



7TH GRADE · SYSTEMS CHALLENGE

Flight of Fancy

Teacher Facilitation Guide

Duration: ~ 7 50-minute class sessions



CHALLENGE OVERVIEW

Students continue their work for A+ Airways by tackling the interior of the airplane. Working in small teams, they explore what makes an airline profitable, research how real airlines configure their cabins for different types of passengers, and conduct a hands-on classroom activity to experience how seat spacing affects comfort. They then use digital design software to create their own airplane interior, calculate the profit their design would generate, and prepare to pitch it to A+ Airways at the end of the semester.

BY THE END OF THIS CHALLENGE, STUDENTS WILL BE ABLE TO:

- Explain what an entrepreneur is and describe the risks and rewards of owning an airline
- Define revenue, expense, and profit, and calculate profit for a given airplane configuration
- Use market research tools to identify a target market and understand passenger needs
- Measure seat pitch and evaluate seating configurations for comfort and practicality
- Design an airplane interior using digital floor planning software
- Calculate the predicted profit for their interior design and justify their business decisions

MODULE STRUCTURE

- Activity 1 — Risk, Reward, and the Airline Business (Day 1)
- Activity 2 — Calculating Profit (Day 2)
- Activity 3 — Market Research and Customer Needs (Day 3)
- Activity 4 — Seat Modeling Lab (Day 4)
- Activity 5 — Fuselage Design (Days 5–6)
- Activity 6 — Final Design and Profit Analysis (Day 7)

MATERIALS

Computers or Chromebooks with internet access

Floor planning software (RoomSketcher, Floorplanner, or similar — free tier)

Rulers and measuring tape

Printed student activity sheets

Calculators

Engineering Notebooks

[Handout 1 – Understanding Risks and Rewards](#)

[Handout 2 – Profit Calculation Sheet](#)

[Handout 3 – A+ Airways Interior Design RFP](#)

[Handout 4 – Seat Configuration Research Sheet](#)

[Handout 5 – Seat Modeling Data Sheet](#)

[Handout 6 – Fuselage Design Guide](#)

[Handout 7 – Fuselage Design Profit Analysis Sheet](#)

STANDARDS ALIGNMENT

NGSS Engineering Design

MS-ETS1-1: Define the criteria and constraints of a design problem

MS-ETS1-2: Evaluate competing design solutions using a systematic process

Science and Engineering Practices

Practice 4: Analyzing and interpreting data

Practice 5: Using mathematics and computational thinking

Common Core Standards for Mathematical Practice

SMP 1: Make sense of problems and persevere in solving them

SMP 2: Reason abstractly and quantitatively

SMP 4: Model with mathematics

SMP 6: Attend to precision

See the Flight of Fancy Systems Challenge Planning Guide for complete alignment details.

KEY VOCABULARY

Entrepreneur	Someone who starts a business, taking on financial risk in hopes of a reward.
Risk	The possibility of losing something of value — often money — when making a business decision.
Reward	The potential gain from taking a risk.
Revenue	Money coming in — for an airline, this is mainly ticket sales.
Expense	Money going out — the costs of running the business (fuel, crew, maintenance, etc.).
Profit	Revenue minus expenses. A positive number means the airline is making money.
Loss	When expenses are greater than revenue — the airline spent more than it earned.
Market	The specific group of customers a business is trying to serve.
Seat pitch	The distance from a point on one seat to the same point on the seat directly in front of it. Used to measure how much legroom passengers have.
Configuration	The way seats are arranged in a row — for example, 3-3 means three seats on each side of the aisle.
Fuselage	The main body of the airplane that contains the passenger cabin.
Floor plan	A scale drawing showing the layout of a space viewed from above.

ACTIVITY 1

Risk, Reward, and the Airline Business

TIME
~50 min

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

Students are introduced to the Systems Challenge through the lens of entrepreneurship. They watch a short video about the history of commercial aviation, discuss what it means to take a risk and earn a reward, and apply those ideas to the airline industry. By the end of the activity, students understand why building a profitable airplane interior is harder than it sounds.

SETUP & MATERIALS

- "100 Years of Aviation" video
- [Understanding Risks and Rewards](#) sheet — 1 per student

Part 1 — The 100 Years of Aviation Video (10 min)

Play a short video about the history of commercial aviation. A 3–5 minute clip works well — look for one that covers the early days of flight through to modern commercial air travel. As students watch, ask them to note: Who took a risk? What was the potential reward?

