

# AEROCENE EXPLORER

How to Float: An Instruction Manual

**Aerocene** EXPLORER

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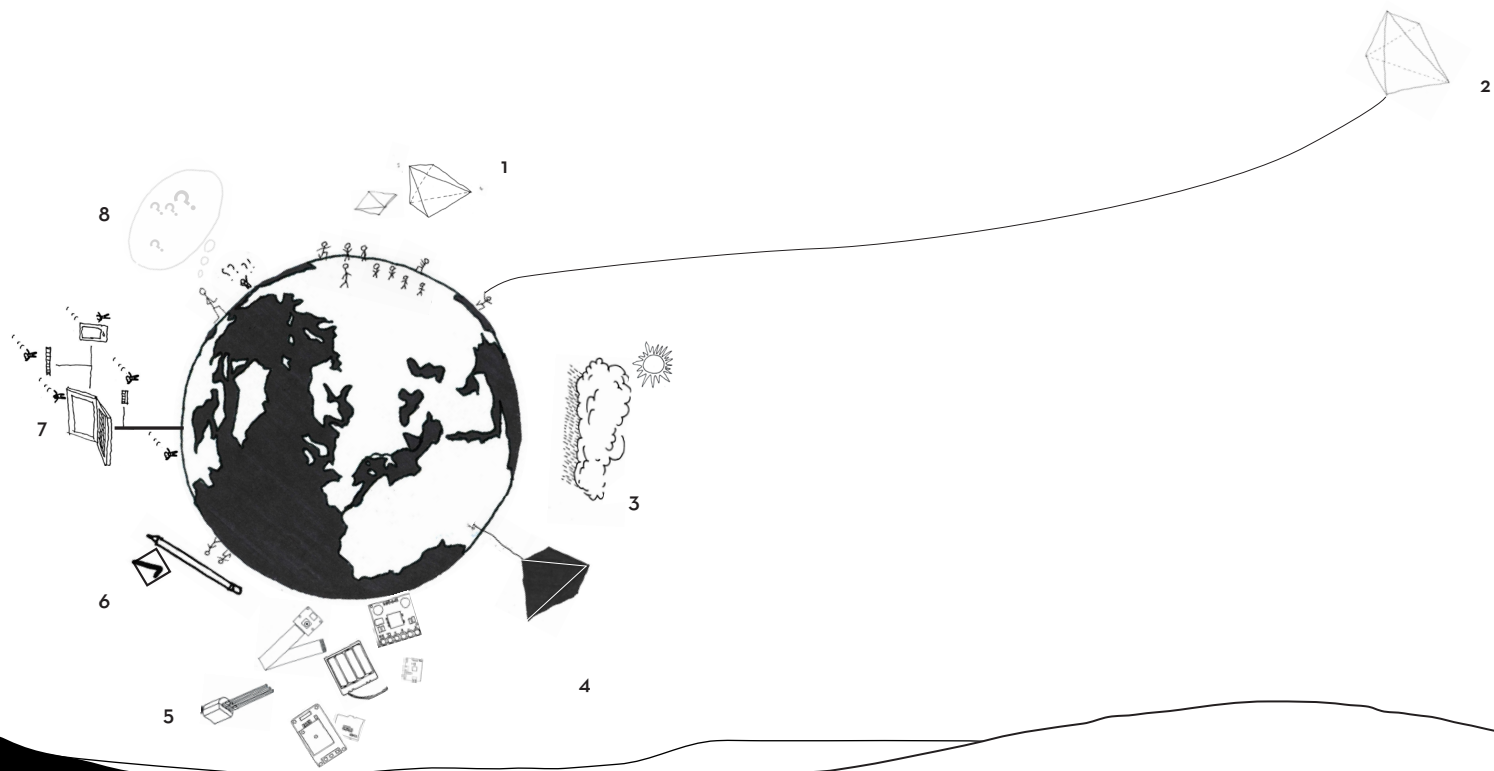
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2 Dividing your team

3 Before You Lose Gravity: Weather Forecasting + Location Scouting

4 The Explorer Sculpture

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5 Sensing Devices Pack

6 Final Check

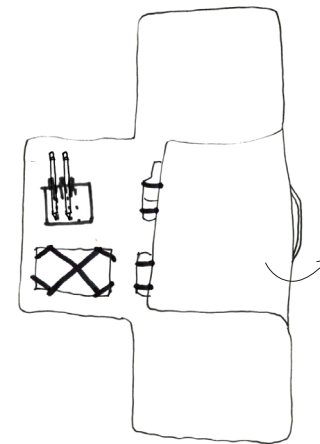
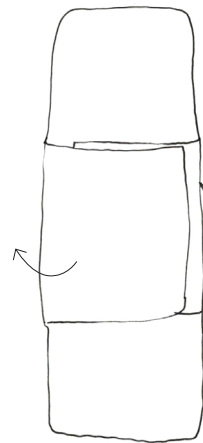
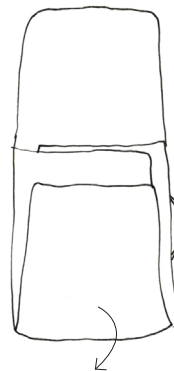
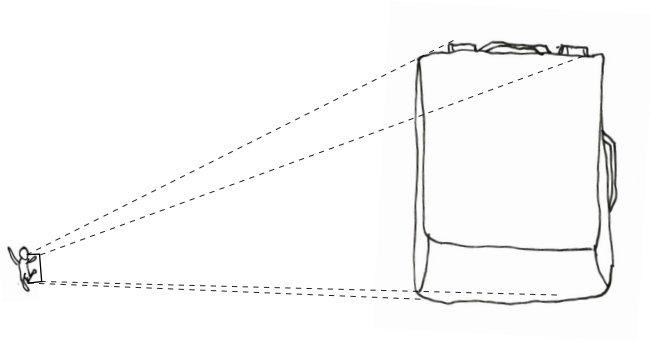
7 Join Aerocene's online open source community

8 FAQ

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## This is what you will find in your Explorer kit.

