

RULES FOR THE DRONE SCIENCE MISSION GAME



INTRODUCTION

The citizens of Disasterville are worried. A long-dormant volcano near the town has recently shown signs of renewed activity. Geologists hiked up the volcano and put instruments in place to help monitor it. However, it may not be safe to send another crew up onto the volcano, and scientists want aerial measurements of the volcano to complement the readings from the instruments on the ground.

The mayor of Disasterville has offered to hire your company, which flies drones, to monitor the volcano for signs that it might erupt. You will equip your drone with cameras and gas sensors and other instruments that can detect signals that an eruption might happen soon. You will fly your drone to the volcano several times, collecting data with your instruments on each flight.

The mayor has offered you \$700 to equip your drone with special cameras and sensors to monitor the volcano. The mayor has also offered a cash reward for any scientific data your drones bring back from each flight to the volcano.

Collect as much scientific data about the volcano as you can!



Science Data Points

GOAL AND BASIC STEPS OF GAME PLAY

Your **goal** is to collect as much scientific data (Science Data Points) about the volcano as you can in **three** drone flights to the volcano.

The main steps in playing the game are:

1. Set up your drone. Buy a battery, a camera, and some sensors to mount on your drone.
2. Fly your first mission to the volcano. Collect as much science data about the volcano as you can.
3. Earn money for the science data you collect. Spend the money on better equipment for your drone.
4. Fly a second mission to the volcano. Once again, try to collect lots of Science Data Points.
5. Earn more money and spend it on better equipment.
6. Fly a third and final mission to the volcano. Collect more Science Data Points.
7. Add up your Science Data Points for all three flights. The team with the most points wins!



The **Quick Start Guide** below provides step-by-step instructions for play. If this is your first time playing the game, you should also read through the **Rules - Details** section that follows the Quick Start Guide.

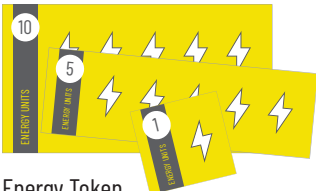
QUICK START GUIDE



Weight Token



Drone Token



Energy Token



Flight Event Cards



Science Event Cards

Setup

- Choose roles for players. Each team should have a Banker, an Engineer, a Pilot, and a Scorekeeper.
- Give each player the game board for their role.
- Place cards and tokens on the game boards.
- **Place \$700 on the Engineer's Board as starting money** to equip your team's drone.

Equip Your Team's Drone

- Spend money buying a camera, battery, and sensors for your drone.
- Your drone must have at least one camera and a battery. You can buy up to four sensors, but it is **not** a requirement to have **any** sensors.
- Add up the masses for all of your equipment. Place the weight token on the Mass & Energy Use Table.
- Record your equipment and total mass on the Score Sheet.
- Charge your battery. Place Energy Tokens on the Engineer's Board.

Fly First Mission

- Place the Drone Token on Home Base on the Pilot's Board.
- Fly for one minute towards the volcano.
 - » Move your Drone Token ahead one space.
 - » Spend Energy Units based on the mass of the equipment on your drone.
 - » Pick a Flight Event Card from the top of the deck and follow the instructions on it.
- Fly four more minutes to the volcano.
 - » Each minute, spend Energy Units.
 - » Each minute, draw a new Flight Event Card.
- Hover above the volcano collecting science data.
 - » Each minute, spend Energy Units.
 - » Each minute, draw a new Flight Event Card.
 - » Each minute, draw a new Science Event Card or use the last card drawn.
 - » Collect Science Data tokens.
 - » Record the number of minutes your drone spends at the volcano on the Score Sheet. Add a tick mark after each minute.
 - » At the end of each minute, decide whether your drone should stay at the volcano or head back to base.



- Fly back to base.
 - » Each minute, move your Drone Token one space along the path from the volcano back towards Home Base.
 - » Each minute, spend Energy Units.
 - » Each minute, draw a new Flight Event Card.
- If your drone runs out of Energy Units before it makes it back to Home Base, it crash-landed. You lose some science data and must spend money on repairs.

