Time Keeper Challenge (Intermediate)

The Timekeeper Challenge: A 30-Minute Engineering Startup Simulation

Welcome! For the next 30 minutes your team is a **startup company**. Your product is a **mechanical timer** built from plastic cups, string, and tape. Design it, fund it, build it, prove it works, and sell it, all while making more money than the other companies in the room.

This page has everything you need. **Read it before the event** if you can. Teams that arrive with a design sketch and a plan will have a big advantage.

> **Bring:** your worksheet (the one with the QR code that led you here) and a pencil. No electronics may be used to time anything during an official test (see Rules).

---

1. The Big Picture

- **The product:** a device that measures **30 seconds (±3 s)** *without electronics*.
- **The customer:** a market that will buy your sensor design if it is accurate, early, and cheap to make.
- **The money:** the government may fund your proposal. You spend money on labor, materials, machining, and official tests. The market buys your sensors if you have a successful demo, with bonuses for being first and most accurate. **The company with the highest final profit wins.**
- **The catch:** the clock is running on your payroll from the moment the simulation starts.

Different strategies can win:

Strategy	Idea
First to market	Get a certified passing device done early and file your report before anyone else.
Lean operator	Build something so cheap and simple that your margin is huge.
Precision specialist	Spend on testing and refinement to be the most accurate.

---

2. Timeline

Minute	Event
0	"Go!" Payroll starts. The Store and Machine Shop open. Form your team.
12	**Proposals due** to the Government.
15	**Awards announced.**
27	**Last certified test** may begin.
30	**Final reports due. Hard stop.**

Teams form on their own schedule. There is no deadline, but the payroll is already running (see below).

---

3. Forming Your Company

- Teams have **3 to 6 members**.
- Pick a company name and write it on your worksheet.
- Record each member's **class year**. This sets each person's labor rate.
- **No layoffs.** Everyone on the final team is on the payroll.

---

4. Labor Costs

Each team member is paid per minute:

Class	Rate
Freshman	$5 / minute
Sophomore	$10 / minute

Class	Rate
Junior	$15 / minute
Senior	$20 / minute
Non-student / faculty / other	You name your own rate (minimum **$5 / minute**)

When does the meter start? At **minute 0**, when the simulation starts. Recruiting, brainstorming, and writing the proposal all count as work. **Every member of your final team is billed from minute 0**, even if they joined later.

When does it stop? The moment you **submit your final report**.

Example: A team of 1 senior, 2 juniors, 1 sophomore, and 1 freshman costs 20 + 15 + 15 + 10 + 5 = **$65 per minute**. If they submit their final report at minute 28, labor is 28 × $65 = **$1,820**.

Upperclassmen are fast and expensive. Underclassmen are cheap. Building a good mix is part of the challenge.

---

5. The Store and Machine Shop

The Store is an **unmanned table** that is open from minute 0. It runs on the **honor system**: take what you need, and **record everything you take on your worksheet**. Stock is limited, and when it's gone it's gone.

Item	Price	Stock
Large cup (12 oz party cup)	$40	10
Small cup (5 oz clear plastic)	$20	100
Twine (per length)	$30	**[TBD]** (poor quality and limited, and it may break)
Sharpie	$25	**[TBD]**
Tape (per length)	$40	**[TBD]**
Scissors	$100	**[TBD]**
Fishing line (per length)	$100	**[TBD]** (very limited and expensive)

Free: water (from a sink or drinking fountain), air, gravity, and sand or coins from your own pockets. Also on the table: **one free sticker per team**. It is not a material and does not go on your bill.

> **Only Store items and the free list may be built into your device.** No electronics or outside parts.

Machine Shop

- **$50 per hole**, regardless of hole size.
- Mark the hole location and size on the cup with a Sharpie first.
- **First come, first served.** Waiting in line still costs payroll.
- Record each hole on your worksheet.

You can also cut your own holes if you buy scissors. Is the machine shop worth $50? That's a business decision.

---

6. The Government

The Government has a fixed budget for all companies (about **$8,000**). It may fund **zero, one, or several** proposals. If your proposal looks too expensive or unrealistic, **it will not be funded.**

- Your proposal asks for a fixed amount of money.
- If funded, you receive **exactly that amount, counted as income in your final profit**. You keep whatever you don't spend. If you spend more, **the overrun comes out of your profit.**
- If you are not funded (or submit late) you can still compete. You just have no grant income.

The proposal (due at minute 12)

Fill in these two sections on your worksheet and hand it in:

1. **A drawing** of your device, labeled with materials and rough dimensions.
2. **Your requested budget**, built from the cost worksheet (labor + materials + machining + certified tests).

Padding your budget makes you look expensive, and a cheaper competitor may win the money. Underestimating means you eat the overrun. A cheaper, credible plan is more likely to be funded.

---

7. Testing

Practice runs (free)

Use the practice timer as often as you want. The app shows a target of **30 seconds** and starts a **hidden clock** when you press the **space bar**. Use your device, and when you think 30 seconds have passed, press the **space bar** again. The app shows how far off you were.