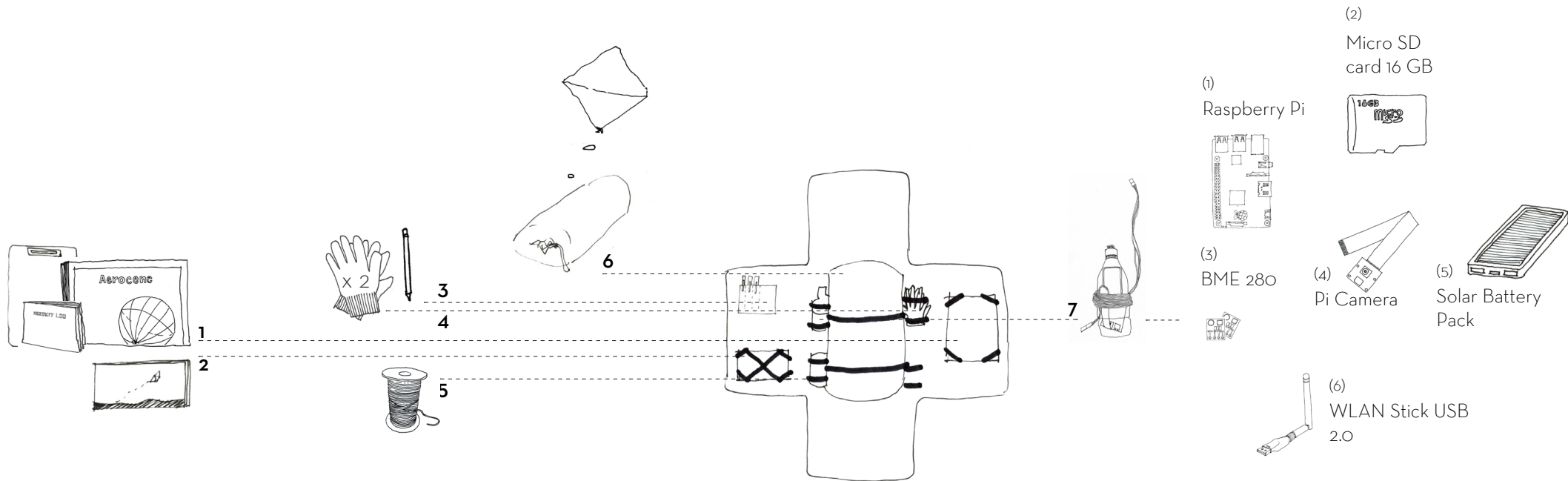
Your Aerocene Explorer is a great starter kit for tethered flight, and it provides everything you need to launch your aerosolar sculpture into the sky and start Exploring!

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1 An Invitation to Explore  
the Aerocene Epoch  
2 Aerocene Newspaper

3 Pens  
4 2 Pairs of gloves  
5 Tether

6 The Explorer  
sculpture

7 Sensing devices container

(2)  
Micro SD  
card 16 GB

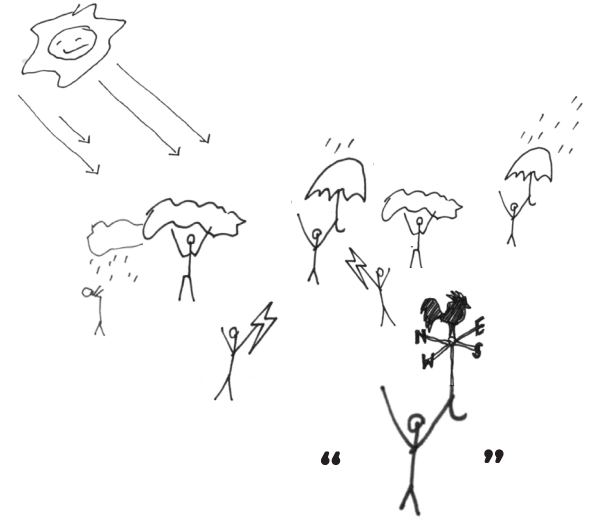
(i)  
Raspberry Pi

(3)  
BME 280

(4)  
Pi Camera

(5)  
Solar Battery  
Pack

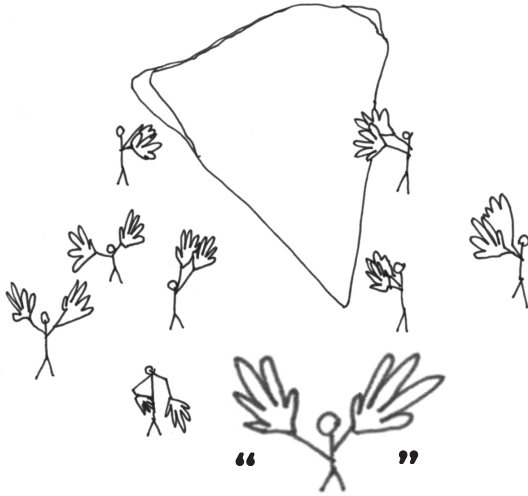
(6)  
WLAN Stick USB  
2.0



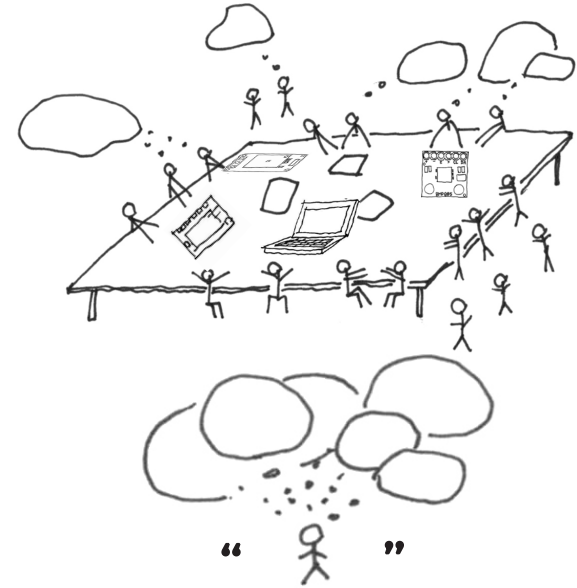
Here's how you can divide your tasks when launching your Explorer.