After Each Flight

- Record the number of Science Data Points earned on the Score Sheet.
- Earn money for Science Data Points.
- If your drone crashed before making it back to Home Base, spend money on repairs.
- Change the equipment on your drone if you want to. Add new equipment, replace the equipment you have with better items, or remove some of your equipment to save weight.
- Add up the masses for all of your equipment and place the weight token on the matching spot on the Mass & Energy Use Table.
- Record your equipment and mass on the Score Sheet.
- Recharge your drone's battery.
- Return all Flight Event Cards and Science Event Cards to their decks.

Second Flight

- Start with the Drone Token on Home Base.
- Fly to the volcano.
 - » Each minute, spend Energy Units and move your Drone Token along the path towards the volcano.
 - » Each minute, draw a new Flight Event Card from the deck.
- Hover over the volcano, collecting science data.
 - » Each minute, spend Energy Units and draw a new Flight Event Card.
 - » Each minute, draw a new Science Event Card or keep the last one picked.
 - » Each minute, collect Science Data tokens.
 - » Record each minute your drone spends at the volcano on the Score Sheet.
- Fly back to base.
 - » Each minute, move your Drone Token one space along the path towards Home Base and spend Energy Units.
 - » Each minute, draw a new Flight Event Card from the deck.
- If your drone runs out of Energy Units before it makes it back to Home Base, it crash-landed. Lose some science data and spend money on repairs.



- After the second flight, follow the **After Each Flight** instructions again, just like you did after the first flight.

Third Flight

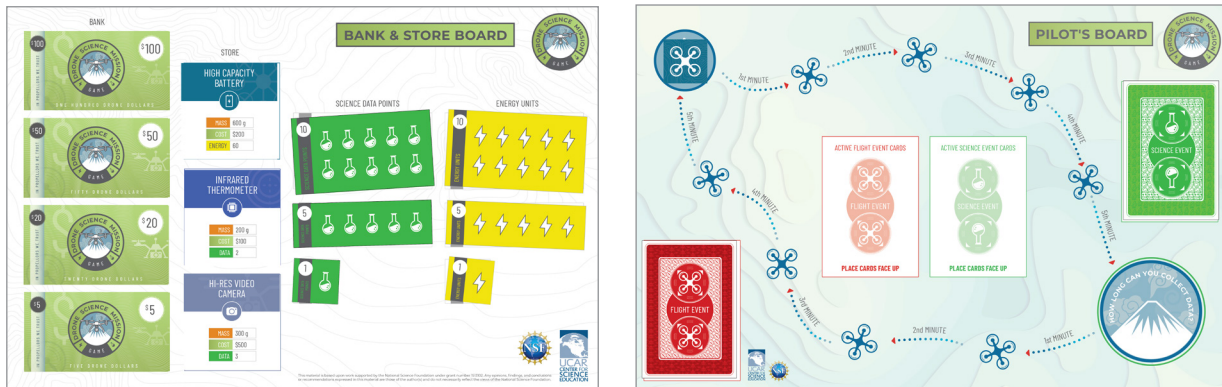
- Follow the same steps as the second flight.
- After the third flight, follow the **After Each Flight** instructions again.
 - » You don't need to buy or sell equipment.
 - » You don't need to recharge the battery.
- Add up the Science Data Points for all three flights and write that on your Score Sheet.