TEACHER TIP – HIGHLIGHT THE HISTORY OF FLIGHT

- Search YouTube for "history of commercial aviation" or "how airlines work" and preview before class. Aim for something visual and accessible — avoid clips that are heavily technical. A good clip will show early flying machines, the growth of passenger travel, and something about how airlines work today.

Part 2 — Risk and Reward Discussion and Activity (30 min)

After the video, open a class discussion about risk and reward. Start with examples students can relate to before moving to the airline context.

DISCUSSION PROMPTS

- What risks did the early aviation pioneers take? What were the potential rewards?
- What are some risks you take in your own life, even small ones? What are the rewards?
- Would you start an airline company? Why or why not?
- What happens to an airline if it spends more money than it makes? What are some real examples?

Real-world Examples:

Company	What happened
Pan American World Airways (Pan Am)	Pan Am was one of the most innovative airlines in history, launching the first transatlantic jet service. But the risks of rapid growth were too high, and the company eventually went bankrupt.
Rolls-Royce	Rolls-Royce developed the RB211 jet engine — a remarkable piece of technology. But the cost of developing it was so high that it drove the company into bankruptcy, even though the engine itself was a success.
American Airlines	American Airlines, one of the oldest and largest U.S. carriers, went bankrupt and later merged with US Airways to survive. Even the biggest companies face financial risk.
Spirit Airlines	Once the largest U.S. budget airline, Spirit shut down completely in May 2026 after filing for bankruptcy twice in two years. Rising fuel costs and mounting debt proved too much, and roughly 17,000 employees lost their jobs when the airline folded.

Distribute the Understanding Risks and Rewards worksheet. Students brainstorm risks and rewards for: everyday decisions, starting a business, and owning an airline specifically.

TEACHER TIP – THE REALITY OF RISK

- The goal here is not to memorize airline history — it is to help students understand that every design decision they make in this challenge has a business consequence. More legroom costs money. Fewer seats means less revenue. This real tension is what makes the challenge interesting.
- Encourage students to think about risk tolerance: some people are comfortable with more risk, and that's OK. What matters is making a calculated risk — one where you've thought through the pros and cons.

Part 3 — Introducing the Systems Challenge (10 min)

Connect the risk/reward discussion to the challenge ahead. Explain that in this challenge, students will focus on the inside of the airplane — the cabin — and design an interior that is both comfortable for passengers and profitable for the airline.

DISCUSSION QUESTIONS

- What do you already know about the A+ Airways problem from the Data Challenge?
- What do you think makes an airplane cabin comfortable? What do passengers care about most?
- If you could design your ideal airplane seat, what would it look like?

ACTIVITY 2

Calculating Profit

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

TIME

~50 min

Students learn to calculate profit for an airline by working through the math of revenue, expenses, and ticket pricing. The class works through a tutorial together before students try their own scenarios. This activity gives students the tools they will need to evaluate their own interior designs in Activity 6.

SETUP & MATERIALS

- [Profit Calculation Sheet](#) — 1 per student
- Calculators

Part 1 — Revenue, Expense, and Profit (10 min)

Write or project the key terms and formula on the board. Keep definitions simple and concrete.

Term	What it means
Revenue	Money coming in. For an airline, this is mostly ticket sales, but also things like baggage fees, food, and Wi-Fi.
Expense	Money going out. Airline expenses include jet fuel, crew pay, airplane maintenance, and airport fees.
Profit	Revenue minus expenses. If this number is positive, the airline is making money. If it is negative, they are losing money (this is called a loss).

$$\text{Profit} = \text{Revenue} - \text{Expenses}$$

Ask students: What are some expenses for an airline that we might forget about? Prompt students to think about: buying or leasing the airplanes themselves, training staff, insurance, and taxes.

DISCUSSION QUESTIONS

- What are the revenues for an airline? What are the expenses?
- If an airplane has 150 seats but only 100 passengers buy tickets, how does that affect profit?
- Why might an airline charge different prices for different seats?

Part 2 — Profit Calculation Tutorial (30 min)

Walk through the Profit Calculation Sheet with the entire class before students work independently. Students calculate each step and fill in their sheet as you go.

