CanSat Report

SevenToHeaven

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ABSTRACT: Height and position determination has never been so important before, regardless of whether it is applied to track airplanes, to identify the orbit of satellites or to guide cars to its desired destination. In fact, there are many applications of height and position measurements in our everyday life. However, these measurements can be conducted using a number of different methods. The objective of this work is to track the geographical position of a mini-satellite by means of an installed GPS sensor. The research is conducted within the framework of the 2023 CanSat Competition organised by the European Space Agency.

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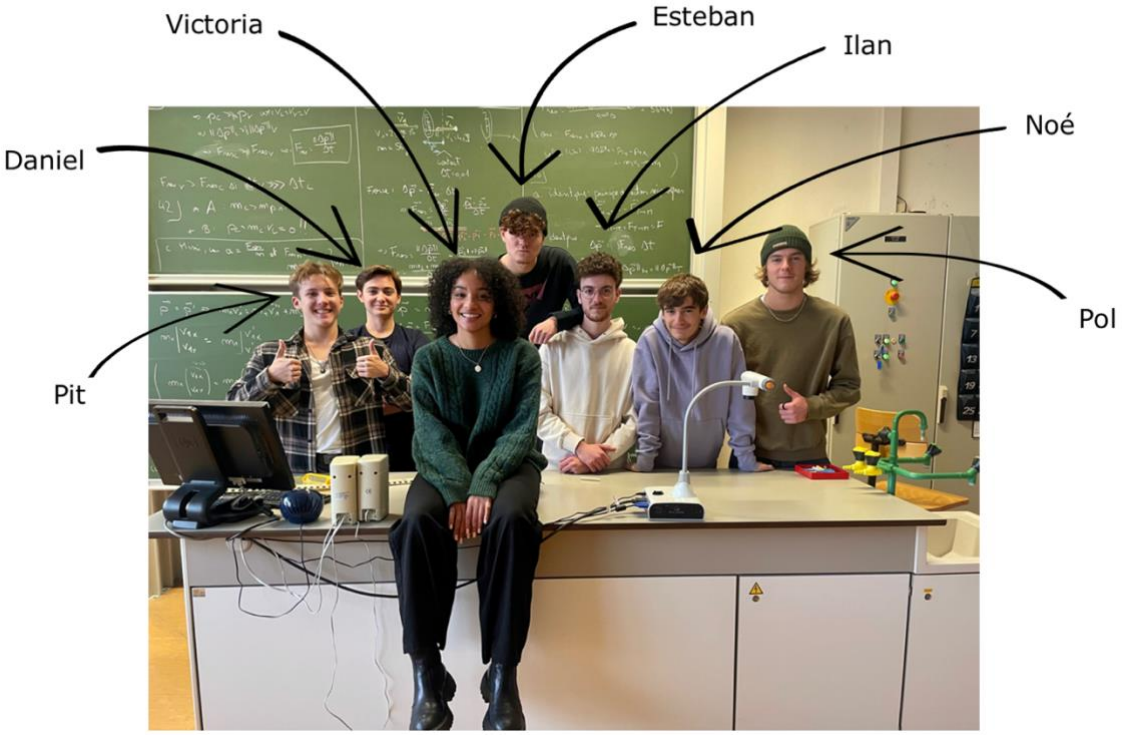
I. Introduction

As a proud member of **SevenToHeaven**, I am excited to share with you our participation in the upcoming 2023 Luxembourg CanSat Competition. Our team is made up of seven individuals from Lycée de Garçons Esch-sur-Alzette, each possessing a unique set of talents and interests. Despite our individual differences, our shared passion for science and space has brought us together, and we are eager to demonstrate our knowledge and abilities by competing against other talented individuals in our age group.

The project ahead of us is ambitious, but we are fully prepared to take on the challenge. Our primary goal is to launch a miniature satellite and conduct various measurements, including monitoring its coordinates during launch and descent. Furthermore, we plan to incorporate additional sensors, such as accelerometers and magnetometers, to collect more comprehensive data for analysis. By studying the information collected from the satellite, we aim to deepen our understanding of the earth's magnetic field and its impact on various aspects of our daily lives, such as navigation and communication.

We understand that collaboration and the utilization of each other's strengths are crucial to achieving our scientific goals. With some of us excelling in programming, and others in physics or engineering, we are confident in our ability to overcome any obstacles and accomplish our objectives.

Participating in this remarkable event is an incredible opportunity for our team, allowing us to challenge ourselves and pursue our passions in science and space exploration. We are excited to face any challenges and perform our best, demonstrating our dedication and enthusiasm for the competition. To put faces to this inspiring project and showcase our teamwork and passion, we would like to share a photo of our team:



II. Project design

II.1. Mission overview

The CanSat competition is an initiative of the European Space Agency that challenges students from all over Europe to plan, design and conduct their own space mission in a smaller scale. The competition's primary challenge is to incorporate all the major subsystems of a satellite, such as power, sensors, and communication systems, into the small and compact volume of a soft drink can.

After preparation, the CanSat is launched into the air using a launch system and carried to an altitude of approximately one kilometer, before descending back to the ground with the help of a parachute. During its flight, the CanSat completes two critical missions that provide valuable data for weather forecasting, atmospheric research, and various other applications.

The **primary mission** of the CanSat is to measure the air pressure and temperature as a function of time, which enables the calculation of altitude and the rate of fall as required. This information is crucial for understanding the behavior of the atmosphere and its impact on the CanSat's trajectory.

The **secondary mission** of the CanSat involves transmitting additional telemetry data to track its geographical position using a GPS sensor. This helps to determine the CanSat's exact location during the flight and enables analysis of its trajectory, velocity, and acceleration. This data can be used for navigation, mapping, and remote sensing applications.

To accomplish these missions, our team utilizes the following equipment:

- A computer
- A CanSat-Pico-Kit that includes all necessary electronic devices except for the GPS module
- A soldering iron station
- A 3D printer to produce the mechanical components we design
- A variety of materials to construct the parachute and antenna

II.2. Mechanical design

CanSat design

Regarding our mechanical design, we discovered that our secondary school had acquired 3D-printing capabilities, so we decided to explore its creative potential for our CanSat. To this end, we utilized an online program called Tinkercad to design multiple mechanical components. Although the program was somewhat rudimentary and took some time to get used to, we persisted until we were able to obtain accurate measurements.

When it came to the external design, we aimed to create a unique shape that would set our CanSat apart.

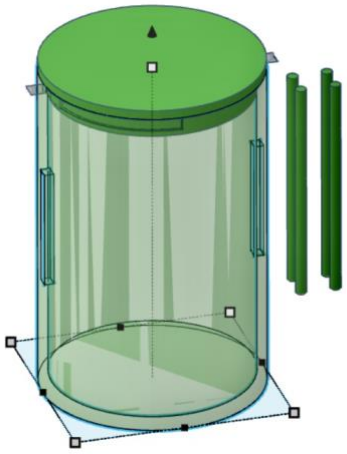


Figure 1: CanSat design

After much deliberation and experimentation, we ultimately selected a shell design that resembled that of a water bottle. This particular design was chosen due its simple functionality and practicality, which we anticipated would facilitate both the assembly and operation processes.

