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Air Traffic Control Lab: Cleared to Land, a Rule for Every Arrival

Grades 6-8 · 45 minutes

Computer science



Slides, rubric and answer key | Print and go | No student accounts | Chromebook friendly

What's included

- A one-page overview: objectives, essential question, vocabulary, standards and assessment
- A 45-minute lesson sequence: warm-up, direct instruction, guided practice, independent practice, closure
- Slides for the board: a PowerPoint file that also opens in Google Slides
- A student worksheet with a QR code and a table for six tests
- A 3-question exit ticket, two to a page, with an answer key
- A rubric: 3 criteria, 4 levels, scored out of 12
- Differentiation for English learners, students with IEPs or 504 plans, and students who need more support or more challenge
- Cross-curricular extensions, and notes for teaching it in grades 4 and 5 and in high school
- Standards: CSTA 2017

Air Traffic Control Lab: Cleared to Land, a Rule for Every Arrival

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Level 1 of Air Traffic Control Lab puts students in the control tower of a made-up airport, Kestrel Valley, with a radar beside the window. Larkspur 21 comes down the final approach and, a mile from the runway, climbs away: a go-around, because no airplane may land without a landing clearance. Students click it on the radar and choose Cleared to land, then do the same for the two arrivals behind it. Then they write the same thing once, as a rule in Blocks: when an arrival is 5 miles from the runway, clear this airplane to land. The three land with nobody clicking. Last, they test the rule at six distances and find where it stops working, and why.

At a glance

ESSENTIAL QUESTION

How can one rule do the same job for every airplane that arrives?

OBJECTIVES

Students will be able to:

- explain why an airplane goes around without a landing clearance
- give an instruction by hand and read the readback on the radio
- write a rule that runs when something happens, for every airplane
- test a rule with several values and record what happens
- explain where and why a rule stops working

VOCABULARY

Air traffic controller, Final approach, Landing clearance, Go-around, Readback, Rule (event)

STANDARDS

2-AP-17

TIME AND MATERIALS

45 minutes, grades 6-8.

- One computer or Chromebook per student
- A projector
- The worksheet and exit ticket, one copy each per student
- The rubric, one copy per student if you grade the work

PREP

Make copies of the worksheet and exit ticket. Before class, open mytekdev.com/try/airtrafficlab?lesson=cleared-to-land-a-rule-for-every-arrival&ref=tpt-airtrafficlab-1 once on a student computer, which checks that your school's filter allows the app, and follow the short guide yourself: about ten minutes.

ASSESSMENT

- Formative: the questions under What to look for, asked while students work, and the exit ticket (answer key included).
- Summative: the worksheet, scored with the rubric.

TECHNOLOGY AND PRIVACY

Runs in any browser, Chromebooks included, with nothing to install. Students need no account and no email: the link works signed out, and nothing they do is stored on our server unless they choose to save.

Lesson sequence

MINUTES	STAGE	WHAT YOU DO	WHAT STUDENTS DO
0 to 5	**Warm-up** Hook	Show the title, essential question and Today I can slides (about 1 minute). Then the warm-up: how does each pilot know it is safe to land?	Answer the warm-up on the worksheet.
5 to 13	**Direct instruction (I do)** Model it	Project Level 1. 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. Press play. Larkspur 21 comes down the final; a mile out it climbs away, and the radio says "going around, no landing clearance". Press play again, click Larkspur 21 on the radar, and choose Cleared to land. Read the radio aloud: the tower's words, then the pilot's readback. **It's working when:** Ask what the pilot said back, and why pilots repeat it. A readback lets the controller catch a mistake before it matters.	Watch, and fill in the vocabulary on the worksheet.
13 to 22	**Guided practice (We do)** By hand, then by rule	Students open the link or scan the QR code. A short guide walks them through the go-around, clearing all three by hand, then the rule in Blocks. Walk the room until every student has all three landed by the rule, with nothing clicked. **Watch for:** Students who put the clear block outside the rule. It does nothing there: a block runs only inside the rule it belongs to.	Follow the guide. Write when Larkspur 21 went around, and whether the rule landed all three.
22 to 37	**Independent practice (You do)** Test the rule	Students change the 5 in the rule to 20, 10, 2, 1.5 and 1, play each time, and record whether all three landed. Then they try the other rule, "when an arrival checks in", with the same block inside. 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. Walk the room with the What to look for questions. **If they ask:** "Between which two numbers does the rule stop working?" The edge **Watch for:** Students who think a bigger number is always safer. In the app 20 works, but a real controller clears an airplane only when they know the runway will be clear for it.	Fill in the table with six tests, and answer the questions.

MINUTES	STAGE	WHAT YOU DO	WHAT STUDENTS DO
37 to 45	**Closure** Where does it stop working? And exit ticket	Show the closure slide. Take answers: at 1 mile the clearance comes too late. Back to the warm-up: who tells the pilot? Now, a controller with a program that helps. Hand out the exit ticket.	Discuss, then answer the exit ticket.