Certified tests ($500 each, paid to the Government)

A certified test is an **official, witnessed run** that goes on the record.

- Each test is **one attempt at 30 seconds**.
- Tests are run at the front of the room by the **Test Operator**, and the app logs every run automatically.
- Tests are **queued** on a whiteboard. If your team is not ready when called, you **forfeit that slot**.
- **No phones, watches, or timing devices** may be used by your team during a certified run.
- **The last certified test may begin at minute 27.** All certified tests must finish by minute 30.
- You can buy as many certified tests as you can afford. You choose which result to claim in your final report.

Passing means the certified time is within **±3 seconds** of 30 seconds.

---

8. The Market

The market expects to buy about **500 sensors in total, at $200 each**. It buys only from companies with a **successful demo**, meaning a certified test within **±3 seconds** of 30 seconds.

How the 500 units are split

- Every successful company gets **1 share**.
- The company with the **most accurate** certified result (smallest error) gets **1 bonus share**.
- The company that is **first to market** (earliest final report that includes a certified pass) gets **1 bonus share**.
- **Units per share = 500 ÷ total shares.** Each company sells its shares' worth of units.

Example with 3 successful companies: A is most accurate (2 shares), B is first to market (2 shares), C is neither (1 share). That's 5 shares, so each share is 100 units: **A sells 200, B sells**

200, C sells 100.

If one company wins **both** bonuses, it gets 3 shares. Ties in accuracy go to the earlier final report.

Your payout

Payout = units sold × ($200 − your cost per unit).

- **Cost per unit** is the total of the Store prices of the parts in your finished device. **Tools are not part of the device**(scissors, Sharpies) unless you built them into it.
- **Factory costs are free.** Assembly and drilling cost nothing in mass production, so holes and assembly time do not count toward unit cost.
- Cheaper devices earn more on every unit. A device costing $200 or more per unit earns nothing.

Worked example: A device uses two small cups ($20 each), one length of twine ($30), and one length of tape ($40). Cost per unit = $110, so profit per unit = $90. If this company is company C above (100 units), its payout is **100 × $90 = $9,000**.

If no team passes ±3 seconds

That just means the technology is less mature than the market hoped. Nobody is a "successful company," and the bonuses are not awarded. The market will place a small **pilot order of 100 units** with the closest team **within ±5 seconds**, if there is one. If nobody is within ±5 seconds, there are no sales.

---

9. The Final Report (due minute 30)

Your **finish time is the minute you submit the report**. Labor stops then. A team with no report makes no market sales. The report must contain:

1. **Team name** and members with class years.
2. **Certified test result(s)** you are claiming (the Test Operator will confirm against the app log).
3. **Total project cost**: labor, materials, machining, and certified tests.
4. **Bill of materials** for one unit, and the resulting **cost per unit**.
5. **A drawing** of the device as built.
6. **Whether you are claiming a successful demo**, and any bonus (most accurate or first to market).
7. **Your net profit** (see below).

Everything except the certified test log is **self-reported**. Be honest and keep your worksheet neat. The organizers may spot check, and misreporting will disqualify a team.

Scoring: who wins?

The winner is the company with the highest net profit.

> **Net profit = government grant + market sales − labor − materials − machining − certified test fees**

Everyone starts at $0. Negative is possible.

Illustrative example (your numbers will differ):

	Amount
Grant received	+$2,800
Market sales (100 units × $90)	+$9,000
Labor (28 min × $65)	−$1,820
Materials	−$180
Machine shop (1 hole)	−$50
Certified tests (2)	−$1,000
Net profit	**+$8,750**

---

10. Rules

- **Teams of 3 to 6.** No layoffs.
- **Only Store items** and the free list go into the device.
- **Honor system.** Record every item you take, every hole you drill, and every certified test you buy.
- **No phones, watches, or timing devices** during certified runs.
- Machine Shop jobs are first come, first served. Mark the hole with a Sharpie first.
- Clean up water spills, and be kind to the volunteers.
- **Certified tests must finish by minute 30. Final reports are due at minute 30.**
- The organizers' decisions are final.
- Have fun.

---

11. Who's Who

Role	What they do
Government	Reviews proposals and awards grants. Also responsible for running certified tests
Machine Shop	Drills holes for $50 each.

12. Tips for Getting Ready

- Sketch two or three designs before the event. Which one uses the fewest materials?
- Think about what actually keeps time: dripping water, a swinging weight, a rolling object.
- Consider whether the machine shop is worth $50, and whether scissors are.
- Plan your team mix. Cheap labor is slow, expensive labor is fast, and *everyone is billed every minute.*
- Estimate your budget honestly. Payroll runs from minute 0, so a 30-minute plan for a team of 5 already costs well over $1,500 before any materials.
- Plan your certified tests. They cost $500 each and the last one must start by minute 27.

Revision #1
Created 2026-09-28 04:06:32 UTC by Jonathan Wheeler
Updated 2026-09-28 04:07:28 UTC by Jonathan Wheeler