The final version of our model consists of two main components: the CanSat, which acts as the structure's foundation, and the screw lid, which serves as the closing mechanism. For the production of our design, we selected polylactic acid as the most appropriate material to fulfill our specific requirements.

Overall, we are proud of the design we have created, as it not only looks pleasing but also operates efficiently. With this design, we are confident that our CanSat will excel in the competition.

Parachute

The parachute is another trivial component of the mechanical design. As the CanSat begins its descent, the parachute attached to the exterior of the can experiences substantial resistance due to the rapid velocity of the fall. Consequently, the parachute is designed to detach from the casing, generating drag that decelerates the descent. As the CanSat continues to fall, the parachute reaches its maximum drag, reducing the velocity to a terminal velocity of approximately 8 m/s to 11 m/s, allowing for a safe landing without damage.

To achieve the desired terminal velocity, the size and shape of the parachute must be designed accurately. If the parachute is too small, it will not provide enough drag to slow down the CanSat's descent, resulting in a potential crash upon landing. Conversely, if the parachute is too large, it will excessively slow down the descent, and the CanSat may drift away from the planned landing spot. Therefore, selecting the right size and shape of the parachute is crucial to ensure a controlled and secure landing.

The development of the parachute began with the decision to use a flat hexagonal structure with a circular shape. This choice was made because a circular parachute offers a slow and steady descent due to its natural symmetry, which maximizes wind resistance and creates drag. To determine the appropriate size of the parachute, we utilized the following equations:

When the Cansat reaches its terminal velocity, the gravitational force F_{grav} is in equilibrium with the drag force F_{drag}:

$$F_{grav} = F_{drag}$$

Replacing the formulas for the two forces gives us:

$$m \cdot g = \frac{1}{2} \cdot C_D \cdot \rho \cdot A \cdot v^2$$

with:

- C_D *: drag coefficient of the parachute*
- ρ *: local density of the air ($\rho = 1{,}225 \frac{kg}{m^3}$)*

- A *: canopy surface area*
- v *: descent velocity of the CanSat in m/s*
- m *: mass of the CanSat (typically 0.35 kg)*
- g *: acceleration due to gravity (*$g = 9{,}81\frac{m}{s^2}$*)*

Rearranging the formula to find A, we obtain:

$$A = \frac{2 \cdot m \cdot g}{C_D \cdot \rho \cdot v^2}$$

Replacing the following numerical values:

- $C_D = 0{,}8$
- $\rho = 1{,}225\ \frac{kg}{m^3}$
- $v = 8\ \frac{m}{s}$
- $m = 0{,}35\ kg$
- $g = 9{,}81\frac{m}{s^2}$

We get:

$$A = 0{,}109\ m^2$$

With the formula of the area of a circle, we deduce the value of the radius:

$$A = \pi \cdot r^2$$

$$r = \sqrt{\frac{A}{\pi}}$$

$$r = \sqrt{\frac{0{,}109}{\pi}}$$

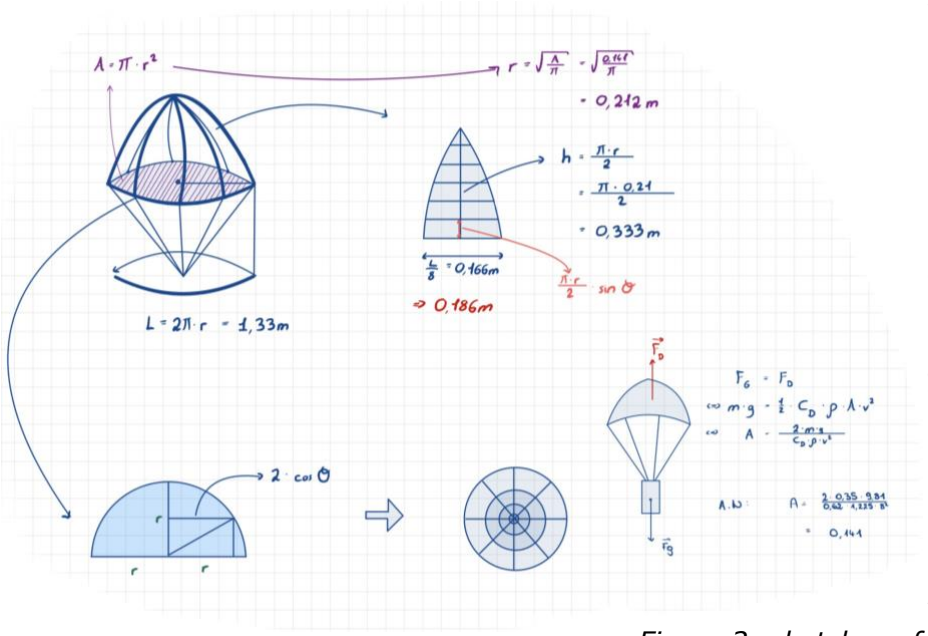
$$r = 0{,}186\ m$$

After completing the parachute, we tested it by throwing it out of a window. By using the Viana and GraphicalGW apps, we managed to compute its terminal velocity, which turned out to be 8 m/s. However, the parachute did not provide a smooth descent, prompting the team to consider a new design that would offer more stability.

The new design involved a octogonal hemispherical parachute, which formed a hemisphere when filled with air. The octagonal shape of the parachute provided greater control, while the hemispherical canopy design helped to distribute air resistance more uniformly across the parachute. The fabric was made from sections called gores, which were stitched together to form the complete

hemispherical shape. The more gores used, the closer the shape was to a true hemisphere, but the more complex the production procedure.

To determine the appropriate size of the new parachute, our teachers assisted us by utilizing the same equations as the first parachute while adjusting the drag coefficient. Additional equations and schemas are illustrated in the following sketches:



Θ	$\frac{2\pi \cdot r \cdot \cos\Theta}{8}$	$\frac{\pi \cdot r \cdot \sin\Theta}{2}$
0	18,7	0
10	18,4	5,8
20	17,6	11,4
30	16,4	16,7
40	14,8	21,4
50	12,7	25,5
60	10,3	28,8
70	7,7	31,3
80	4,9	32,8
90	/	33,3

Figure 2: sketches of the hemispherical parachute

In addition to the parachute construction, a vent hole was incorporated to facilitate the equalization of pressure between the inside of the satellite and the external atmospheric pressure.

During the testing phase, we discovered that the new parachute had a terminal velocity of 5 m/s, which fell short of our expectations. Nevertheless, over the past few weeks, we performed additional tests and resulted in the development of a promising parachute that meets the required velocity standard.

Figure 3: hemispherical parachute

II.3. Electronic design

The electronic design was built around the CanSat-Pico-Kit, which provided the foundational structure and included the following components:

Figure 4: Raspberry-Pi Pico

The Raspberry-Pi Pico microcontroller is the primary component inside the can. It is connected to the BMP280 Barometric pressure sensor, the RFM69HCW Transceiver Radio, and the Lithium Polymer Battery.

