved performance.
MS-ETS1-4	Develop a model to generate data to test ideas.	Activities 3–4	Teams build a 3D CAD model in TinkerCAD and a physical cardstock prototype, using both to test their design.

Science and Engineering Practices

Standard	Where It Shows Up	Classroom Connection
Practice 1: Asking Questions and Defining Problems	Activity 1	Students extract the design problem from the client RFP and write a precise problem statement.
Practice 6: Constructing Explanations and Designing Solutions	Activities 2–4	Students design, build, and test wing prototypes, refining based on test data.

Common Core Standards for Mathematical Practice

Standard	Where It Shows Up	Classroom Connection
SMP 1: Make Sense of Problems and Persevere	Throughout	The open-ended design challenge requires sustained effort across multiple sessions.
SMP 3: Construct Viable Arguments	Activities 2 and 5	Teams defend their design selection in the matrix and present evidence-based arguments during the Sales Pitch.
SMP 4: Model with Mathematics	Activity 4	Students calculate average flight distances and compare ratios to determine percent improvement over baseline.
SMP 6: Attend to Precision	Activities 3–4	Accurate measurements are critical for both the TinkerCAD model and the physical wing fabrication.

This STEM Innovation and Design module was produced by Georgia Institute of Technology's Center for Education Integrating Science, Mathematics, and Computing with support from National Science Foundation Award #2101441.