COMPLETE RULES AND DETAILS

Setup

- Choose roles for players.
 - » The game works best with four players. If you have fewer players, someone can serve in two or more roles. For example, one player could be both the Banker and the Scorekeeper. The game can even be played by one person who serves in all four roles.
 - » Your group plays together, making decisions as a team. For example, everyone in your group should have a say about what sensors to equip your drone with or how long your drone should hover at the volcano. The different roles are meant to make it easier to manage the information on the boards by having one person keep track of each board.
 - » The four roles and the boards or sheets that each player controls are:
 - Banker - Bank & Store Board
 - Engineer - Engineer's Board
 - Pilot - Pilot's Board
 - Scorekeeper - Score Sheet

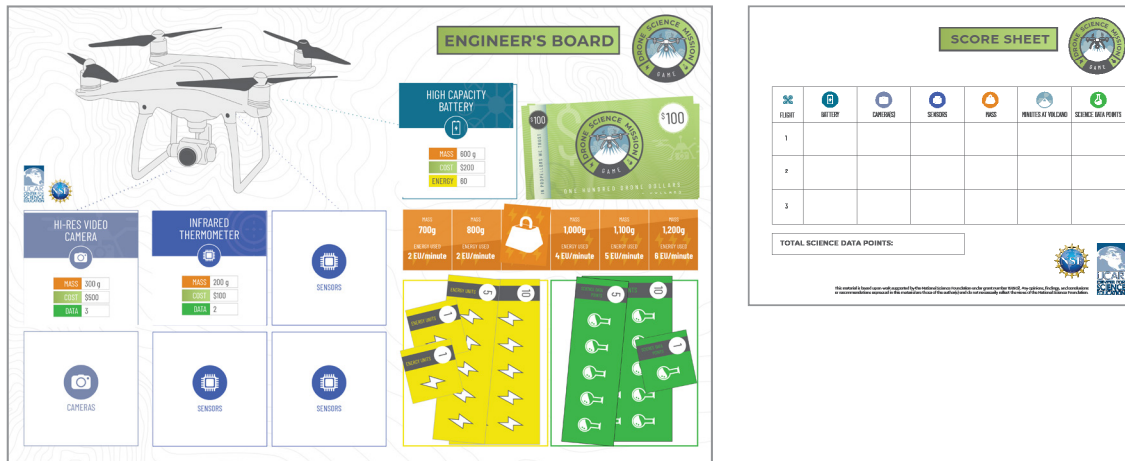


- Place cards and tokens on the game boards.
 - » Pilot's Board
 - Shuffle the deck of Flight Event Cards and place them face down on their space on the Pilot's Board.
 - Shuffle the deck of Science Event Cards and place them face down on their space on the Pilot's Board.
 - » Bank & Store Board
 - Place the Money, Equipment Cards, Energy Tokens, and Science Data Tokens on their spaces on the Bank & Store Board.
- Place **\$700 on the Engineer's Board as starting money** to equip your team's drone.



Equip Your Team's Drone

- Spend up to \$700 buying a camera, battery, and sensors for your drone. You don't need to spend all of the money at the start. If you would like, you can save some for later rounds.
- Your drone must have at least one camera and a battery. You can buy up to four sensors, but it is **not** a requirement to have **any** sensors. Your drone can have two cameras.
- Add up the masses for all of your equipment. Place the weight token on the Mass & Energy Use Table on the Engineer's Board. Notice the Energy Use Rate that matches your equipment's mass.
- Record your equipment and total mass on the Score Sheet.
- Charge your battery. Read the Energy value on your drone's battery. Take that number of Energy Tokens from the Bank & Store Board and place them on the Engineer's Board.



Fly First Mission

- Place the Drone Token on the Pilot's Board on Home Base.
- Fly for one minute towards the volcano.
 - » Move your Drone Token ahead one space.
 - » Spend Energy Units. Look up the number of Energy Units your drone uses each minute on the Mass vs. Energy Use Table on the Engineer's Board. Remove that number of Energy Units from the Engineer's Board and place them back on the Bank & Store Board.
 - » Pick a Flight Event Card from the top of the deck and follow the instructions on it.
- Fly four more minutes to the volcano.
 - » Each minute, spend Energy Units based on the mass of the equipment on your drone.
 - » Each minute, draw a new Flight Event Card from the deck and follow the instructions on it.
- Hover for **at least** one minute above the volcano, collecting science data. For **each minute**:
 - » Spend Energy Units based on the mass of the equipment on your drone.
 - » Draw a Flight Event Card from the top of the deck and follow the instructions on it.
 - » Draw a Science Event Card from the top of the deck and place it face-up on the Active Science Event Card space on the Pilot's Board.
 - » Collect Science Data tokens based on the data values on the camera(s) and sensor(s) on your drone. Add bonus points based on the Active Science Event Card if it matches a camera or sensor on your drone.
 - » Record each minute your drone spends at the volcano on the Score Sheet.