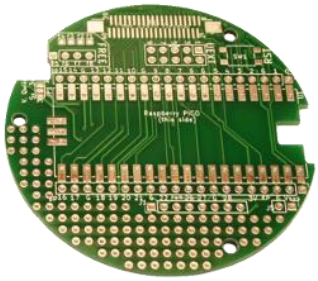


Figure 5: Pico Cansat Base board

The development board is the base for the microcontroller, with the Raspberry-Pi Pico being soldered onto it.

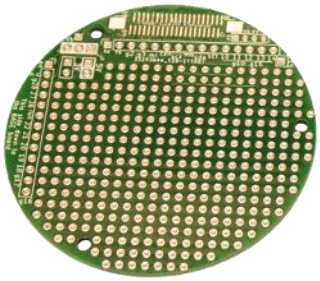


Figure 6: Pico Cansat Proto board

The prototyping board adds a prototyping aread to the Pico Cansat Base board.

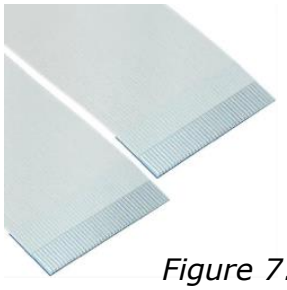


Figure 7: FPC ribbon

The ribbon connects the Pico Cansat Base board and the Pico Cansat Proto board.

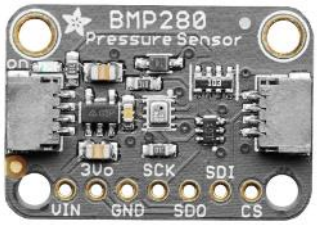


Figure 8: BMP280 Barometric pressure sensor

The BMP280 Barometric pressure sensor is used to evaluate pressure, altitude and temperature. It is connected to the Raspberry-Pi Pico microcontroller.

Figure 9: TMP36 Analog temperature sensor

The TMP36 Analog temperature sensor transforms the sensor voltage read on analog input into an easy-to-read temperature.

Figure 10: RFM69HCW Transceiver Radio

The RFM69HCW Transceiver Radio is used to transmit the measurements of the air pressure, the alitude and the temperature. One transceiver is linked to the Raspberry-Pi Pico microcontroller located inside the can, while the other transceiver is connected to the Raspberry-Pi Pico at the station.

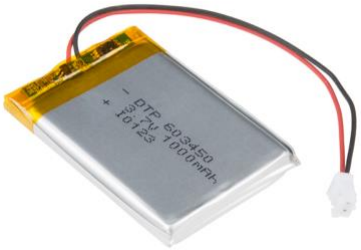


Figure 11: Lithium Polymer Battery

The Lithium Polymer Battery is connected to the Raspberry Pico microcontroller inside the can in order to power it during the launch.

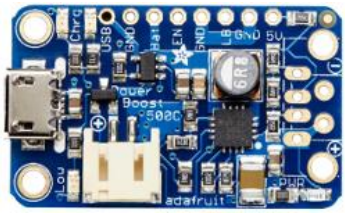


Figure 12: PowerBooster 500 charger

The PowerBooster 500 charger is connected to the Lithium Polymer Battery. serves the purpose of converting the battery power into a usable 5V power source, while also capable of recharging the battery when the kit is powered via USB.

To ensure that all the components and devices inside the can are connected securely and do not interfere with each other, we soldered them together using cables. To guide us through the assembly process, we referred to the step-by-step instructions on the MCHobby page. Below is a brief summary of our assembly process, which includes pictures from the MCHobby page for each step.

Step 1: Soldering the Raspberry Pico

The Raspberry Pico is the brain of our CanSat module. It will collect and process data from the sensors and transmit it to our ground station through a cable antenna and a Yagi-Uda antenna. Additionally, as a safety measure, it will store the data on the on-boardflash memory. To connect the Pico to the base board, we aligned the two using pins and soldered them together, as depicted in the picture on the right. After the soldering was complete, we removed the pins.

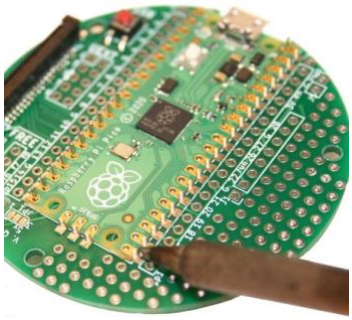


Figure 13: Soldering the Pico

Step 2: Adding the SparkFun Lipo Charger/Booster

The SparkFun Lipo Charger/Booster is the chosen power source for our CanSat module, fulfilling the dual purpose of charging our Lipo battery and providing power to all components. To secure the Lipo Charger/Booster to our base board, we utilized soldering techniques as depicted in the image on the right-hand side. Following this, we placed it to the back of the base board, taking precautions to prevent any inadvertent contact between conducting components. To achieve this, we placed a foam plate that could withstand high temperatures in between both components, using hot glue and double-sided tape to secure it in place.

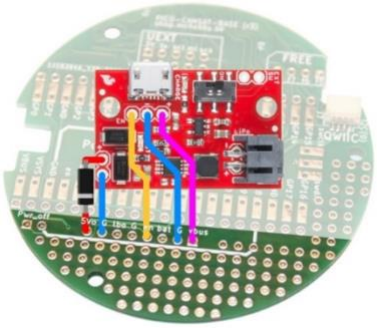


Figure 14: Adding the Lipo Charger/Booster

Step 3: Soldering the RFM69HCW

The RFM69HCW module has been selected as the primary communication medium between our CanSat module and the ground station. Data collected by the onboard RFM69HCW will be transmitted trough a cable antenna to the Yagi-Uda antenna situated at the ground station.

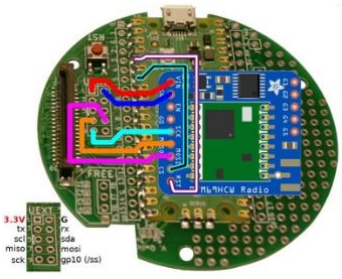


Figure 15: Soldering the RFM69HCW

To install the RFM69HCW module, we placed it on the rear surface of our secondary board and utilized soldering techniques to attach it to the base board, as depicted in the image on the left-hand side. The two boards will be joined together in the coming weeks using FPC connectors and printed rods. Unfortunately, these components are not yet available, delaying the assembly process.

Step 4: Connecting the BMP280

For our CanSat module, the BMP280 has been designated as the temperature and pressure sensor. This device will gather crucial data, enabling us to monitor temperature and pressure changes relative to the altitude of our module.

Its integrated Qwiic connector was utilized to connect the BMP280 to the base board.