1 Weather Forecasting + Location Scouting Team






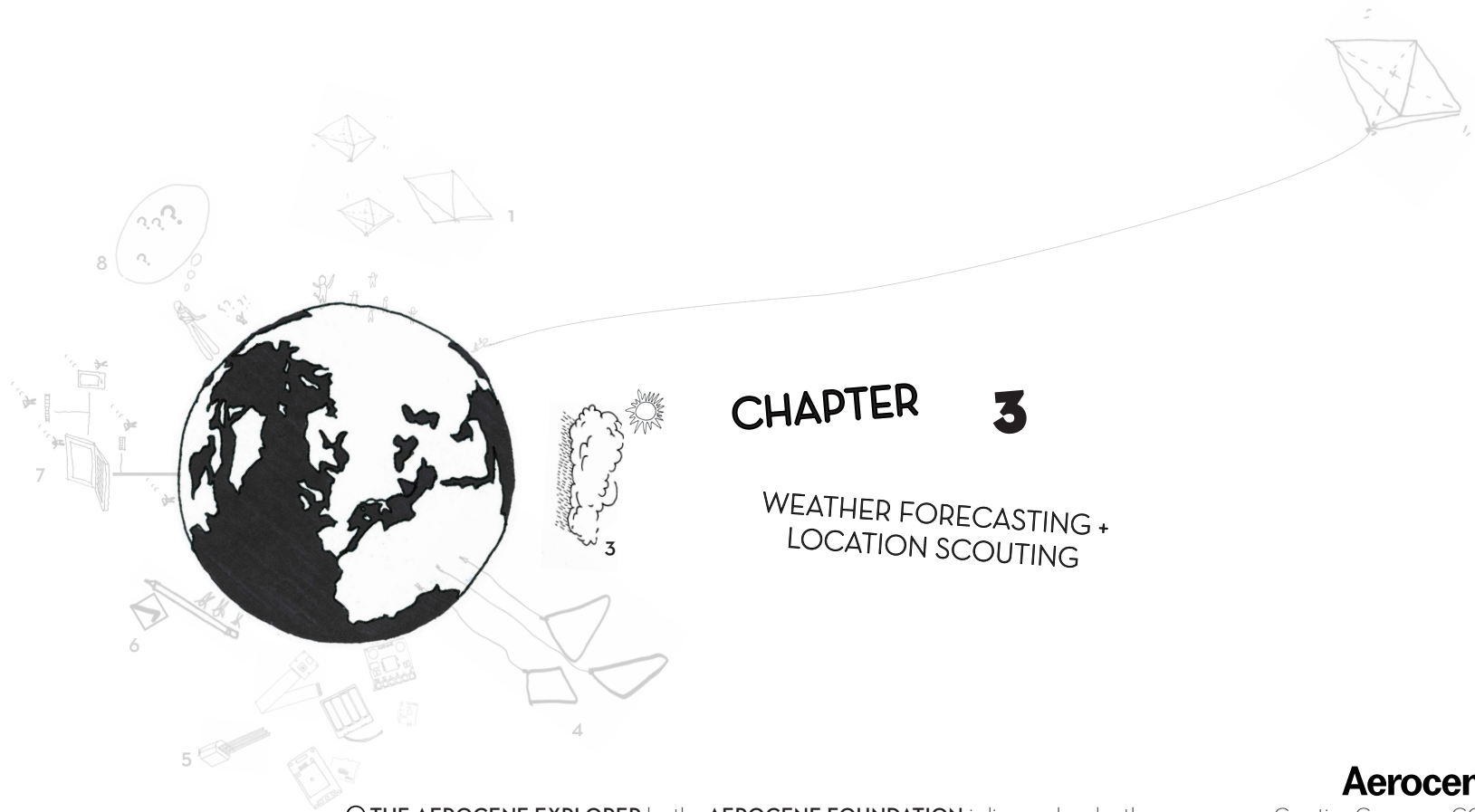
2 Explorer Sculpture Team



3 Sensing Devices Team



"Let's start preparing for your  
Aerocene Explorer launch!"



## CHAPTER 3

### WEATHER FORECASTING + LOCATION SCOUTING



## Making a Weather Forecast

A very important part of any Aerocene sculpture launch begins a few days beforehand, when you forecast the weather. Plan your launch for a day with optimal weather conditions – a bright, sunny morning with zero wind or very mild winds. This will ensure a safe experience for you and your Explorer sculpture.

The greater the difference between the outside temperature and the air inside the Explorer, the better the lift will be. For best results, launch from a light-coloured surface like white sand or snow (high albedo) during high pressure (anticyclonic).

Basic weather forecasting is easy and fun. We recommend going online to [www.wunderground.com](http://www.wunderground.com) and typing the name of your launch location into the 'Find Your Hyper Local Weather' box. Click on 'Full Forecast' to get a detailed weather forecast for the area.

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## The Wind Factor

Do not inflate your Explorer in strong winds (over 10 miles per hour), as the sculpture or its electronic components could become damaged, and there is a greater risk of injury.

Do not launch if the wind is over 11 km/h or higher than a 2 on the Beaufort scale, that is, when leaves and small twigs are constantly moving on the ground.



## Scouting the Perfect Launch Location

Let the sun make it fly, let the sun raise it high!

Things to consider: plan to launch on a clean, flat, and relatively soft surface, like a beach or a grassy field – no hard surfaces like pavement, or rocky areas with stones or sharp vegetation, as these could damage the sculpture while on the ground. The ideal surface will also be light in colour with a high albedo (such as a white-sand beach), to more easily reflect the Sun’s rays, though this is not a requirement.