Before you teach: a ten-minute walkthrough

Open mytekdev.com/try/airtrafficlab?lesson=cleared-to-land-a-rule-for-every-arrival&ref=tpt-airtrafficlab-1. A short guide opens over Level 1, Cleared to land. 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 traffic.** Larkspur 21 calls in 6 miles out at the start. Fernway 62 calls in at 1:10, 12 miles out, and Tidewing 4 at 2:20, 16 miles out.
2. **Clearing by hand.** Press play, click an airplane on the radar, and a box opens with its instructions; Cleared to land is the green one. The tower says it and the pilot reads it back in the radio log, and CLRD TO LAND appears in the data block.
3. **The rule.** Blocks, Rules: "when an arrival is 5 miles from the runway", with "clear this airplane to land" inside. The rule runs once for each airplane as it reaches 5 miles. The Python tab shows it as a function, closing_in, and tower.when_miles_out(5, closing_in).
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.
5. **Numbers to expect.** Nothing done: Larkspur 21 goes around at 2:12. Cleared by hand or by rule: the three land at 2:44, 6:43 and 8:43, and the level ends at 9:28. The rule at 20, 10, 5, 2 and 1.5 miles: all three land. At 1 mile: Larkspur 21 goes around. "When an arrival checks in" with the clear block: all three land.

> The app accepts a clearance 20 miles out, and every arrival lands, because each one lands in turn. A real controller clears an airplane only when they know the runway will be clear when it gets there. It makes a good closing question.

Background for the teacher

An airplane may not land without a landing clearance from the tower: "Runway three six, cleared to land." The words in the app come from the FAA's rule book for controllers. If the clearance has not come by about a mile out, the pilot goes around: climbs away, flies a circuit and comes back. A go-around is not a failure; it is the safe thing when something is not right.

Pilots read every instruction back, so the controller hears a mistake before it matters. The radio log in the app shows both halves, the tower's words and the readback.

Real controllers already use computers that help: tools that sequence arrivals and warn of conflicts. In the app the student's program is like those tools. It acts on events, and the student can step in by hand at any moment; the radio log marks each instruction as the student's or the program's. 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).

What to look for

Ask these while students work. A student who has understood the lesson can answer them without help:

- Why did Larkspur 21 go around?
- What did the pilot say back, and why?
- How does the rule know which airplane to clear?
- Between which two numbers does the rule stop working, and why?
- Why might a real controller not clear an airplane 20 miles out?

> The third question is the one that matters. A student who says "it runs for each airplane as it gets to 5 miles, and clears that one" understands an event. A student who says "it clears them all at the start" has the result but not the idea.

Cross-curricular extensions

- Math: an airliner on final flies about 140 knots, 140 nautical miles an hour. How many seconds does it take to fly the last mile?
- English: listen to how pilots and controllers keep words short and exact. Rewrite a classroom instruction in the same style.
- Careers: look up what an air traffic controller does in a day, and how the FAA hires them.
- Computer science: find a rule in an app you use, such as a phone that silences itself at night, and say what event starts it.

Vocabulary

Air traffic controller	The person in the tower or the radar room who tells each airplane where to go and when, so they stay apart.
Final approach	The straight line an airplane flies down to the runway, the dashed line on the radar.
Landing clearance	Permission to land: "Runway three six, cleared to land." No airplane may land without one.
Go-around	Climbing away instead of landing, then coming back to try again. It is the safe choice when something is not right.
Readback	The pilot repeating the instruction, so the controller knows it was heard right.
Rule (event)	Code that runs when something happens, such as an airplane reaching 5 miles, every time it happens.

Differentiation

ENGLISH LEARNERS

- Keep the vocabulary slide up, and point at the radar, the airplane or the radio log as you say each word: the picture carries the meaning.
- Give a sentence frame on a card: When an arrival is ____ miles from the runway, the rule ____.
- Act it out: one student walks toward a line taped on the floor, and stops only if the "controller" says "cleared to land" in time.

STUDENTS WITH IEPS OR 504 PLANS

- Pair students, one at the keyboard and one recording results.
- Give the six numbers on a card: 20, 10, 5, 2, 1.5, 1.
- Where the IEP allows a modified assignment, score the first two rubric rows only.

STUDENTS WHO NEED MORE SUPPORT

- Build the rule together on the board, block by block.
- Fill in the 5 mile row of the table together.
- The card above the tower view says what went wrong after every run.

STUDENTS READY FOR MORE

- Open Level 2: an arrival flying across the approach. Write a rule that turns it onto the final, and keep the landing rule.
- Open the Python tab and find the rule. Which line says when it runs?
- Try "when the runway is clear" with the clear block inside. Does it land all three? Why might a real controller like it better?