The final results are illustrated below:

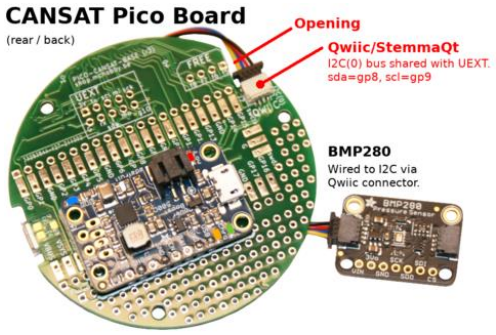


Figure 16: Connecting the BMP280

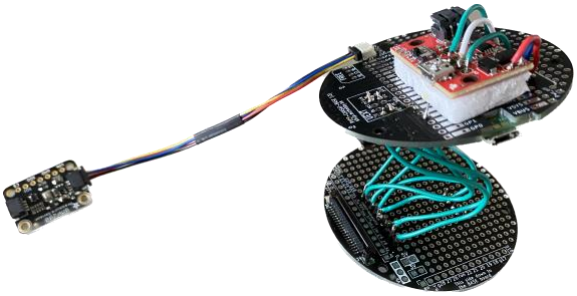


Figure 17: front view (I) of the electronical design

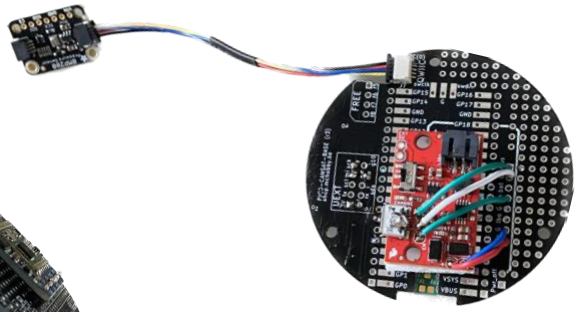


Figure 19: top view of the electronical design

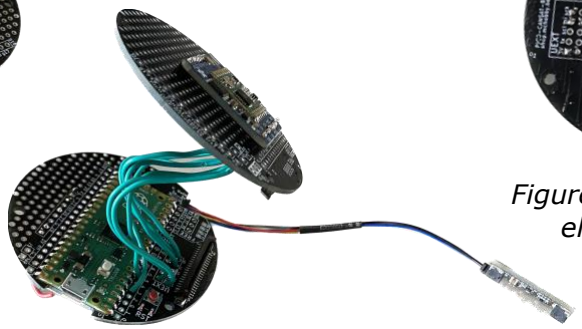


Figure 18: front view (II) of the electronical design

Step 5: Assembly of the ground station

The ground station consists of a Raspberry Pico connected to a second RFM69HWC and a Yagi-Uda antenna. To enhance flexibility during testing, we constructed it on a breadboard. Furthermore, the ground station will be stationary and connected to a laptop. As a result, there is no requirement for soldering unless it is handled with care. The only moving part in the setup will be the Yagi-Uda antenna, which will be directed towards the CanSat module during flight. The primary purpose of the ground station is to accumulate transmitted data from the CanSat and store it locally on the computer.

The connections of the different wires and pins are illustrated by the diagram:

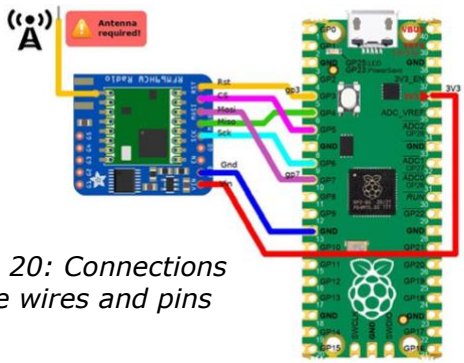


Figure 20: Connections of the wires and pins

Step 6: Secondary mission upgrades

Regarding the secondary mission, we have already procured an external GPS module and a BNO055 sensor capable of measuring the magnetic field (3 axis), acceleration (3 axis), angular velocity (3 axis), and gravitational acceleration (3 axis) of our CanSat. Regrettably, we have not been able to incorporate these components into our board due to different delays with other parts of our project. Once we have optimized the current build for our primary mission, we may consider integrating these components if there is sufficient time to proof test them.

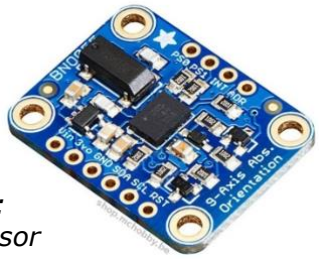


Figure 21: BNO055 sensor

Figure 22: GPS module

II.4. Ground station design

As previously mentioned, the ground station is comprised of a Raspberry Pico, a second RFM69HWC, and a Yagi-Uda antenna. In this discussion, we will focus on the Yagi-Uda antenna, which was selected for its affordability, ease of construction, and quick assembly.

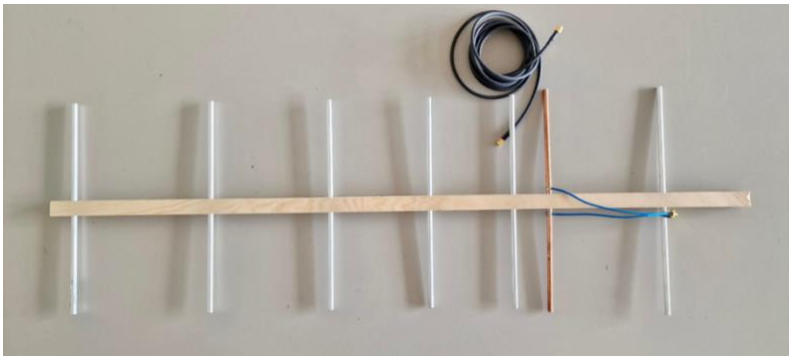


Figure 23: Yagi-Uda antenna

To construct the antenna, we conducted extensive research online to determine the ideal configuration. After evaluating various options, we concluded that incorporating 6 to 7 elements would provide the most favorable outcomes for our project. As a result, we opted to utilize seven elements, consisting of five driving components known as directors, one reflector, and one dipole. The directors serve as the primary driving elements, working in unison with the reflector to amplify and concentrate the signal, while the dipole functions as the principal radiator of the antenna. When selecting the material of the dipole, we chose to use copper in order to guarantee maximum conductivity and minimize any potential signal loss.

To determine the ideal length and position of the components, we employed an online calculation software that aided us in calculating the required frequency of 434.4 MHz.

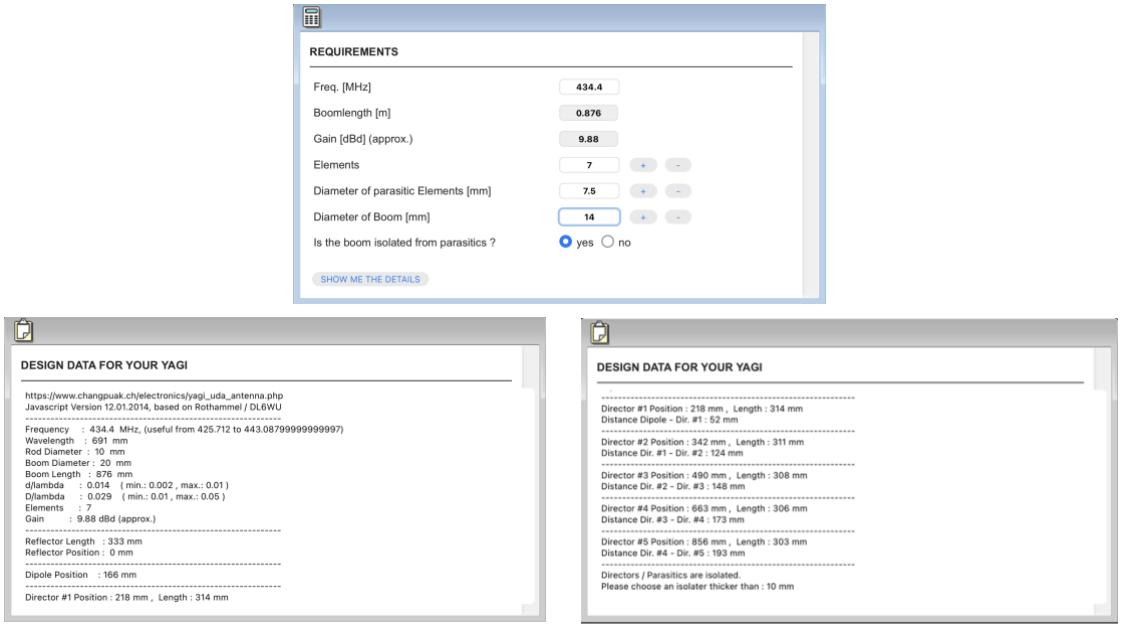


Figure 24: online calculation software

Once we obtained the measurements, we cut all the components to size and soldered the dipole to the radio module, thereby connecting the antenna to the ground station.