CASE 1 WALKTHROUGH (smaller aircraft, straightforward)

- Setup: A small airplane with 50 seats. Fuel cost for one flight: \$2,500. Pilot and crew wages: \$1,500.
- Step 1 — Revenue: Students calculate total revenue at three different ticket prices (e.g., \$75, \$100, \$125 per seat) assuming all seats are sold.
- Step 2 — Expenses: Enter fuel (\$2,500) and crew wages (\$1,500) = \$4,000 total expenses.
- Step 3 — Profit: Subtract expenses from revenue for each ticket price. Ask: At which ticket price does the airline make a profit? Which price causes a loss?

CASE 2 WALKTHROUGH (larger aircraft, more variables)

- Setup: A larger airplane with more seats, higher fuel costs, and additional expenses. Students determine their own ticket prices and see how changes affect profit.
- Key addition: Not all seats will always be sold. If only 80% of tickets are sold (an 80% occupancy rate), how does that change the revenue calculation?
- Students explore: Is it better to have more cheaper seats or fewer expensive seats? How do you decide?

TEACHER TIP – EMPHASIZE OCCUPANCY

- The most common confusion is mixing up revenue per flight (all seats sold) with revenue when not all seats are filled (adjusted revenue). Make sure students understand the occupancy rate concept before Case 2.

Part 3 — Discussion (10 min)

DISCUSSION QUESTIONS

- At what ticket price does the airline start making a profit in Case 1? How do you know?
- Why are airplane tickets expensive? What expenses are airlines covering?
- What expenses did we not account for in these calculations? How might that affect real-world profit?
- How hard is it to estimate profit when you don't know for sure how many tickets will be sold?

ACTIVITY 3

Market Research and Customer Needs

TIME
~50 min

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

Students use the A+ Airways RFP and online research to identify a target market for their airplane interior. They research how real airlines configure their cabins, examine trade-offs between different seat types and classes, and make an initial decision about which type of passenger they are designing for. This decision will guide their design choices in Activities 4–6.

SETUP & MATERIALS

- [A+ Airways Interior Design RFP](#)
- [Seat Configuration Research Sheet](#)
- Laptops or tablets for research
- Projector for modeling research tool use in Part 1

Part 1 — Re-read the RFP and Choose a Market (15 min)

Review the A+ Airways RFP. Remind students that A+ Airways said they could increase profit either by seating more passengers or by charging fewer passengers more money. Those two paths lead to very different interior designs. Introduce the concept of a target market — the specific group of customers a company is trying to serve. Airlines typically organize their cabins around one or more of these market types:

Market Type	What it means for the design
Budget / Economy	Pack in as many seats as possible to sell more tickets at lower prices. Legroom is tight. Profit comes from volume.
Standard / Mixed Class	A mix of economy and premium seats. Some passengers pay more for extra comfort. Balances volume and price.
Premium / Business Class	Fewer seats with much more space. Charge higher prices. Profit comes from a smaller number of high-paying passengers.

Be sure to emphasize that **there is no single right answer**. A budget airline and a luxury airline can both be profitable — they just make money differently. Your job is to pick a market, design for it well, and show the math that makes it work.

DISCUSSION QUESTIONS

- Who do you think is the most likely customer for A+ Airways based on the RFP?
- What are the risks of choosing a budget model? What are the risks of choosing a luxury model?
- Which market would you choose, and why?

Part 2 — Research Seat Configurations (25 min)

Have students use SeatGuru (seatguru.com) or a similar seat map tool to research how real airlines set up their cabins. Students should look at at least two or three different airlines and record their findings on the Configuration Research sheet.

What to look for:

- Row configuration: how many seats are on each side of the aisle (e.g., 3-3, 2-2, 1-2-1)
- Seat pitch: many airlines list this on their websites — it tells you how much legroom passengers get
- Seat categories: which seats are premium/business class versus economy?
- Total seat count: how many seats does the aircraft hold?

TEACHER TIPS – SEARCHING FOR SEATMAPS

- SeatGuru is a good starting point, but airline websites (American, Delta, Southwest, etc.) also publish seat maps and pitch information. You can also do a simple Google Images search for "airplane seat map" to find examples.
- Encourage students to look at both a budget airline (like Frontier) and a full-service airline (like Delta or American) so they can compare the trade-offs.