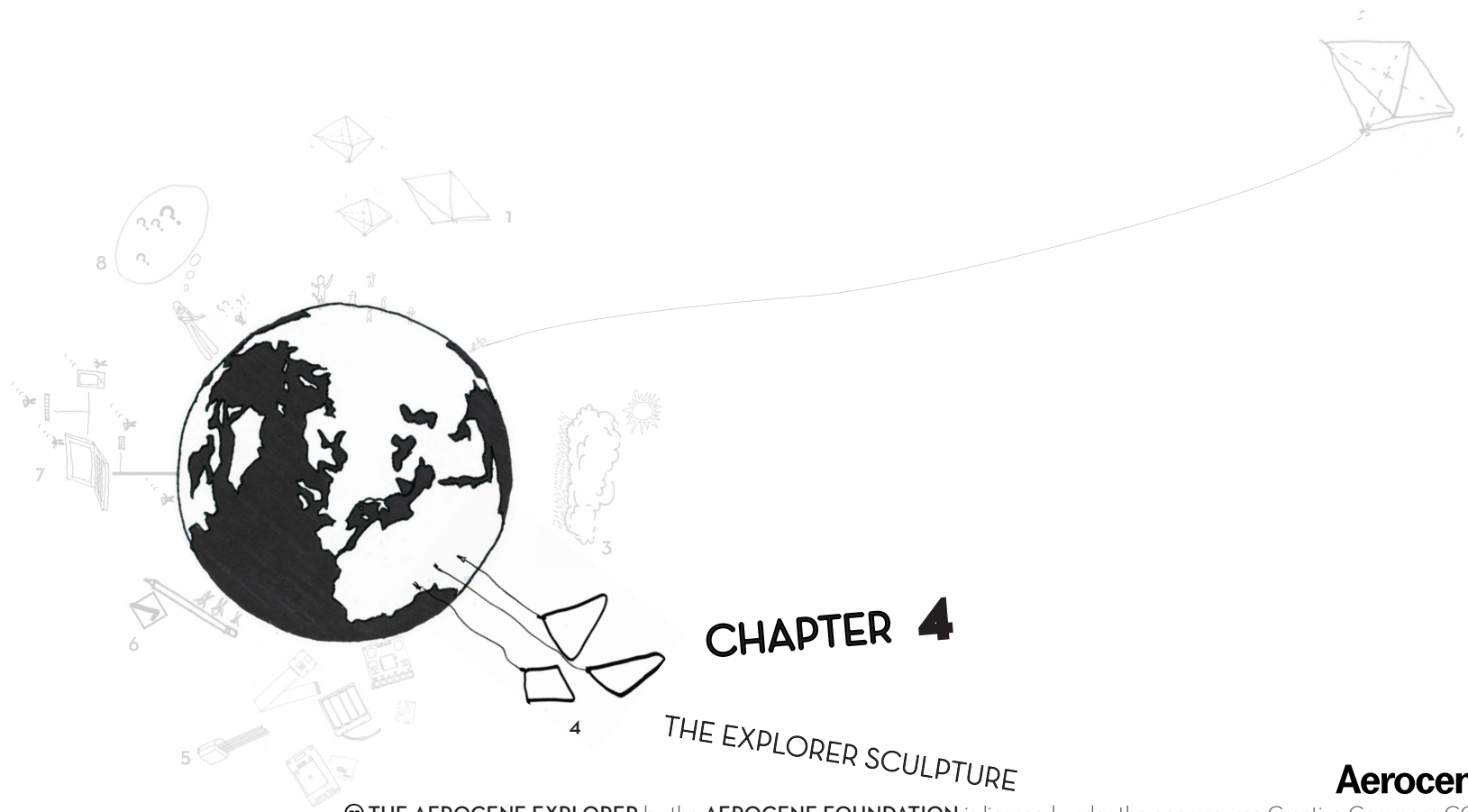
Choose a place where you can see the sun rise and arrive about 30 minutes before dawn to start inflating the sculpture. Do not choose a location with large obstacles like tall trees or buildings, as the amount of direct sunlight will be reduced and and reach the Explorer too late.

The Explorer takes about 30 minutes on average to inflate, and around an hour until lift is achieved.

Give yourself enough space

The minimum space required to launch is approximately the size of a football field (about 110 m x 70 m).





## CHAPTER 4

### THE EXPLORER SCULPTURE

## The Explorer sculpture

### Launch Day: Inflation and Lift Off

On the morning of your launch, arrive at your location 30 minutes before sunrise so the Explorer is inflated and ready when the Sun rises. For tips on how to pick the perfect launch location, see Chapter X

Make sure everyone who handles the Explorer sculpture puts on gloves first (two pairs are included in the kit). Gloves also should be worn when holding the rope tether. Unfold the sculpture on the ground, prepare the rope for tethering, and open the Velcro closure.

Unlike that used by other airborne vehicles, the process of inflating the Explorer sculpture releases zero carbon emissions or particulates and uses zero gasses, engines, batteries, or generators.

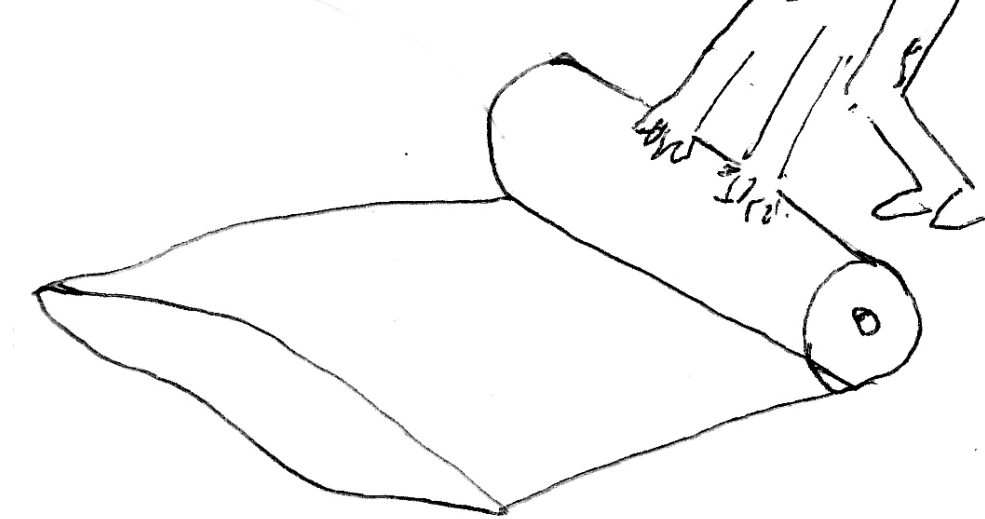
Gather a group of 2-3 adults, and position yourselves at different ends of the Explorer, each holding the sculpture with one hand on the bottom and the other hand on the top. Make sure the Velcro closure is open. Run with the sculpture until it is filled with air, then quickly seal the Velcro closure.

Next, connect the tether to one carabiner, and attach the sensing devices pack to the other carabiner.

Place the Explorer in direct sunlight for about 30-60 minutes, until the sculpture begins to lift itself into the air.

Congratulations! Your Explorer is airborne!





## Launch Day: Bringing the Explorer Back to Earth

There are two reasons to bring your Aerocene Explorer back down to the ground. First, you had a successful flight and were able to record atmospheric data and take photos and video. Or second, the weather changed suddenly, e.g. the wind speeds increased to dangerous levels, or it began to rain.

It is important to react quickly if the weather conditions change, making it no longer safe for the Explorer to remain airborne. When inflated, the Explorer has a large surface area, and even a relatively small increase in wind speed can produce a lot of pressure on the tether, making it harder to hold and control.

To bring the Explorer back down, two people must pull on the tether until it is possible to touch the Explorer's fabric. Grab the coloured fabric edges and hold onto the sculpture, disconnecting the sensing devices. Open the Velcro closure completely and position it facing in the direction of the wind to release the air from inside the sculpture.

Hold the sculpture's fabric on the opposite side of the Velcro closure and start to roll the fabric together until there is no air inside the sculpture and you have reached the Velcro closure.

If the weather allows, you can open the sculpture again on the ground and start to fold it up (see page XX for instructions).