II.5. Software design

Raspberry Pico onboard the CanSat module

Below is our software design for the Raspberry Pico onboard our CanSat module.

```
# Import
from machine import SPI, I2C, Pin, ADC
from bme280 import BME280, BMP280_I2CADDR
from rfm69 import RFM69
import time

# Frequency, Encryption & Nodes
FREQ           = 434.4
ENCRYPTION_KEY = bytes([3,7,7,4,6,6,6,8,6,5,6,1,7,6,6,5])
NODE_ID        = 120
BASESTATION_ID = 100

# Buses & Pins
spi = SPI(0, baudrate=50000, polarity=0, phase=0, firstbit=SPI.MSB)
nss = Pin(5, Pin.OUT, value=True)
rst = Pin(3, Pin.OUT, value=False)
i2c = I2C(0)

# RFM69HCW
rfm = RFM69(spi=spi, nss=nss, reset=rst)
rfm.frequency_mhz  = FREQ
rfm.encryption_key = (ENCRYPTION_KEY)
rfm.node           = NODE_ID
rfm.destination    = BASESTATION_ID

# BMP280
bmp = BME280(i2c=i2c, address=BMP280_I2CADDR)
baseline = 1010.0

# TMP36
# adc = ADC(Pin(26))

# Onboard LED
led = Pin(25, Pin.OUT)
```

```
# Main Loop
with open('Data.txt', 'w') as _file:
    _file.write('Counter, Time (s), Temperature (°C), Pressure (hPa), Altitude (m) \n')
print('Team          : SevenToHeaven')
print('Frequency     :', rfm.frequency_mhz)
print('Encryption    :', rfm.encryption_key)
print('NODE_ID       :', NODE_ID)
print('BASESTATION_ID:', BASESTATION_ID)
print('***HEADER***')
print("Counter, Time (s), Temperature (°C), Pressure (hPa), Altitude (m)")
print('***DATA***')
counter = 1
ctime = time.time()
while True:
    temperature = bmp.raw_values[0]
    pressure = bmp.raw_values[1]
    altitude = (baseline - pressure)*8.3
    msg = "%i |%i |%6.1f °C |%6.1f hPa |%6.1f m" % (counter,time.time()-ctime,temperature,pressure,altitude)
#     msg = "Servus %i" % (counter)
    led.on()
    print(msg)
    with open('Data.txt', 'a') as _file:
        _file.write(msg + '\n')
    rfm.send(bytes(msg, "utf-8"))
    led.off()
    counter += 1
    time.sleep(0.4)
```

Here are the different steps of our code:

- **Import:** We import the needed modules, e.g. the modules tied to the BMP280 and the RFM69HCW.
- **Frequency, Encryption and Nodes:** We setup our global variables, including our frequency, and choose an encryption key. Our encryption key corresponds to the digits of our team's name converted from a string into bytes.
- **Buses and Pins:** We define the buses and pins we refer to in our code.
- **RFM69HCW:** We setup the variables tied to the RFM69HCW.
- **BMP280:** We setup the variables tied to the BMP280.
- **Onboard LED:** We define the LED pin.
- **Main loop:** We overwrite the currently saved data and print the given variables and the header. Afterwards, we initialize the measurements and measure for each iteration of our loop the temperature, the pressure, the altitude and add the values to our message. The message is saved to the flash memory and send to the ground station. After each iteration, we proceed to the next measurement.

Here is the output of our test run:

```
Team          : SevenToHeaven
Frequency     : 434.4
Encryption    : bytearray(b'\x03\x07\x07\x04\x06\x06\x06\x08\x06\x05\x06\x01\x07\x06\x06\x05')
NODE_ID       : 120
BASESTATION_ID: 100
***HEADER***
Counter, Time (s), Temperature (°C), Pressure (hPa), Altitude (m)
***DATA***
1 |1 |  24.6 °C | 974.8 hPa | 292.2 m
2 |1 |  24.6 °C | 974.9 hPa | 291.0 m
3 |1 |  24.6 °C | 974.8 hPa | 292.0 m
4 |2 |  24.6 °C | 974.9 hPa | 291.5 m
5 |2 |  24.6 °C | 974.8 hPa | 291.7 m
6 |3 |  24.6 °C | 974.8 hPa | 292.0 m
7 |3 |  24.6 °C | 974.8 hPa | 291.7 m
8 |4 |  24.6 °C | 974.9 hPa | 291.3 m
9 |4 |  24.6 °C | 974.8 hPa | 291.7 m
10 |5 |  24.6 °C | 974.8 hPa | 292.0 m
```

Raspberry Pico included in the ground station

Below is our software design for the Raspberry Pico included in our ground station.

```
# Import
from machine import SPI, Pin
from rfm69 import RFM69
import time

# Frequency, Encryption & Nodes
FREQ           = 434.4
ENCRYPTION_KEY = bytes([3,7,7,4,6,6,6,8,6,5,6,1,7,6,6,5])
NODE_ID        = 100

# Buses & Pins
spi = SPI(0, baudrate=50000, polarity=0, phase=0, firstbit=SPI.MSB)
nss = Pin(5, Pin.OUT, value=True)
rst = Pin(3, Pin.OUT, value=False)

# RFM69HCW
rfm = RFM69(spi=spi, nss=nss, reset=rst)
rfm.frequency_mhz  = FREQ
rfm.encryption_key = (ENCRYPTION_KEY)
rfm.node           = NODE_ID

# Onboard LED
led = Pin(25, Pin.OUT)

# Main Loop
with open('Data.txt', 'w') as _file:
    _file.write('Counter, Time (s), Temperature (°C), Pressure (hPa), Altitude (m) \n')
print('Team          : SevenToHeaven')
print('Frequency     :', rfm.frequency_mhz)
print('Encryption    :', rfm.encryption_key)
print('NODE_ID       :', NODE_ID)
print("Waiting for packets...")
while True:
    packet = rfm.receive(timeout=0.5)
    if packet is None:
        pass
    else:
        led.on()
        print("[DATA](len=%i,RSSI=%i)%s" % (len(packet),rfm.last_rssi,packet))
        packet_text = str(packet, "ascii")
        print("[MSG]", packet_text)
        with open('Data.txt', 'a') as _file: _file.write(packet_text + '\n')
        led.off()
```

The software design for the Raspberry Pico included in our ground station is quite similar to the software design for the Raspberry Pico onboard our CanSat module. The most notable diffence is the receive command. While our CanSat module sends the message, our ground station receives the message and displays it. Furthermore, the messages are saved to the local storage of the ground storage.