Adapting for other grades

Younger students: In grades 4 and 5, do the go-around and the hand clearances together on the board, then let pairs build the rule. Score the first two rubric rows, total 8, and 6 meets the objectives.

Older students: In high school, open the Python tab: the rule is a function and a line that registers it, tower.when_miles_out(5, closing_in). Ask students to write when_checks_in themselves, then go on to Level 3, where the rule has to slow a faster airplane behind.

Student worksheet

Name: _____ Date: _____

Open the app: scan the QR code, or go to mytekdev.com/try/airtrafficlab?lesson=cleared-to-land-a-rule-for-every-arrival

Essential question: How can one rule do the same job for every airplane that arrives?

Warm-up: How does a pilot know it is safe to land? _____

1. **Vocabulary.** Air traffic controller, final approach, landing clearance, go-around, readback, rule: write each in your own words.

2. **Nothing done.** Larkspur 21 went around at ____ . The radio said: _____
3. **My table.** Miles in the rule / did all three land? 20: ____. 10: ____. 5: ____. 2: ____. 1.5: ____. 1: ____. "When an arrival checks in": ____.

4. **The edge.** The rule works down to ____ miles, and stops working at ____ miles.

1. Why does the rule stop working at 1 mile?

2. How does one rule clear three different airplanes?

Exit ticket

Name: _____

1. Without a landing clearance, an airplane: (A) lands anyway (B) goes around (C) waits on the runway

2. "When an arrival is 5 miles from the runway" runs: (A) once, at the start (B) once for each airplane, as it reaches 5 miles (C) every second

3. A friend's rule says "when an arrival is 1 mile from the runway" and the first airplane goes around. Use what you learned today to say what to change, and why.

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Exit ticket

Name: _____

1. Without a landing clearance, an airplane: (A) lands anyway (B) goes around (C) waits on the runway

2. "When an arrival is 5 miles from the runway" runs: (A) once, at the start (B) once for each airplane, as it reaches 5 miles (C) every second

3. A friend's rule says "when an arrival is 1 mile from the runway" and the first airplane goes around. Use what you learned today to say what to change, and why.

Answer key: exit ticket

QUESTION	ANSWER	WHY
1	B	It climbs away and comes back. Landing without a clearance is not allowed.
2	B	A rule waits for its event, and runs each time it happens, for that airplane.
3	Open answer	A bigger number, 1.5 or more, such as 5: at 1 mile the clearance comes too late for the pilot.

Worksheet: what students should find

BLANK	WHAT THE APP SHOWS
Nothing done	2:12. "Larkspur Twenty-One, going around, no landing clearance."
My table	20, 10, 5, 2 and 1.5: all three land. 1: Larkspur 21 goes around. "When an arrival checks in": all three land.
The edge	Works down to 1.5 miles, stops working at 1.
Question 1	At 1 mile the clearance comes too late: the pilot needs it before a mile out, and a moment to answer.
Question 2	The rule runs once for each airplane as it reaches the distance, and clears that airplane.

> Every run of Level 1 is the same three airplanes at the same places, so a rule gives the same result on any computer. A student whose result differs changed something else too.

Rubric

Score each row from 1 to 4.

Name: _____

CRITERIA	4 EXCEEDS	3 MEETS	2 APPROACHING	1 BEGINNING
Clearing by hand	Clears all three by hand and explains the go-around and the readback in their own words.	Clears all three by hand.	Clears one or two, or clears too late.	Does not clear any.
Writing the rule	Writes the rule, lands all three with nothing clicked, and explains why the block goes inside the rule.	Writes the rule and lands all three with nothing clicked.	Builds the blocks but they do not run, or clicks as well.	No rule.
Testing the rule	Tests six or more distances, records each, and explains why 1 mile fails.	Tests five distances and records each.	Tests one or two.	Does not test.

Total: ____ / 12. A score of 9 or more meets the objectives.

Standards

The lesson is built for CSTA 2-AP-17: students test one rule with six values, find where it stops working and explain why. Writing the rule itself is the start of event-driven programming, which high school students carry further in the CSTA 3A-AP-16 notes.

FRAMEWORK	CODE	GRADES	STANDARD	HOW THE LESSON MEETS IT
CSTA 2017	**2-AP-17**	6-8	Systematically test and refine programs using a range of test cases.	Students test their landing rule at six distances, record which pass, and refine the rule from the results.

Checked November 2026 against: CSTA K-12 Computer Science Standards, Revised 2017.

Optional: save student work in a free class

The whole lesson runs at the link on the worksheet, with no accounts and no sign-up.

To keep students' work, and see it all in one place, make a free class. It takes about ten minutes, once, and covers every lesson in this series: mytekdev.com/tools/class-setup

Students in a class open mytekdev.com/tools/air-traffic-control-lab/lessons/cleared-to-land-a-rule-for-every-arrival/start instead of the worksheet link. Each one gets their own copy of the starter, and the same link reopens it next time.

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