Part 3 — Choose Your Market and Make Initial Decisions (10 min)

Based on their research, each team makes two key decisions that will drive the rest of the challenge:

1. Who is their target market? (budget travelers, business travelers, families, etc.)
2. What is their general seat strategy? (maximize seat count for volume, or offer fewer seats at a higher price?)

Students record their choices and a brief justification on their Configuration Research sheet. Remind them that they will need to defend these choices when they calculate profit and when they pitch to A+ Airways.

DISCUSSION QUESTIONS

- What did you find in your research that surprised you about how airlines set up their cabins?
- Which airline's seat configuration would you personally prefer as a passenger? Does that match the choice you made for your design?
- How does your target market affect the decisions you'll make about seat spacing and ticket price?

ACTIVITY 4

Seat Modeling Lab

TIME
~50 min

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

Students get out of their seats and into the data. Using classroom chairs to simulate airplane rows, they set up different seating configurations, measure seat pitch, and physically test what it is like to climb over a seatmate to get out of a row. The experience is hands-on and often memorable — students come away with a real feel for the trade-offs between seat density and passenger comfort.

SETUP & MATERIALS

- Before class, arrange one demo row of chairs to show students what a "3-3" configuration looks like. You can label chairs: Window / Middle / Aisle on each side. Students will then rearrange for different configurations during the activity.
- Suggested configurations to test: 3-3 (standard economy), 2-3 (common on narrowbody aircraft), 2-2 (standard business class), 1-2-1 (spacious business/first class).
- Create a class data chart for each group to record pitch, comfort ratings, and practicality ratings for each configuration.
- Measuring tape — 1 per group
- [Seat Modeling Data Sheet](#) — 1 per group
- Markers or sticky notes to label configurations

Part 1 — Set Up and Measure (20 min)

Divide the class into groups. Each group sets up one configuration and measures the seat pitch — the distance from a point on one chair to the same point on the chair directly in front of it. Students record seat pitch and comfort ratings in inches on their data sheet.

Step	Instructions
1. Set up the row	Arrange chairs to match your assigned configuration. Place two rows so you can measure pitch.
2. Measure seat pitch	Use a measuring tape to find the distance from the back of one seat to the back of the seat in front of it. Record in inches.
3. Rate comfort	Have each team member sit in the same seat and rate legroom comfort on a 1–5 scale (1 = very cramped, 5 = very comfortable).
4. Record your data	Write the configuration, pitch measurement, and comfort rating on your data sheet.

TEACHER TIP – FOSTER EMPATHY FOR ALL TRAVELERS

- Real airplane seat pitch ranges from about 28–30 inches on budget airlines to 36–40 inches or more in business class. Help students put their measurements in context: if their demo row has 32 inches of pitch, that's actually more generous than many economy seats and comfortable for most middle school students. Encourage students to think about how comfortable travelers with a range of body types, including the adults in their lives, would be in the same seats.

Part 2 — The Practicality Test (20 min)

This is the most memorable part of the activity. For each configuration, have one student sit in the "window" seat and in the "aisle" seat. The window-seat student must try to get out of the row — without the aisle-seat student standing up — and rate how difficult it was.

Navigation Ease Rating Scale:

- 5 — Clear path, easy to get out without any contact
- 3 — Some squeezing or contact required
- 1 — Impossible to exit without the aisle-seat passenger standing up

Students record comfort ratings on their data sheets. Time permitting, each group can model and test a second seat configuration. Groups share their data across a class chart so everyone can see all configurations.

TEACHER TIP – LEAN INTO THE SEATING EXPERIENCE

- This activity is usually a highlight of the challenge — students genuinely find it funny and memorable. Lean into it. The physical experience of being squeezed in (or having plenty of room) makes the design trade-offs feel real in a way that just reading about legroom does not.

Part 3 — Data Discussion and Design Implications (10 min)

Bring the class back together and review the class-wide data chart. Lead a discussion connecting what students measured to the design decisions ahead.

DISCUSSION QUESTIONS

- Which configuration had the most legroom? Which had the least?
- Is there a configuration where comfort and seat count seem reasonably balanced?
- How will the pitch measurements you collected today affect your fuselage design?

TEACHER TIP – DON'T FORGET TO RECORD PITCH

- Students will use the pitch measurement from their chosen configuration to set the scale in Floorplanner in Activity 5. Make sure they have recorded a specific pitch value (in inches) that they plan to use before leaving class today.