II.6. Recovery sytem

Another important part of a CanSat is its recovery system, which enables it to safely return to Earth after finishing its mission. The recovery system typically consists of two primary components: a parachute and a recovery beacon. The parachute decelerates the CanSat's descent, while the recovery beacon aids in locating the CanSat upon landing. For our project, we have utilized the GPS module as a recovery beacon, sending a signal to ground stations to assist in the CanSat's retrieval. Additionally, we have designed our parachute with a red and white color scheme, enhancing its visibility.

II.7. Testing

Parachute

Below are the are the illustrations of our ultimate parachute design, created with the help of Viana software:

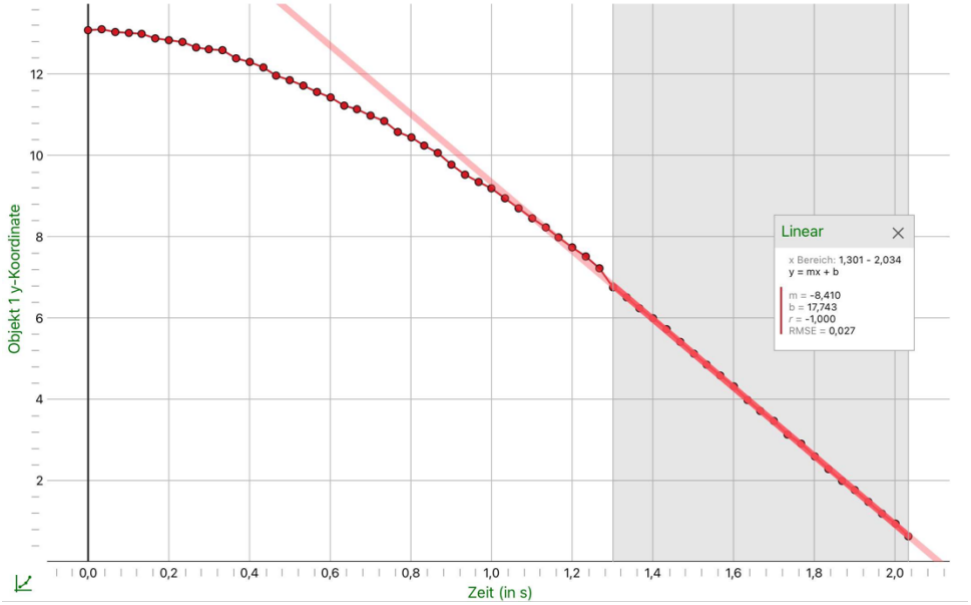


Figure 25: position as a function of time, diagram of the hemispherical parachute

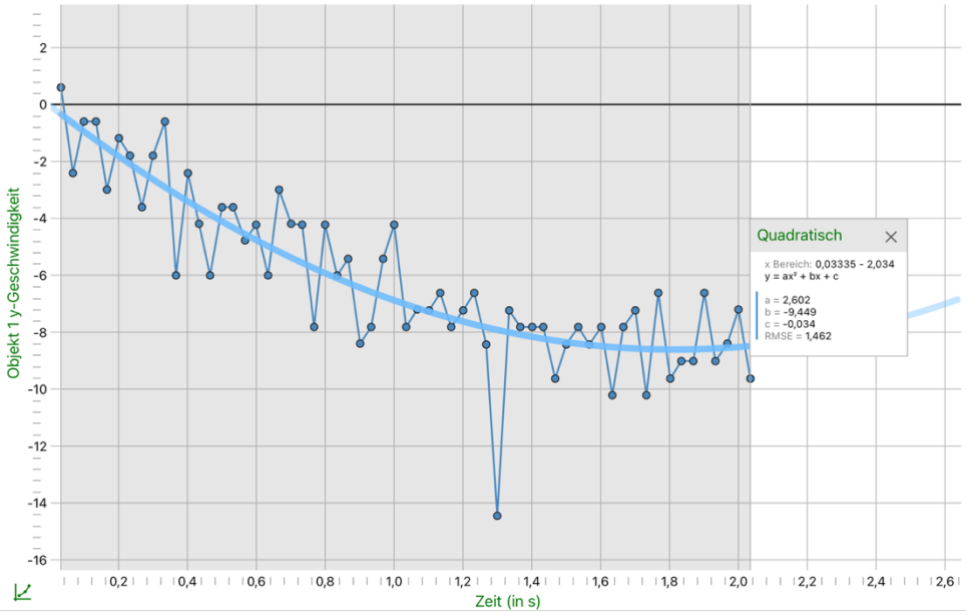


Figure 26: velocity as a function of time, diagram of the hemispherical parachute

For more detailed information about the parachute and its evolutionary process, we recommend reviewing the project design.

Antenna

During our testing of the Yagi-Uda antenna, we observed that the RSSI was below our expectations, fluctuating between -70 and -50 dBm. This indicated that the antenna's performance was not optimal and required further investigations. To tackle this issue, we conducted a thorough review of all the measurements taken over the past few weeks, with the aim of identifying areas for improvement to ensure a more stable connection. After examining the antenna's design and placement, as well as the transmitter and receiver

modules, we resolved the interference issues, resulting in a promising antenna for the upcoming launch.

Software and electronic design

To begin with the software design, we acquainted ourselves with the Thonny integrated development environment and Python programming language by experimenting with simple code snippets. For instance, we created a calculator that solves second-degree polynomials. Subsequently, we moved on to installing MicroPython on our Raspberry-Pi Pico board, which enabled us to access the board's various pins and experiment with different code snippets. For example, we tested turning an LED on and off. Afterwards, we tested the programs for the Raspberry-Pi Pico and its attachments by connecting multiple microcontrollers and examining whether signals could be sent and received between them. For the measurements, we simply needed to confirm their plausibility and adjust the code if necessary.

However, the primary challenges we faced while working on the code included incorrectly named pins, slow laptops, and defective cables. Despite most of the shorter and even some of the longer cables not working, this was not specified as the reason for the code's failure during testing, which forced us to analyse the entire code and try various techniques to identify the issue. After wasting a lot of time, we opted to replace the cables, and from that point on, everything went well.

III. Requirements

To ensure the succes of the project, the CanSat hardware and missions must be designed to the following requirements and constraints:

Mass/weight

The dimensions of the CanSat components must conform to the standard can size of 115 mm in length and 66 mm in diameter, with the exception of radio and GPS antennas that can be installed externally. In the rocket's payload area, there is typically an additional 45 mm of space available in the axial direction of the CanSat to accommodate external elements such as the parachute, equipment for fixing the parachute, and antennas.

The minimum weight requirement for the CanSat, which includes the parachute, is set at 300 grams. In case it falls short of this requirement, additional weights such as sand or lead need to be loaded onto it.