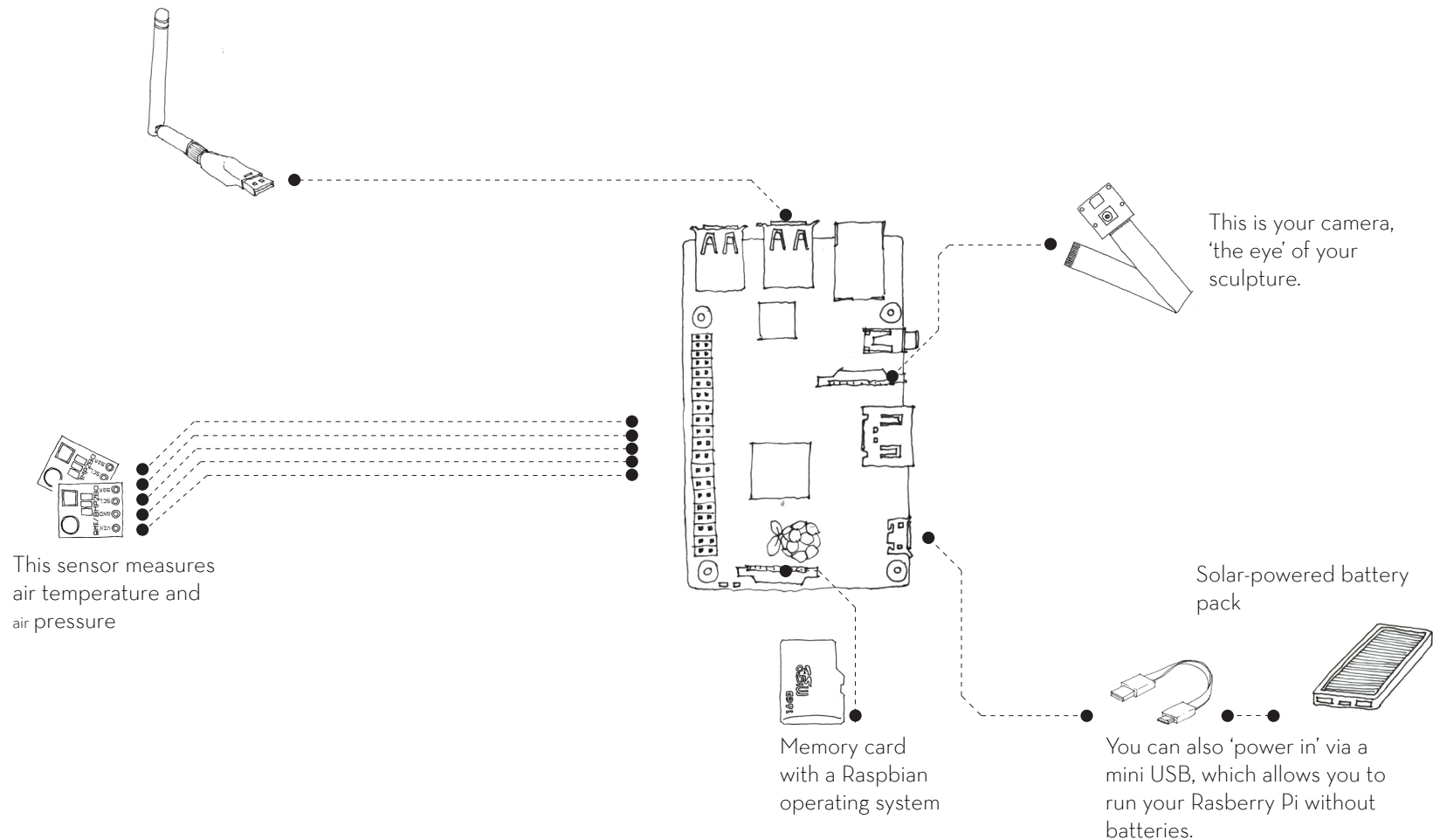


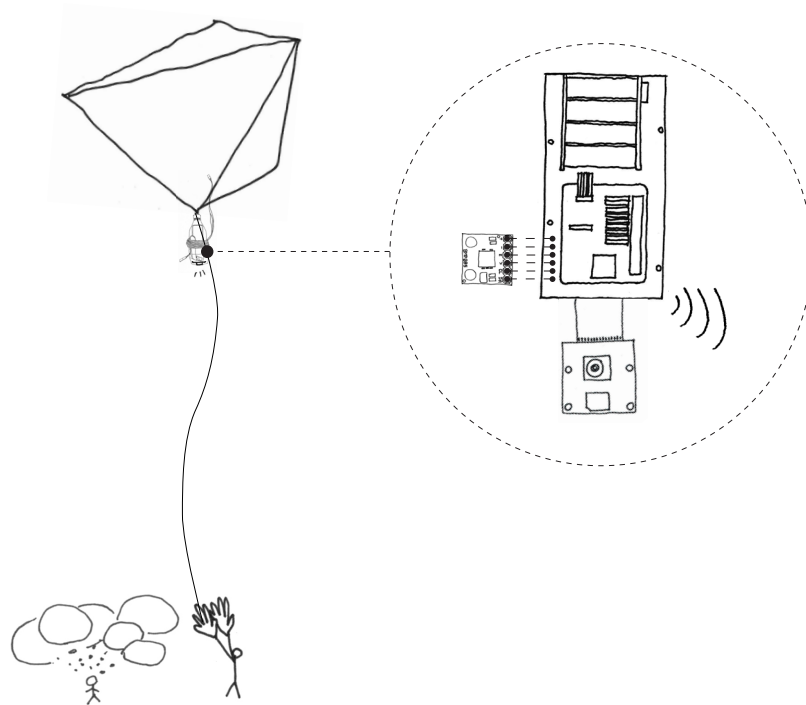
# CHAPTER 5

## SENSING, DEVICES PACK



## Sensing Devices Pack





## Sensing Devices: How they work

When your Aerocene sculpture is floating through the air, its sensing devices are constantly recording air quality, temperature, humidity, and pressure.

Open your web browser and type in the following web address: 172.24.1.1

Now open your web browser and type in the following web address:

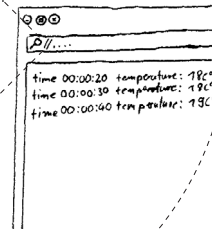
172.24.1.1

There you can see all the incoming data from the sensor in real time. It will be stored on the USB memory stick.

If you type in this web address

xxxx.xxxx.xxxx

you will get a livestream from the camera on your device.