ACTIVITY 5

Fuselage Design

TIME

~100 min

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

Students use Floorplanner — a free online floor planning tool — to build a digital model of their airplane interior. They set the fuselage dimensions, place seats based on the pitch measurements from Activity 4, and view their design in both 2D and 3D. This activity translates all of their research and measurement work into a real design artifact.

SETUP & MATERIALS

- Laptops or tablets with internet access — 1 per student or 1 per team
- Floorplanner accounts set up at floorplanner.com (free Basic accounts for schools)
- Seat pitch measurements from Activity 4
- Fuselage Dimension references – consider providing websites for students to visit to find dimensions of commercial aircraft with their chosen seating configuration.
- [Fuselage Design Guide](#)

TEACHER TIP – SET-UP FLOORPLANNER ACCOUNTS EARLY

- Set up Floorplanner accounts before class if possible — account creation can eat into design time. Basic accounts are free and allow students to save their work. If students will share devices, create a shared class login rather than individual accounts.

Part 1 — Getting Started with Floorplanner (~25 min)

Walk students through the basics of Floorplanner as a class before they work independently. Project your screen and demonstrate each step.

Key steps to demonstrate:

1. Create a new project. Name it with your team name and "A+ Airways Interior."
2. Draw the fuselage walls: use the "Draw Walls" tool to create the rectangular outline of the cabin. Use the dimensions a common commercial airline jet to set the correct length and width of the fuselage.
 - EX: Airbus A320 Family: This aircraft family features a maximum cabin width of 12.1 feet (3.70 m) and an internal cabin length ranging from 90.3 feet (27.51 m) for the A320 up to 109.8 feet for the stretched A321neo.
1. Set units to inches. This is important — students will enter their seat pitch measurements in inches, and the scale must match.
2. Add doors for the front and rear exits.
3. Switch between 2D view (for layout) and 3D view (to check how it looks from inside).

TEACHER TIP – USEFUL FLOORPLANNER FEATURES

- Floorplanner has a large model library (chairs, tables, etc.). Students can use chairs or rectangular shapes to represent airplane seats. Encourage them to be consistent — use the same object for all seats so the layout is clear.
- The 3D "Dollhouse" view is great for checking whether the design looks too cramped. If seat objects are overlapping, the physical design would be too tight for passengers. Use this as a quick visual check.

Part 2 — Building Your Cabin Layout (~75 min)

Students work in their teams to build their full interior layout. Circulate to check progress and ask probing questions.

Design checklist for students:

- Fuselage walls drawn at correct dimensions
- Seats placed in rows matching the configuration you chose (e.g., 3-3, 2-2)
- Seat pitch set to match your measurement from Activity 4
- Aisle clearly visible between seat rows
- If your design includes different seat classes, label them (e.g., "Business" and "Economy" zones)
- 2D layout saved; 3D view checked for obvious errors

As teams work, prompt them to record the following on their Fuselage Design Guide: total number of seats in their design, how many are premium/economy/other, and the seat pitch for each section. They will need this for the profit calculation in Activity 6.

Have students export or screenshot their 2D floor plan before the end of Activity 5. They will need this image for their final pitch presentation.

DISCUSSION QUESTIONS

- How many seats does your design have? How does that compare to the aircraft you researched in Activity 3?
- Does your seat layout match your target market? If you chose business class, does the design reflect that?
- When you look at the 3D view, does your cabin look comfortable? Would you want to sit there?

TEACHER TIP – THOUGHTFUL FUSELAGE DESIGN

- Some teams will try to maximize seat count by packing in as many seats as possible. If their pitch is unrealistically tight (less than 28 inches), prompt them to think about the navigation ease data from Activity 4 and how that will affect their profit calculation in Activity 6.
- Teams who finish the basic layout early can add additional details: galley area at the front or rear, overhead bin markers, or a first-class curtain divider.

ACTIVITY 6

Final Design and Profit Analysis

TIME

~50 min

Essential Question: Does your design make business sense?

Students apply the profit calculation skills from Activity 2 to their own interior design. Using their seat count and chosen ticket prices, they calculate the predicted profit per flight for their A+ Airways cabin. They compare this against the airline's costs and decide whether their design meets the client's needs — or whether they need to adjust before the final pitch.