Material restrictions

The usage of explosive materials such as projectiles, fireworks, or any other hazardous substances that are prone to catch fire easily are strictly prohibited.

Power supply

It is mandatory for the CanSat to possess an independent power source, such as accumulators, batteries, or solar panels. Additionally, the power source must be easily accessible for replacement or recharging purposes. To ensure uninterrupted functionality, the battery capacity must be adequate for a minimum of 4 hours of continuous CanSat operation.

The primary switch of the satellite must be readily accessible.

Recovery sytem

A recovery mechanism, preferably a parachute, is mandatory for the CanSat to facilitate a safe landing. Furthermore, the materials used for the CanSat's

construction must be brightly colored or have high visibility to enable its quick and easy recovery after landing.

The parachute must be securely fastened to the CanSat to withstand significant amounts of force.

For recovery purposes, it is advised to maintain a descent rate of approximately 10 m/s. However, to ensure safety, the CanSat's descent speed should not exceed 12 m/s or fall below 5 m/s.

Statics and dynamics

The CanSat must possess the capability to endure an acceleration of up to 20 g.

Cost

The overall cost of the final CanSat design should not surpass 500€, which includes the expenses for the CanSat kit received during the mentor's workshop. The budget does not include any ground stations or any additional non-flying items.

If any sponsorship is received, all the items sponsored must be accurately stated in the budget, along with their actual market prices.

Mission requirements

The CanSat is required to measure, at the very minimum, the temperature and air pressure parameters mentioned in the primary mission.

To avoid any radio communication interference with other participating teams, it is essential to have the flexibility to modify the radio frequency. It is mandatory for all teams to adhere to the assigned frequency during the launch campaign.

While the CanSat is descending, it is compulsory to transmit data both to the ground station and store it in the CanSat's internal file storage.

IV. Overall progress

IV.1. Human resources

The division of work in our team is structured to ensure a successful CanSat design. Santos Esteban and Quaring Pit are leading the efforts in creating a solid design for the CanSat, while also focusing on 3D printing. Cagnetta Victoria is responsible for the parachute, ensuring that it functions effectively and safely. The informatics aspect of the project is being handled by Licina Ilan and Marques Daniel, while soldering and testing the electronic design is their additional responsibility. Picard Noé and Thiel Pol are taking care of the antenna and the ground station, making sure that the communication aspect of our project is properly addressed.

However, it is important to note that while each member of our team has a primary responsibility, we all work together to ensure the success of our project. Communication is one of our top priorities, and we make sure to share our progress and problems with each other. By doing so, we are able to leverage each other's strengths and experiences to come up with the best possible solution.

IV.2. Planning

We meticulously planned each step of our project, striving to organize everything in the best possible way to ensure a successful outcome. The project involves numerous intricate details that demand our utmost attention. We devoted considerable time to researching and compiling the essential ideas for every aspect of the project. Additionally, we maintained a sharp focus on the project timeline and documentation requirements for each mission.

2022-2023 Timeline	
Phase 1: Call for projects and team selection	
End of registrations	November 11th
Announcement of selected teams	November 14th
Phase 2: Introductory meetings	
Teacher workshop	October 20th and 17th
Kick off-meeting on Microsoft Teams	November 16th 17:00 to 18:00
Phase 3: CanSat construction and testing	
Students YAGI training (optional)	January 25th 17:00 to 20:00
1st design report submission	January 27th

Jury feedback on the 1st design report	February 7th
2nd design report submission	March 22nd
Jury feedback on the 2nd design report	March 24th
Mandatory technical support session Drones drop to test & YAGI antenna testing	March 25th
Final teams' selection	March 30th
Phase 4: Competition	
Execution of the launches	April 28th
Final reports presentation & awards ceremony	April 29th
Phase 5: European Competition for Luxembourg winner	
European Launch Campaign	June 23rd to 30th
Deadline to submit CanSat Final Report to ESA	July 31st

IV.3. Budget

Our project was allocated a budget of 500€, and we were fortunate to receive a CanSat kit that included electronic components. See the appendix for the detailed bills.

IV.4. Outreach

We established an Instagram account to keep our loved ones and acquaintances updated on our progress. It proved to be a remarkable source of motivation for us, as evidenced by the staggering 30,000 views we garnered from just one video.

Moving forward, we intend to amplify our reach by showcasing our project on Uelzechtkanal, a prominent television broadcaster in Luxembourg, as well as during our school's Porte Ouverte event. By doing so, we aspire to reach a diverse audience from different age groups and backgrounds and raise awareness about the European Space Agency's mission.

@_SEVEN_TO_HEAVEN

V. Scientific results

Unfortunately, we were unable to incorporate the GPS, hence we chose to utilize an AirTag to facilitate retrieval. Additionally, it helped to determine the vertical velocity and vertical acceleration by analyzing the height data. The data we obtained is included in the appendix and has been plotted for analysis:

