Family edition

Air Traffic Control Lab: A Second Runway, Testing a Design

Ages 14-18 · about 45 minutes, in one sitting

In Air Traffic Control Lab your child runs a busy airport, adds a second runway, and finds out why a better design needs better rules too.

What you need

- A computer or Chromebook with a current browser.
- The link: mytekdev.com/try/airtrafficlab?lesson=a-second-runway-testing-a-design&ref=fam-airtrafficlab-4. No account, no email and nothing to install.

Before you start: try it once yourself

Open mytekdev.com/try/airtrafficlab?lesson=a-second-runway-testing-a-design&ref=fam-airtrafficlab-4. A short guide opens over Build your traffic's busy schedule, with the program in Python. The tower view is on the left: the airport from the control tower, the airliners with their landing lights on and a tag with each call sign. The radar is on the right: the runway at the top, the dashed final approach line, and a green dot for each airplane with its data block (call sign, altitude in hundreds of feet, speed in tens of knots). Under the radar the radio log keeps every word said, marked "you" or "program". Click an airplane on the radar to give it an instruction.

1. **The schedule.** 14 arrivals straight in on the final, about 2.5 minutes apart, none bunched; 12 departures; wind from 360 at 8; schedule number 7. The same settings and number always make the same traffic. Missions, Build your traffic shows and changes them.
2. **The program.** Four rules: slow each arrival to 160 knots when it calls in; every 10 seconds, keep each arrival's place behind the one ahead (follow_speed); clear it at 5 miles; and ready, which sends a departure when the next arrival is more than 4.5 miles out.
3. **The second runway.** Parallel, 3,000 ft west of the first, for departures only. Arrivals land on 36R and departures leave from 36L, and the radio says so. The radar draws both runways.
4. **Speed.** Time runs at 4 times by default. Speed up and Slower, under the tower view, change it; the round play button starts the shift again from the beginning, with the program as it is now. At 16 times a run takes about 3 to 4 minutes; a busy computer may run a little slower.
5. **Numbers to expect.** One runway: departures wait 10.1 minutes on average, 29 movements an hour. Two runways, the same program: 10.1. Two runways, ready without the if: 0.3, 33 an hour, and the shift ends about 6 minutes sooner. One runway without the if: a conflict. Arrivals 3 minutes apart: 1.7, 1.3 and 0.3. 4 minutes apart: 1.2, 1.2 and 0.3.

> With the if taken out on one runway, a departure rolls in front of an arrival close in, and the conflict alert ends the shift. It is a good thing for children to see: the rule that slowed the two-runway airport is the rule that keeps the one-runway airport safe.

The ideas, in plain words

Busy airports often have parallel runways, one for arrivals and one for departures, so a departure need not wait for a gap between arrivals. Whether that helps depends on how busy the airport is, and on the procedures: the rules the tower and the airplanes follow. A new runway with the old procedures can carry no more traffic than before.

The program here is event-driven: ready runs each time a departure is waiting and a runway clears. Its condition, the next arrival over 4.5 miles out, was right for one runway and wrong for two. Comparing designs on the same test case, and finding why one did not help, is the work of engineering with a simulation.

The app simplifies: real parallel runways need a set distance apart to be used independently, departures also wait behind a heavy jet's wake, and real schedules vary through the day. Air traffic controllers in the United States are hired by the FAA, which says it hired a record 2,235 trainees in its 2026 fiscal year. Applicants must apply before turning 31, and the median pay was $148,080 a year in 2025 (Bureau of Labor Statistics).

Do it together

1. Open mytekdev.com/try/airtrafficlab?lesson=a-second-runway-testing-a-design&ref=fam-airtrafficlab-4, press play, then `Speed up` until it says 16 times faster. Wait for the result card, about 3 to 4 minutes.

   > **You'll know it worked when:** Departures waited 10.1 minutes on average.

2. Open `Missions`, `Build your traffic`, tick "A second runway", press `Fly this traffic`, and speed up again.

   > **You'll know it worked when:** Departures still waited 10.1 minutes.