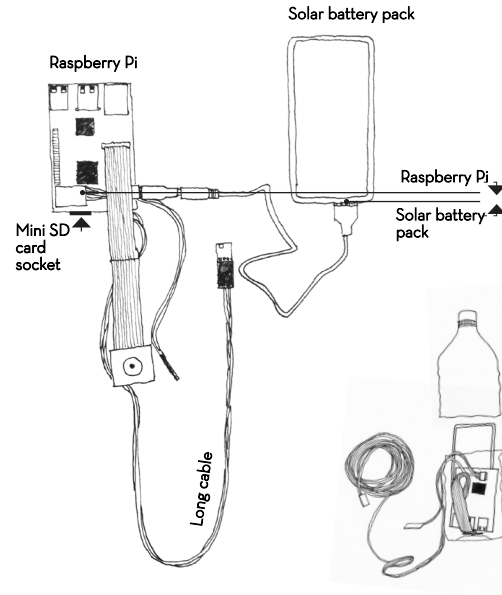


To have a look what is going on up there, take out your smartphone, search for

Aerocene Wi-Fi, and connect to it.



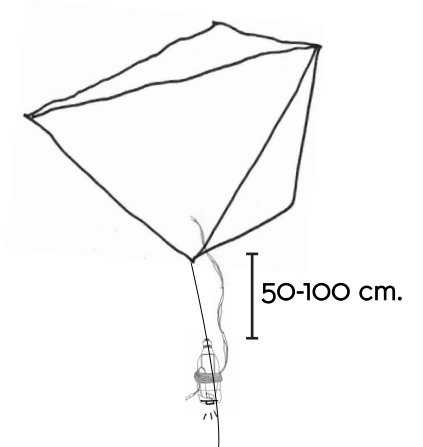
Aerocene Explorer kit



STEP 1  
Connect the Raspberry Pi to the solar-powered battery pack



STEP 2  
Connect the long cable to the inside part of the sculpture and switch on solar-powered battery pack



STEP 3  
Place the pack of sensing devices about 50-100 cm. underneath the sculpture



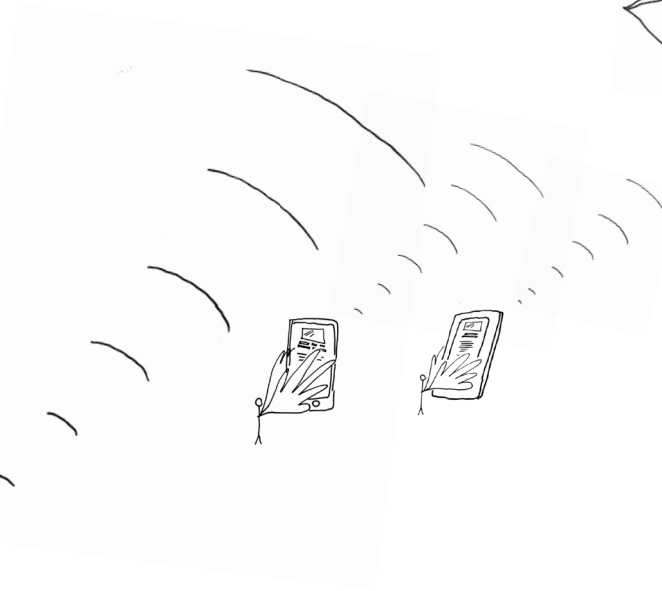
#### STEP 4

Using your smartphone, turn on your Wi-Fi and connect to Wi-Fi name :“Aerocene Explorer”



#### STEP 5

Open your web browser and type 172.24.1.1 in the address bar



#### STEP 6

If you want to take a photo:  
Record images < Download videos and images < choose frame < download < save image

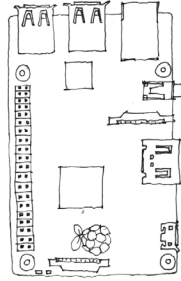


#### STEP 7

Click the “atmosphere observation” box to check the atmospheric data as it records in real time

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**Aerocene** EXPLORER

## What is your A.A.Orbiter ?



1 Raspberry Pi (Controller unit)

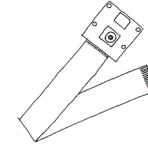
The Raspberry Pi is a one-chip pc developed to teach people basic programming. “Pi” stands for python interpreter and is also the program language used to run the parts on the Orbiter. Our Orbiter can be powered by batteries or via a micro-USB port.

If you plug in a monitor at the HDMI port and a keyboard via the USB, the Pi can be used like a normal Linux desktop PC.

After the first start the Pi asks you to login.  
Just use the standard login and type:

```
Login as user:  pi
password:      raspberry
```

Then, start with your first command: startx

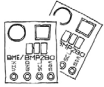


2 Raspberry Pi camera (Camera module)

The Raspberry Pi camera has 5.0 MP resolution and a wide angle lens. This makes it great for taking pictures from above.

In video mode it can capture up to 90 frames per second.





### 3 BME280 (Pressure and temperature sensor)

The BME280 sensor is a small chip from Bosch that is able to sense the pressure and temperature of the surrounding air. The chip needs a 3,3 V Volt power connection from the Raspberry Pi to start working.

To read the recorded data, we use the I2C protocol, which operates over the pins SDA and SCL on your Raspberry Pi. This protocol allows you to put many different sensors in row on just one pin and read them separately through their addresses.

In the data we read out from the module is raw, that means we need to format it into comparable data.



### 4 Solar Battery Pack

A solar-powered battery pack will keep the sensing devices charged while the Explorer is traveling through the air.

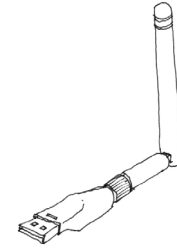
However, it is recommended to plug the battery pack into an electrical outlet to completely charge before each launch.



### 5 SD card

This is the internal memory of your Raspberry Pi. It comes with the pre-installed Raspbian OS, which is specifically designed for the Raspberry Pi Debian Linux operating system.

Additionally we installed a program that allows you to connect your phone with the Raspberry Pi and stream from the camera and the logfile.



### 6 WLAN Stick USB 2.0



# CHAPTER 6

## FINAL CHECK



## Overall Checklist:

What to do before your launch

☐ 7 days before



In order to have a safe tethered flight, you need to prepare a few things beforehand.

1

- ☐ Visit the launch site
- ☐ Check out the surrounding environment for possible dangers like high-voltage power lines or low-flying planes

2

- ☐ Check the weather forecast online
- ☐ Choose a sunny day with zero wind or very little wind

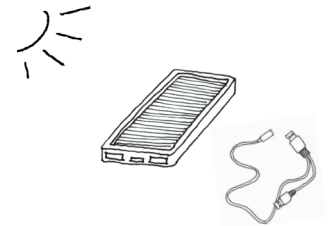


☐ 1 day before

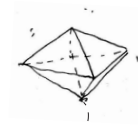


- ☐ Charge your solar-powered battery pack (for best results, plug it into an electrical outlet to reach full charge)

- ☐ Don't forget to set your alarm!



