FLIGHT OF FANCY · 7TH GRADE · SYSTEMS CHALLENGE

Planning Guide

Duration: ~7 Class Periods | Grade 7

Activity Overview and Pacing

Activity	Name	Day	Time	Essential Question
1	Risk, Reward, and the Airline Business	Day 1	~50 min	What does it mean to take a risk — and what makes it worth it?
2	Calculating Profit	Day 2	~50 min	How does an airline figure out if a design is worth building?
3	Market Research and Customer Needs	Day 3	~50 min	Who are you designing for, and what do they want?
4	Seat Modeling Lab	Day 4	~50 min	What makes an airplane seat layout comfortable — and how do you measure it?
5	Fuselage Design	Days 5–6	~100 min	How can you design an airplane interior that serves your passengers and the airline?
6	Final Design and Profit Analysis	Day 7	~50 min	Does your design make business sense?

Activity Descriptions and Materials

Activity 1 — Risk, Reward, and the Airline Business | Day 1 | ~50 min

Essential Question: *What does it mean to take a risk — and what makes it worth it?*

Students are introduced to entrepreneurship through the lens of the airline industry. They explore what risks and rewards look like for a business owner and frame the challenge: designing an airplane interior for A+ Airways.

Materials:

- Student activity sheets
- Engineering Design Logs

Activity 2 — Calculating Profit | Day 2 | ~50 min

Essential Question: *How does an airline figure out if a design is worth building?*

Students learn to calculate revenue, expenses, and profit for an airline configuration. They practice with sample data and begin to see how seating decisions affect the bottom line.

Materials:

- Student activity sheets
- Calculators

Activity 3 — Market Research and Customer Needs | Day 3 | ~50 min

Essential Question: *Who are you designing for, and what do they want?*

Teams identify a target passenger market (business, economy, family) and use market research tools to understand their needs and preferences. They define design requirements for their interior based on their chosen market.

Materials:

- Computers with internet access (for market research)
- Student activity sheets

Activity 4 — Seat Modeling Lab | Day 4 | ~50 min

Essential Question: *What makes an airplane seat layout comfortable — and how do you measure it?*

Students measure seat pitch in the classroom, compare different row spacing configurations, and evaluate comfort and capacity trade-offs. They begin planning their seating layout.

Materials:

- Rulers and measuring tape
- Student activity sheets

Activity 5 — Fuselage Design | Days 5–6 | ~100 min

Essential Question: *How can you design an airplane interior that serves your passengers and the airline?*

Teams use floor planning software to design their airplane interior, placing seats, lavatories, galley, and other elements within a fixed fuselage template. They must balance passenger comfort with seat count and profit.

Materials:

- Computers with floor planning software (RoomSketcher, Floorplanner, or similar)
- Student activity sheets

Activity 6 — Final Design and Profit Analysis | Day 7 | ~50 min

Essential Question: *Does your design make business sense?*

Teams finalize their interior design, calculate predicted profit per flight for their configuration, and prepare a brief justification of their design decisions for a class share-out.

Materials:

- Completed floor plans
- Calculators
- Student activity sheets

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.	Activities 1–3	Students extract A+ Airways requirements (profitability, passenger comfort, safety) and define constraints (fuselage dimensions, regulatory limits) before designing.
MS-ETS1-2	Evaluate competing design solutions using a systematic process.	Activities 4–6	Teams compare different seating configurations against criteria of comfort, capacity, and profit before committing to a final design.

Science and Engineering Practices

Standard	Where It Shows Up	Classroom Connection
Practice 4: Analyzing and Interpreting Data	Activities 2 and 6	Students analyze profit calculations and interpret market research data to inform design decisions.
Practice 5: Using Mathematics and Computational Thinking	Activities 2 and 6	Students calculate revenue, expenses, and profit for different seating configurations.

Common Core Standards for Mathematical Practice

Standard	Where It Shows Up	Classroom Connection
SMP 1: Make Sense of Problems and Persevere	Throughout	The airline design problem requires integrating business reasoning, customer needs, and spatial design across multiple sessions.
SMP 2: Reason Abstractly and Quantitatively	Activities 2 and 6	Students move between concrete seat counts and abstract profit-per-flight calculations.
SMP 4: Model with Mathematics	Activities 2 and 6	Students build a mathematical model of airline profit (seats × ticket price − expenses) and use it to evaluate design options.
SMP 6: Attend to Precision	Activities 4–5	Seat dimensions and fuselage layouts require accurate measurement and scale.

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.