SETUP & MATERIALS

- Completed Floorplanner designs from Activity 5
- [Fuselage Design Profit Analysis Sheet](#)
- [Profit Calculation Sheet](#) from Activity 2
- Calculators
- Laptops to export final images from Floorplanner

Part 1 — Calculate Your Profit (25 min)

Students use their design data to complete the Fuselage Design Profit Analysis. Walk through the steps on the board before they start:

PROFIT CALCULATION STEPS

1. Seat count: How many total seats does your design have? How many are economy / premium?
2. Ticket prices: What price will you charge for each seat type?
3. Revenue: $(\text{Economy seats} \times \text{economy price}) + (\text{Premium seats} \times \text{premium price}) =$ Revenue per flight (assuming all seats sold).
4. Adjust Revenue: Calculate Adjusted Revenue: Realistically, not every seat is filled every flight. Uncomfortable planes lose customers. If the practicality score for your seat configuration was 1 or 2, reduce your revenue to 80% of Full Capacity revenue. Otherwise, 90% of full capacity revenue is a good estimate.
5. Expenses: Use the standard A+ Airways operating costs from the Profit Calculation sheet.
6. Profit = Adjusted Revenue – Expenses.

TEACHER TIP – MAKE PROFIT MAKE SENSE

- If a team's profit calculation comes out negative, that is a great learning moment — don't rescue them immediately. Ask: What could you change to make this work? More seats? Higher ticket prices? A different mix of seat classes? This mirrors real engineering iteration.
- If a team's profit is positive but very low, ask: Is this a design you would actually pitch to A+ Airways? Would they be impressed by \$200 per flight profit?

Part 2 — Export and Review (15 min)

Students export their completed Floorplanner designs. Each team should have:

- A 2D floor plan screenshot or export showing the full cabin layout
- A 3D view screenshot showing what the cabin looks like from inside
- Their completed Fuselage Design Profit Analysis Sheet

Have teams do a final review against the A+ Airways requirements:

Requirement	Does your design meet it?
The design must include a proposal for profit	Is your profit calculation complete and positive?
The design must address passenger comfort	Does your pitch and configuration reflect your target market?
The design must include a seat layout	Is your Floorplanner design complete and saved?
The design must be practical for an airline to operate	Is there a clear aisle? Room for crew to move?

Part 3 — Prepare for the Pitch (10 min)

The full sales pitch to A+ Airways happens at the end of the Design Challenge, but now is a good time for students to note what they have built so far and what story they will tell. Tell students: At the end of the next challenge, your team will pitch to A+ Airways. You will need to present your interior design, explain your target market, show your performance data from the wing tests, and share your predicted profit. Everything you have built in this challenge will be part of that pitch. Collect Fuselage Design Profit Analysis Sheets for so students can reference calculations in the Design Challenge when they prepare their final pitch.

DISCUSSION QUESTIONS

- What is the strongest part of your interior design? What would you want to highlight in a pitch?
- If you could go back and change one thing about your design, what would it be?
- Do you think A+ Airways would approve your design? Why or why not?

Companion Handouts

Handout 1. Understanding Risks and Rewards

Name:

Date:

Period:

What is an entrepreneur?

An entrepreneur is someone who starts their own business. They come up with an idea for a product or service, then take the risk of building it into a real company. If it works, they earn the reward. If it doesn't, they can lose the money and time they put in.

1. In your own words, what does it mean to take a "risk"? Give an example from your own life.

2. Think of a time when a risk you (or someone you know) took "paid off." What was the reward?

3. What are some risks that the owner of an airline company might take? List at least two.

4. What could be the rewards for an airline company if things go well? List at least two.

Handout 2. Profit Calculation Sheet

Name:

Date:

Period:

Directions

- Airlines stay in business by earning a profit. In this activity, you'll calculate profit for two airplane scenarios.
- Follow along to complete Case 1 as a class before completing Case 2 on your own.

Key Terms

Term	What it means
Revenue	The total money an airline collects from selling tickets.
Expense	The money an airline must spend to operate a flight (fuel, crew, etc.).
Profit	What's left after expenses are subtracted from revenue.
Profit = Revenue - Expenses	

Case 1

Step 1: Record A+ Airways Standard Flight Information

Number of seats on the airplane:	
Fuel cost for this flight:	
Crew wages for this flight:	
Total expenses (fuel + crew wages):	

Step 2: Calculate revenue at each ticket price below, assuming every seat sells.