- Decide whether to continue hovering over the volcano collecting data or to head back towards Home Base.
- For each extra minute your drone is at the volcano, repeat the flight events and science events.
 - » Each minute, spend Energy Units and draw a new Flight Event Card.
 - » Each minute, draw a new Science Event Card or keep the last one picked.
 - » Each minute, collect Science Data tokens based on your cameras and sensors and on the Active Science Event Card.
 - » Record each minute your drone spends at the volcano on the Score Sheet.
- Fly back to base
 - » Each minute, move your Drone Token one space along the path from the volcano back towards Home Base.
 - » Each minute, spend Energy Units.
 - » Each minute, draw a new Flight Event Card from the deck and follow the instructions on it.
- If your drone runs out of Energy Units before it makes it back to Home Base, it crash-landed. You lose some science data and must spend money on repairs.

After Each Flight

- On the Score Sheet, record the number of Science Data Points earned for the first flight. Return the Science Data tokens to the Bank & Store Board.
 - Earn money for Science Data Points. Move the amount of money earned from the Bank & Store Board to the Engineer's Board.
 - » Earn \$20 for each Science Data Point up to ten points (up to \$200).
 - » If you earned more than 10 Science Data Points, you earn \$10 for each Science Data Point above 10 points.
 - » Example: If you earned 23 Science Data Points, you would get \$330. You would earn \$200 for the first 10 points (10 x \$20) plus \$130 for the remaining 13 points (13 x \$10).
 - If your drone crashed before making it back to Home Base, spend money on repairs.
 - If you want to, change the equipment on your drone.
 - » You can add new equipment, replace the equipment you have with better items, or remove some of your equipment to save weight.
 - » You can buy new equipment from the Bank & Store Board.
 - » You can sell equipment you no longer need back to the Bank & Store Board for **half** the price you paid for it.
 - Add up the masses for all of your equipment and place the weight token on the matching spot on the Mass & Energy Use Table.
 - Record your equipment and mass on the Score Sheet.
 - Recharge your drone's battery. Remove any Energy Units left over from the first flight. Add Energy Units from the Bank & Store Board based on the capacity of your drone's battery.
 - Return all Flight Event Cards and Science Event Cards to their decks. Shuffle each deck of cards. Place the Event Card decks on the Pilot's Board.
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Second Flight

- Start with the Drone Token on Home Base on the Pilot's Board.
- Fly to the volcano.
 - » Each minute, spend Energy Units based on your drone's mass and move your Drone Token one space along the path to the volcano.
 - » Each minute, draw a new Flight Event Card from the deck and follow the instructions on it.
- Hover over the volcano, collecting science data.
 - » Each minute, spend Energy Units and draw a new Flight Event Card.
 - » Each minute, draw a new Science Event Card or keep the last one picked.
 - » Each minute, collect Science Data tokens based on your cameras, sensors, and the Active Science Event Card.
 - » Record each minute your drone spends at the volcano on the Score Sheet.
- Fly back to base.
 - » Each minute, move your Drone Token one space along the path towards Home Base and spend Energy Units.
 - » Each minute, draw a new Flight Event Card from the deck and follow the instructions on it.
- If your drone runs out of Energy Units before it makes it back to Home Base, it crash-landed. Lose some science data and spend money on repairs.
- After the second flight, follow the **After Each Flight** instructions again, just like you did after the first flight.

Third Flight

- Follow the same steps as the second flight.
- After the third flight, follow the After Each Flight instructions again.
 - » You don't need to buy or sell equipment.
 - » You don't need to recharge the battery.
- Add up the Science Data Points for all three flights and write that on your Score Sheet.