☐ Launch Day: Before you leave home



- 1** ☐ Load the batteries and make a final systems check
- Systems check:
- ☐ Switch on the device and look for the green LED light
  - ☐ If it starts flashing, the program is running successfully and it is able to collect data
- 2** ☐ Check the wireless connection for photo and video streaming
- ☐ Connect with the Wi-Fi name :“Aerocene Explorer”
- Open your web browser on your PC or smartphone and type in 172.24.1.1 in the address bar. Now you can see ‘through the eyes’ of your Explorer sculpture

- 3** ☐ Check the logfile for further data analyses
- ☐ Type xxy address in the browser
- ☐ Find the spreadsheet of your collected data
- ☐ Tip: save both web addresses in your ‘Favorites,’ so you can access your data quickly later
- ☐ To shut everything down, simply switch off the power
- 4** ☐ Unplug the USB memory stick
- ☐ Erase the txt file on it, so you will have an empty spreadsheet ready for your launch

☐

Once the system check is complete, you are ready to launch!



# CHAPTER

# 7

JOIN AEROCENE'S ON-  
LINE OPEN SOURCE  
COMMUNITY







Join Aerocene's online  
open source community

Hack it yourself

Share and comment

Upload your data and  
photos

Participate in contests



# CHAPTER 8

## FAQ





# FAQ

## THE AEROCENE EXPLORER'S CONTENTS

### What does the Explorer kit contain?

Inside each kit, you'll find your Explorer sculpture, a photo/video camera, a sensing devices pack (to measure air temperature both inside and outside the sculpture, air quality, humidity, and pressure), two pairs of gloves, a tether, a clipboard, pens, the instruction manual/guide, tests, instructions for how to upload your collected data and photos to Aerocene's online open source community, and a copy of the Aerocene Newspaper.

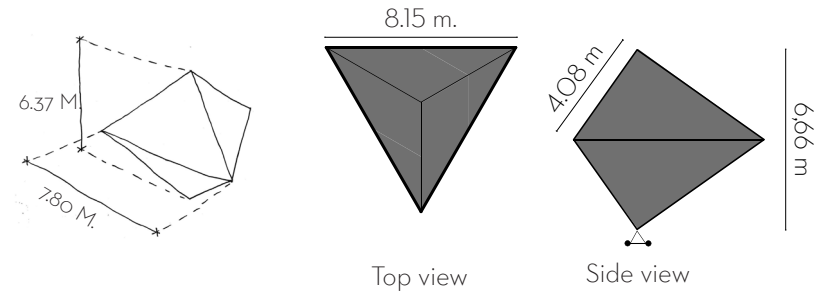
The Explorer will challenge you to lift the sculpture to the skies, collect atmospheric data, and capture aerial photography and video via non-intrusive and emission-free scientific exploration tools. You can use the included technical devices to collect your data, or additionally, invent your own light-weight sensors and lift them up!

### How high will the Explorer sculpture fly?

This is dependent on the tether's length, so 150 m if you use the tether that comes with the kit. It is possible to fly higher with a longer tether (not provided).

### How large is the Explorer sculpture when it is fully inflated?

The total volume is 61 m<sup>3</sup>.







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How large of an area is needed for the launch of the Explorer sculpture?

An approximate area of the size of a football field (about 110 m x 70 m) minimum is recommended to have enough space for the launch.

How long does it take for the Explorer sculpture to become airborne?

This depends on the weather conditions and also the reflectivity of the type of ground (albedo) to transmit heat to the sculpture. The average time to lift is about one hour.

How long does it take to inflate an Aerocene sculpture?

About 30 minutes on average.

What are the ideal conditions for launching my Explorer sculpture?

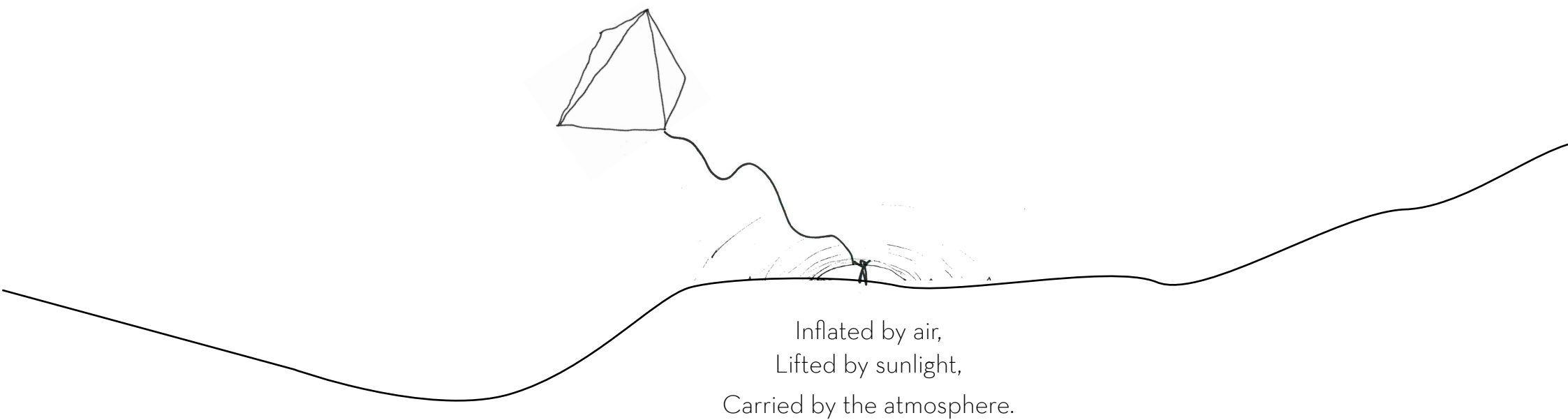
The ideal conditions are in the morning of a sunny day with clear skies. It is necessary to launch on a relatively soft surface, like a grassy field or beach – no hard surfaces, like pavement or rocky areas, as this could damage the sculpture. The ideal surface for your launch will be light in colour, to more easily reflect the Sun's rays (like on a white-sand beach), though this is not a requirement.

How is the Explorer sculpture inflated?  
Is there any special equipment or motor required?

The Explorer sculpture is inflated in an environmentally friendly way that releases zero emissions into the environment and produces no toxic gases or particulates. It inflates through wind power, specifically, by people holding onto it with gloved hands and running. We recommend a minimum of 2-3 adults for this. .