Ticket Price	Revenue (Price × Seats)	Total Expenses	Profit or Loss (Revenue – Expenses)
\$75			
\$100			
\$125			

At which ticket price(s) does A+ Airways earn a profit? At which price does it lose money? Why?

Case 2

Design Your Own Scenario

Now it's your turn. A+ Airways is considering a larger airplane with more seats — but also higher costs. Choose your own ticket price and work through the calculation.

Number of seats on this airplane:	
Fuel cost for this flight:	
Crew wages for this flight:	
Other expenses (insurance, taxes, etc.):	
Total expenses:	
Ticket price you choose:	

Step 1 — Full Capacity Revenue: Calculate revenue assuming every seat sells.

Step 2 — Occupancy Rate: In real life, airplanes don't always fly full. Assume this flight is only 80% full. Calculate your Adjusted Revenue. Adjusted Revenue = Full Capacity Revenue × 0.80.

Step 3 — Profit: Adjusted Revenue – Total Expenses.

Reflection: *Is it better for an airline to sell more seats at a lower price, or fewer seats at a higher price? Use your numbers above to support your answer.*

Handout 3. A+ Airways Interior Design RFP

A+ Airways — Interior Design Request for Proposals

A+ Airways is seeking proposals from aircraft design companies to create the interior designs for a fleet of new airplanes. Our current fleet is aging — the oldest in the industry. Our airplanes are not fuel efficient, do not meet current federal air quality regulations, and require a large amount of maintenance.

To cover these costs, A+ has added more rows of seats, leaving just 29 inches of leg room between rows — the least among all airlines. Customers don't like this, and we are losing them to competitors.

A+ needs to turn things around. We are requesting proposals for how to make our planes more profitable. Proposals should include a new airplane interior design and a prediction of potential profits.

Handout 4. Seat Configuration Research Sheet

Name: _____

Date: _____

Period: _____

Directions

- Research 3 different real passenger aircraft. For each one, find out the seating information listed below.
- Use airline websites, seat comparison tools (like SeatGuru), or aviation databases. Record your sources.

Aircraft 1

Aircraft name / model:	
Type (passenger, cargo, other):	
Total number of seats:	
Seat width (inches):	
Seat pitch — leg room (inches):	
Seat configuration (e.g. 3-3, 2-4-2):	
Source (website):	

Aircraft 2

Aircraft name / model:	
Type (passenger, cargo, other):	
Total number of seats:	
Seat width (inches):	
Seat pitch — leg room (inches):	
Seat configuration (e.g. 3-3, 2-4-2):	
Source (website):	

Aircraft 3	
Aircraft name / model:	
Type (passenger, cargo, other):	
Total number of seats:	
Seat width (inches):	
Seat pitch — leg room (inches):	
Seat configuration (e.g. 3-3, 2-4-2):	
Source (website):	

Which of the 3 aircraft would you most want to fly in? Why?

Which configuration fits the most passengers? Which gives passengers the most room? Is there a trade-off between those two goals?

Handout 5. Seat Modeling Data Sheet

Group Members:

Date:

Period:

Directions

- Set up the row: Arrange chairs to match your assigned seat configuration. Place two rows so you can measure pitch.
- Measure the pitch: Use a measuring tape to find the distance from the back of one seat to the back of the seat in front of it. Record in inches.
- Rate Comfort: Have each team member sit in the same seat and rate legroom comfort on a 1–5 scale (1 = very cramped, 5 = very comfortable).
- Rate Practicality: Have one group member sit in the "window" seat and another student sit in the "aisle" seat. The window-seat student must try to get out of the row — without the aisle-seat student standing up — and rate how difficult it was.

Configuration 1					
Seat Configuration (Circle One)	3-3	2-3	2-2	1-2-1	
Total passengers this arrangement fits:					
Seat pitch (inches):					
Comfort Rating: 1 = very cramped, 5 = very comfortable	1	2	3	4	5
Practicality Rating: • 1 = Impossible to exit without the aisle-seat passenger standing up • 3 = Some squeezing or contact required • 5 = Clear path, easy to get out without any contact	1	2	3	4	5

Notes on Arrangement 1:

--

Configuration 2					
Seat Configuration (Circle One)	3-3	2-3	2-2	1-2-1	
Total passengers this arrangement fits:					
Seat pitch (inches):					
Comfort Rating: 1 = very cramped, 5 = very comfortable	1	2	3	4	5
Practicality Rating: 1 = Impossible to exit without the aisle-seat passenger standing up 3 = Some squeezing or contact required 5 = Clear path, easy to get out without any contact	1	2	3	4	5

Notes on Arrangement 2:

Which arrangement did you prefer, and why?