Flight Event Cards

There are seven different types of Flight Event Cards. Most of them are bad news. They take effect immediately, but those effects only last one turn (one minute of "game time").

- **Bad Winds:** Your drone is flying against a headwind or fighting swirling air currents, using extra energy in the process. Lose one Energy Unit. Transfer an Energy Unit token from the Pilot's Board to the Bank & Store Board.
- **Very Bad Winds:** Lose 3 Energy Units.
- **Good Winds:** Conditions are very calm, or your drone is being helped by a tailwind, saving energy. Immediately **gain** one Energy Unit. Transfer an Energy Unit token **from** the Bank & Store Board to the Pilot's Board.
- **Mechanical Problem:** A problem with a propeller or motor or some other mechanical part of your drone causes it to use one extra Energy Unit this minute.
- **Battery Problem:** Your drone's battery is draining faster than usual. Spend two extra Energy Units this minute.
- **Eagle Attack:** A large bird attacks your drone. Spend one extra Energy Unit this minute while you dodge the bird. **If your drone is over the volcano** collecting scientific data, you lose all of



the Science Data Points you would have collected during **this turn** because you cannot aim your instruments at the volcano while you avoid the eagle. Note: you don't lose any of the Science Data Points you collect before or after the bird's attack, **just** points you would have collected **this turn**.

- **Instrument Malfunction:** There is a temporary problem with one of your sensors or cameras. **If your drone is over the volcano** collecting scientific data, you lose all of the Science Data Points that one instrument would have collected this turn. You can choose which instrument malfunctions. It is usually a good idea to choose an instrument that has a lower value for Data and to avoid using this card on an instrument when a Science Event Card that matches that instrument is in play. The problem with the instrument corrects itself on the next turn. If your drone is not over the volcano, but is **flying to or from home base when this card is selected**, this card has **no effect**.

Science Event Cards

There are six different Science Event Cards. If the Active Science Event Card matches a sensor or camera your drone is carrying, you get extra Science Data Points.



1. After your drone arrives at the volcano, draw a Science Event Card from the deck and place it face-up on the Active Science Event Card space on the Pilot's Board. This card represents the science event that is happening during your drone's first minute at the volcano.
2. At the start of the second minute of your drone hovering at the volcano, you have a choice. You can either:
 - » Draw a new Science Event Card from the deck, and replace the Active Science Event Card with the new card you drew. You probably want to do this if the Active Science Event Card does NOT match up with any of the sensors or cameras on your drone.
 - » Keep the current Active Science Event Card in play for one more minute. You probably want to do this if the Active Science Event Card does match up with a sensor or camera on your drone, giving you bonus Science Data Points.
3. At the start of the third and all following minutes of your drone hovering at the volcano, there are three possibilities.
 - » You can always choose to draw a new Science Event Card from the deck, replacing the Active Science Event Card.
 - » If the Active Science Event Card has already been in play for two minutes, you **must** draw a new Science Event Card. A Science Event Card cannot remain active for more than two minutes of game time.
 - » If the Active Science Event Card has only been in play for one minute (one turn), you can choose to keep it active **OR** draw a new card.

Once all of the Science Event Cards in the deck have been used, there are no more science events during the current flight. **Do not place the cards back in the deck** and reuse them. **After** each flight, the Science Event Cards should be shuffled and returned to the Science Event Cards space on the Pilot's Board before you begin the next flight.

Science Event Cards represent the fact that a volcano changes from hour to hour and from day-to-day. When your drone arrives at the volcano, the volcano might be erupting - spewing out hot lava and throwing a cloud of ash into the air. Or the volcano might be less active, only giving off small amounts of gases. Also, there might be different things going on at different places on or above the volcano. There might be lava flowing down the south side of the volcano, or steam blowing out of a vent on the east side, or an ash cloud erupting from the crater at the summit.

The Science Event Cards represent lucky timing or placement of your drone. If your drone arrives when the volcano is erupting, it can gather more scientific data. If the drone is hovering over the right place on the volcano when a new vent opens beneath it, it collects more data.