3. Open `Python` and read ready. Delete the if line, and move the line under it to line up with the if was. Run it again.

   > **If you get stuck:** Python needs the indent: the cleared_for_takeoff line sits four spaces in, under def.
   >
   > **You'll know it worked when:** 0.3 minutes.

4. Ask: why did the new runway not help at first?

   > **You'll know it worked when:** The rule still made every departure wait for the arrivals, even though it had its own runway.

Talk about it

Ask these while you work together. A child who has understood it can answer them without help:

- What stayed the same between your runs, and why does that matter?
- Why did the second runway not help at first?
- What does ready do, and when does it run?
- Why is the if needed on one runway and not on two?
- When is a second runway worth building?

> The second question is the one that matters. A child who says "the program still waited for the arrivals" has found that a design is the hardware and its rules together. A child who says "it was a glitch" has not looked at the program.

For younger and older kids

Younger: For a younger child, stop after the second run and talk about why nothing changed.

Older: For an older child, try arrivals 4 minutes apart with one runway and two, and decide whether the second runway is worth building.

Keep going

- On one runway, change the 4.5 in ready to other numbers, one run each, and find the smallest that stays safe. What does each change do to the wait?
- Find the arrival spacing where a second runway starts to save more than 5 minutes a departure.
- Add arrivals from the east and west in Build your traffic: does the program still land them all? What would it need?

Bring it into other subjects

- Math: graph the departures' wait against the arrival spacing for one runway and for two.
- Economics: if each minute of delay costs an airline a set amount per departure, what does the second runway save in a year of such hours?
- Careers: look up what an airport planner does, and how airports decide to build a runway.
- Civics: find a runway project near you, and what the people living nearby said about it.

For your records

Ready to copy into an hour log, a portfolio or a transcript.

LESSON	Air Traffic Control Lab: A Second Runway, Testing a Design
SUBJECTS	Engineering, Computer science
TIME	45 minutes

WHAT WE DID	Tested one and two runways on the same busy schedule in an airport simulation, changed the program's departure rule, and compared the delays to decide when a second runway helps.
SKILLS PRACTICED	Testing a design fairly; Conditions in Python; Deciding from data

Activity sheet (optional)

Name: _____ Date: _____

Open the app: scan the QR code, or go to mytekdev.com/try/airtrafficlab?lesson=a-second-runway-testing-a-design

Essential question: Does a better design help if the rules stay the same?

Warm-up: A school adds a second cafeteria door, but the line is just as slow. How could that happen? _____

1. **Vocabulary.** Departure, parallel runway, throughput, delay, test case, event handler: write each in your own words.

2. **The guide.** One runway: departures waited ____ minutes. Two runways, same program: ____ minutes. Why the same? _____

3. **My table.** Spacing / runways / ready with or without the if / wait or what happened. 2.5, 2, without: ____. 2.5, 1, without: ____. 3, 1, with: ____. 3, 2, without: ____. 4, 1, with: ____. 4, 2, without: ____.

4. **My change.** The lines of ready after my change: _____

1. Why is the if needed on one runway and not on two?

2. Would you build the second runway? Use your table.

Quick check

Name: _____

1. Comparing two designs fairly means: (A) changing as much as possible each run (B) using the same test case and changing one thing (C) running each design once on a different schedule

2. ready runs: (A) once, at the start (B) when a departure is waiting and a runway clears (C) every second

3. A friend adds a third runway and nothing improves. Use what you learned today to say what they should look at, and why.

Answers

QUESTION	ANSWER	WHY
1	B	With the same schedule, a difference in the result comes from the one change.
2	B	It is an event handler: the system calls it when the event happens.
3	Open answer	The rules: a condition written for the old design may still make airplanes wait, like ready's check on the arrivals.

If your state or umbrella school asks, this lesson covers NGSS HS-ETS1-4, CSTA 2017 3A-AP-16.

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The app this lesson uses is free and runs in the browser, with nothing to install and no account needed. It is at mytekdev.com.

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