How many people are required to complete all the tasks necessary for the launch, data recording, aerial photography, and landing?

The minimum suggested team would be six people, although the team could be extended to a group of around 35 people, depending on how the tasks are structured. In a team of six, it is recommended that four people are assigned to take care of the sculpture, one person manages the team and records data, and one person takes care of the technical sensory and recording devices.



Sculptures that are paving the way for the most sustainable and energy efficient vehicle humans have ever created

‘Earth is always traveling, and it’s good to be aware that we are on such a ship. Like any ship, ours has a limited amount of resources, and we need to take stock of that, or this ship will stop being a place where we can survive.’

— Tom <sup>4</sup>s Saraceno





## Welcome to the AEROCENE epoch

Aerocene is an open-source, multi-disciplinary project furthering the artistic and scientific exploration of environmental issues. Based on the vision of artist Tomas Saraceno, Aerocene is developing new solutions and technologies for sustainable Aerocene travel and living, with support from multiple collaborators and partners around the world. Aerocene is a movement, an invitation to shape a period of time, a new epoch. Aerocene is a response to, and a way to transcend, our current Anthropocene epoch.

The Explorer is part of Aerocene's developing series of air-fuelled sculptures built to achieve carbon-emissions-free journeys around the world, becoming buoyant only from the heat of the Sun and infrared radiation from the surface of Earth. Floating without burning fossil fuels, without using solar panels or batteries, and without helium, hydrogen, or other rare gases, the Aerocene sculptures contain a message of simplicity, creativity, and cooperation in a world of tumultuous geopolitical relations, reminding us of our symbiotic relationship with the Earth and all of its species. Aerocene transcends boundaries between art and science and has become a visionary open participatory platform of knowledge production and distribution.

Aerocene's ultimate realisation will be Cloud Cities, Saraceno's long-term artistic research project to develop a modular and transnational city in the clouds whose realisation may be understood as a model for sustainable and emancipatory building practices. Saraceno's art has revolved around the realisation of a flying city slowly gliding through the sky in cloud-like formations of innumerable, coequal structures. Cloud Cities comprise a collection of geometric, inflated shapes that challenge the notions of place, space, future and gravity.

Aerocene is to imagine a metabolic and thermodynamic transformation of human societies' relation with both the Earth and the Sun. It is an invitation to think of new ways to move and sense and live with the circulation of energy. And, it is a scalable process to repattern atmospheric dwelling and politics through open source ecology of practices, models, data and sensitivity to the more than human world. The Aerocene proposes airborne cities floating among clouds, just as the Earth floats in the cosmic plane.\*

\*The ideas come from the exchange between Bronislaw Szerszynski, Sasha Engelmann and Tomas Saraceno, previously expressed in "Becoming Aerocoslar," 2015, published by 21er Haus - Belvedere, Vienna.

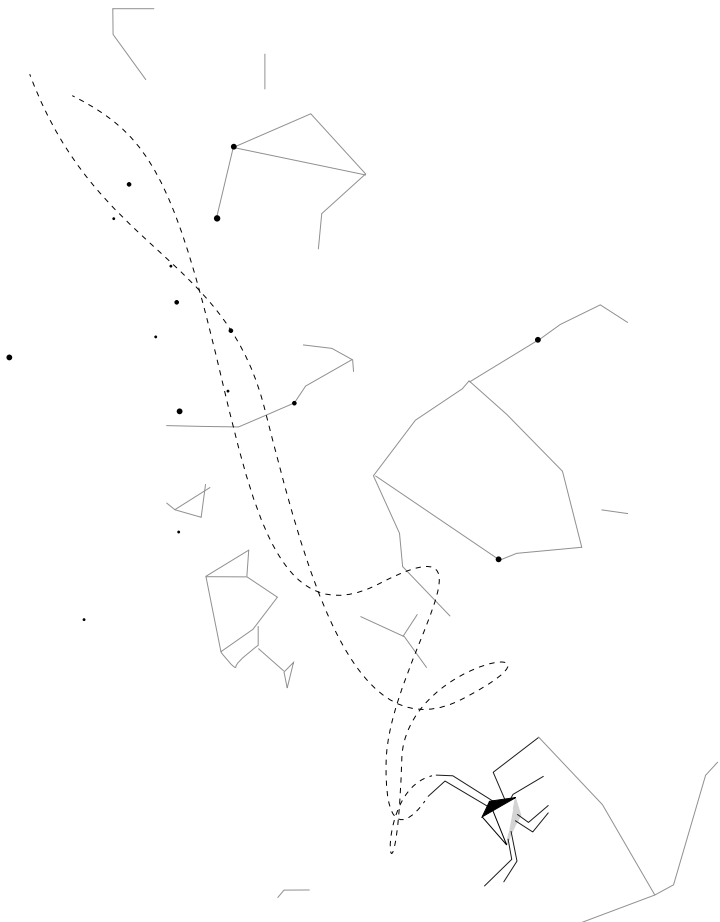
## Special Thanks

IAK (TU Braunschweig), Funk und Computer Zentrum  
Hohenschoenhausen, Massachusetts Institute of Technology, Alexander  
Bouchner, Sasha Engelmann, Jol Thomson, Pablo Suarez, Janot Mendler  
de Suarez, Daniel Schulz, Cara Cotner, Irin Siri wattanagul, Ignas Petronis,  
Sven Steudte, Thomas Krahn, Mathias Pelli, Philip Dreyer, Adrian Krell,  
Kotryna Slapsinskaite, Stefano Arrighi, Caterina Benincasa, etc...

Aerocene is comprised of a dedicated and diverse global community of artists, geographers, philosophers, thinkers, speculative scientists, explorers, balloonists, technologists, and dreamers. The Aerocene project's primary collaborators and supporters are the Center for Art, Science & Technology (CAST) at the Massachusetts Institute of Technology (MIT), CNES (French National Space Agency), CCK Argentina, Public Lab, The Goethe Institute, Radioamateur, Freifunk, and IAK architecture-related Art Institute at Technische Universität Braunschweig, TBA21, among others. Anyone is invited to share, collaborate, and perform actions in the communal creation and development of the new Aerocene epoch.

The Aerocene Foundation  
Hauptstrasse 11-12  
10317 Berlin  
Germany

<http://www.aerocene.com/>  
<http://tomassaraceno.com/>



# Aerocene

## LOGBOOK

### A----

FLIGHT NUMBER	D A T E	LAUNCH BY/ CONTACT	THIS FLIGHT HRS. MIN	T O T A L HRS. MIN	PAYLOAD	REMARKS
------------------	---------	-----------------------	-------------------------	-----------------------	---------	---------