What problems did you notice with either arrangement — things that would make passengers unhappy?

How will what you experienced today help you design the interior of your airplane for A+ Airways?

Handout 6. Fuselage Design Guide

Name:

Group:

Date:

Directions

Use this guide while you design your A+ Airways cabin in Floorplanner. Fill in each section as you build — you'll need these numbers again for your profit analysis in Activity 6.

Part 1 — Reference Aircraft & Fuselage Dimensions

Choose a real commercial aircraft to base your fuselage on. Look up the cabin width and length for an aircraft that has your chosen seat configuration. Add the measurements for cabin length and width in feet and inches to the Fuselage Dimensions table below.

Fuselage Dimensions Table

Reference aircraft I'm using:		
	Feet	Inches
Cabin width:		
Cabin length:		

****Reminder: Set your Floorplanner units to inches so your fuselage and seat pitch measurements match.***

Part 2 — Seat Layout Plan

Plan your cabin layout before you start placing seats in Floorplanner.

Target market for this design:

- ☐ Budget / Economy-focused
- ☐ Standard / Mixed-class
- ☐ Premium / Business-focused

Row configuration (e.g., 3-3, 2-2, 2-4-2):	
Seat pitch I'm using (from Activity 4):	

Part 3 — Design Checklist

Check off each item as your team completes it in Floorplanner.

- ☐ Fuselage walls drawn at the correct dimensions
- ☐ Seats placed in rows matching your chosen configuration
- ☐ Seat pitch matches your Activity 4 measurement
- ☐ A clear aisle is visible between seat rows
- ☐ Seat-class zones are labeled (if your design has more than one class)
- ☐ 2D layout saved, and 3D view checked

Part 4 — Final Seat Count

Once your layout is complete, fill in the table below. You will use these numbers in your Profit Calculation Sheet during Activity 6.

Seat Class / Section	Number of Seats	Seat Pitch (inches)
Premium / Business		
Economy / Standard		
Other		
Total		

Notes: *Anything else about your design you'll want to remember for your pitch (galley, overhead bins, dividers, etc.)*

Handout 7. Fuselage Design Profit Analysis Sheet

Name: _____

Date: _____

Period: _____

Key Formulas

Revenue = Number of passengers × Ticket price

Profit = Revenue – Operating Cost

Operating Cost per flight = \$28,000 (given by A+ Airways — includes fuel, crew, airport fees)

Step 1 — Your Seat Configuration

Your seat configuration (e.g. 3-3):	
Number of rows:	
Total number of seats:	
Seat class(es) offered (economy / business / first):	

Step 2 — Ticket Pricing

Directions

- Decide on a ticket price for each seat class you offer. Your prices should be realistic — look at what airlines actually charge for similar seat types to support your reasoning.
- Calculate Adjusted Revenue: Realistically, not every seat is filled every flight. Uncomfortable planes lose customers. If the practicality score for your seat configuration was 1 or 2, reduce your revenue to 80% of Full Capacity revenue. Otherwise, 90% of full capacity revenue is a good estimate.

Seat Class	Total # of Seats in Class	Ticket Price (\$)	Revenue (\$) (Full Capacity)	Adjusted Revenue (\$) (80-90% of Revenue)
Economy				
Business				
First Class				
TOTAL (Adjusted) REVENUE =				

Step 3 — Profit Calculation

Total Adjusted Revenue (from Step 2):	\$
Operating Cost (given):	\$ 28,000
Profit = Revenue – Operating Cost:	\$

Step 4 — Reflection

Is your airline profitable? If yes, by how much? If no, what would you change to become profitable?

You had to choose between more passengers (higher revenue) and more comfort (higher ticket prices). What choice did your design make, and why?

What data from your seating research (Sheet 2) and the seating experiment (Sheet 3) did you use to help make your design decisions?

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