In the game, you can only use the same Science Event Card for two minutes (turns). After that, you've collected all of the useful data you can get from that event and it is time to move on to another place above the volcano and make other observations.

Your sensor or camera must match up with the Active Science Event Card to earn bonus points. If the volcano is giving off a cloud of ash, and your drone has a carbon dioxide sensor but NOT an aerosol sensor, you don't gain any bonus points. If, however, your drone is carrying a humidity sensor when the volcano emits a cloud of steam, you do score bonus points.

The six different Science Event Cards and their effects are:

- 1. Humidity Bonus** - The volcano is giving off steam. If your drone has a humidity sensor, which measures water vapor or steam, you get **one** extra Science Data Point this minute.
- 2. CO₂ Bonus** - The volcano is giving off carbon dioxide (CO₂) gas. If your drone has a carbon dioxide sensor, you get **one** extra Science Data Point this minute.
- 3. SO₂ Bonus** - The volcano is giving off sulfur dioxide (SO₂) gas. If your drone has a sulfur dioxide sensor, you get **one** extra Science Data Point this minute.
- 4. Aerosol Bonus** - A cloud of ash has erupted from the volcano. If your drone has an aerosol sensor, which detects small particles like dust or smoke or ash, you get **two** extra Science Data Points this minute.
- 5. Temperature Bonus** - There is molten lava just below the surface somewhere on the volcano. You cannot see it with normal light, but a sensor that detects heat using infrared (IR) "light" can spot it.
 - » If your drone has an infrared thermometer, which can measure the temperature at a spot from a distance, you get **two** extra Science Data Points this minute.
 - » If your drone has an infrared camera, which can show heat in the pictures it takes, you get **three** extra Science Data Points this minute.
- 6. Visual Bonus** - There are interesting features that show up in pictures. Scientists can learn about the volcano from the pictures.
 - » If your drone has a basic navigation camera, you get **one** extra Science Data Point this minute. This cheap camera doesn't take great photos, but can see **some** important details.
 - » If your drone has an infrared camera, you get **two** extra Science Data Points this minute. The IR camera shows heat, which can reveal molten lava.
 - » If your drone has a high-resolution video camera, you get **three** extra Science Data Points this minute. This camera takes much better photos than the simple navigation camera.

Crash-Landing Rules

If your drone does not have enough Energy Unit tokens near the end of its trip back to Home Base, your drone crash-lands. When it crashes, it damages some of its data storage systems, so you lose some of your science data. The crash also damages the drone itself, so you must spend money on repairs. The further your drone is from Home Base when it crashes, the more damage it takes.

- If your drone does not have enough Energy Units to make it to the next space along the trip from the volcano to Home Base, it crashes on the space it is currently on. Do **not** move ahead to the next space, even if you have **most** of the Energy Units needed to move ahead one space.
- Count the number of moves (spaces) your drone would need to make it the rest of the way to Home Base. That number is called the **Damage Factor**.
- Subtract the Damage Factor from your set of Science Data Point tokens collected during that flight. You lose those Science Data Points. Return the tokens to the Bank & Store Board.
- Multiply the Damage Factor by \$100. That is the cost of repairs you must make to your drone before it can fly again.



- Example:** Your drone is two moves away from making it back to Home Base. You have 4 Energy Unit tokens remaining in your battery. The mass of your equipment is 800 grams, so your drone is using 2 Energy Units per minute. You draw a Flight Event Card for Very Bad Winds, which costs an extra 3 Energy Units. You need 5 Energy Units (2 for your equipment mass + 3 for very bad winds), but only have 4 Energy Units left. You cannot move ahead, and crash land two spaces away from Home Base. Your Damage Factor is two, so you lose two Science Data Points and must spend \$200 on repairs to your drone.



REPAIRS

Damage Factor is 2 spaces x \$100 = \$200

LOST DATA

Damage Factor (2) minus Science Data Point tokens collected during that flight



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