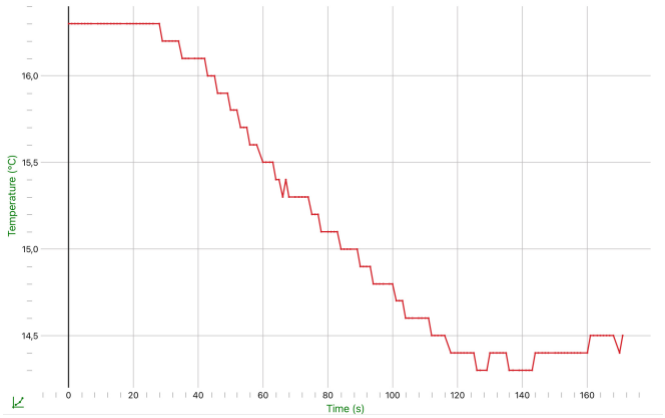


Figure 27: graph showing the CanSat's temperature throughout the launch

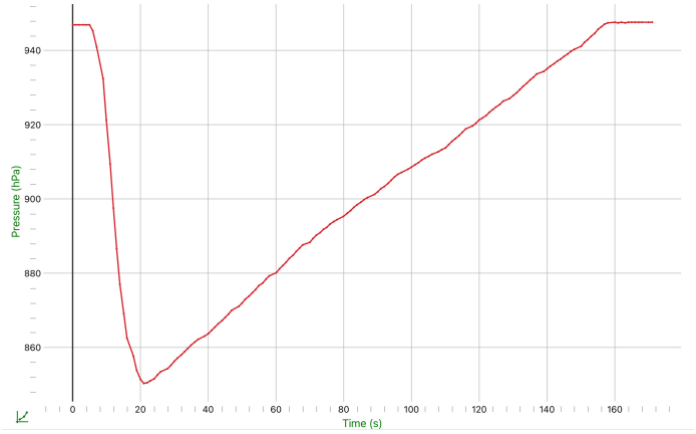


Figure 28: graph showing the CanSat's pression throughout the launch

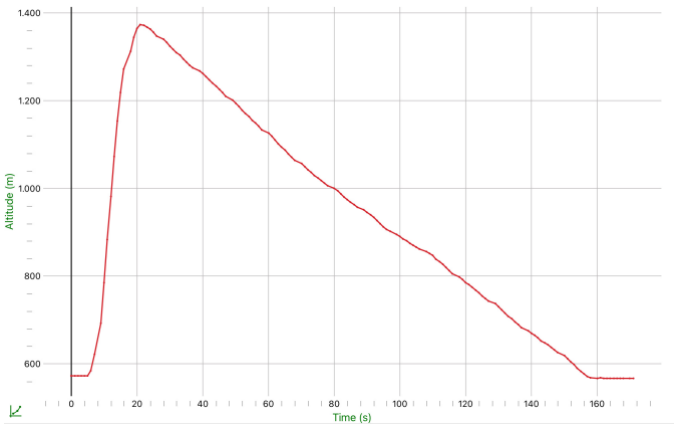


Figure 29: graph showing the CanSat's altitude throughout the launch

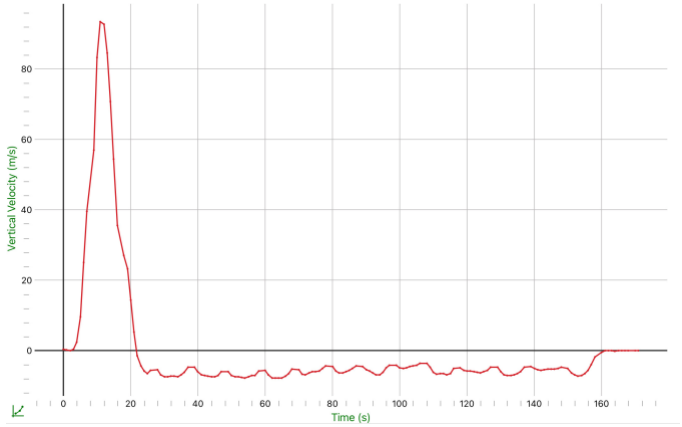


Figure 30: graph showing the CanSat's vertical velocity throughout the launch

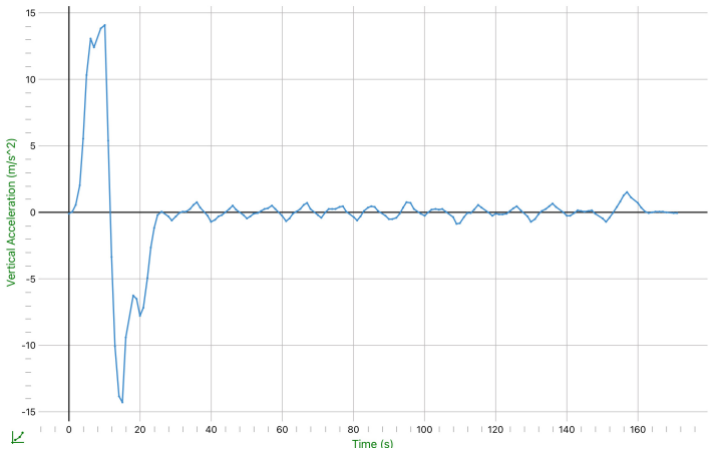


Figure 31: graph showing the CanSat's vertical acceleration throughout the launch

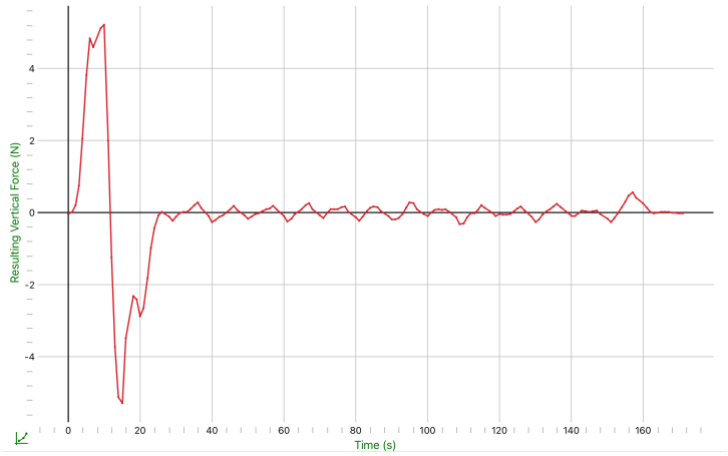


Figure 32: graph showing the CanSat's vertical resulting force throughout the launch

VI. Discussion

Temperature

The illustrated chart depicts the results of our temperature measurements. Upon analyzing the recorded values, we can notice a significant shift in temperature. This trend suggests that as the height of the CanSat increases, the temperature readings decrease proportionally. This observation may be attributed to factors like changes in atmospheric pressure or decreased insulation. However, the graph displays a sluggish increase in temperature, which we speculate is due to the slow response time of the BMP280. By extending the timeframe, we can observe the temperature returning to the projected levels.

Pressure

Our analysis, accompanied by a corresponding graph, reveals a sharp decline followed by a gradual increase in pressure. The graph suggests that pressure rapidly declined during the CanSat's ascent, owing to the application of a chemical rocket during launch, and gradually increased during descent, due to the parachute's deployment to decrease velocity. Additionally, it can be observed that pressure diminishes with altitude. The highest pressure reading of just below 950 hPa was recorded when the CanSat was on the ground before and after landing. The lowest pressure reading was about 850 hPa when the CanSat briefly paused before descent. These observations affirm not only the precision of our measurements and coding throughout the launch procedure but also demonstrate the parachute's efficacy in decelerating the CanSat.

Altitude

In the beginning of the graph, we observe a sharp rise in altitude, followed by a gradual decline. This initial height is a result of the rocket launch, which leads to rapid acceleration. As the rocket stops gaining on height, it eventually reaches a point where its ascent slows down because of the opening of the rocket and the deployment of the cans. This causes the altitude to gradually decrease as the rocket descends towards the ground. The parachute we developed ensures that the time it takes to reach the ground is reduced. The rocket reached a maximum altitude of around 1375 meters, and it took approximately 170 seconds for the satellite to descend to the ground.

Vertical velocity

We obtain the vertical velocity by taking the derivative of the altitude with respect to time:

$$v_y = \frac{dh}{dt}$$

Based on our analysis, we noticed a significant rise in the upward velocity of the can, which was then followed by a gradual decrease. This behavior can be attributed to the rocket's initial thrust when launching the can, which resulted in the surge of velocity. However, we also observed a point on the graph where the velocity started to drop, coinciding with the deployment of the parachute. Indeed, the reduction in speed is mainly due to the drag force exerted by the parachute, which was specifically designed to decelerate the can's descent. The maximum velocity achieved during the launch phase was approximately 95 m/s, but this was considerably reduced due to the effect of the parachute. Ultimately,

our data revealed that the can landed with a final velocity of approximately 6 m/s, which was slower compared to the testing phase. We attribute this reduction in speed to the strong winds present during the launch.

Vertical acceleration

We obtain the vertical acceleration by taking the derivative of the vertical velocity with respect to time:

$$a_y = \frac{dv_y}{dt}$$

The acceleration outcome chart reveals notable fluctuations during the initial stages, which can be explained by the explosive launch of the chemical rocket. This led to a rapid surge in speed, resulting in significant peaks and dips in the graph. The propulsion of the rocket produced a maximum vertical acceleration of 14 m/s^2 during launch. However, as the CanSat approaches its maximum altitude, the acceleration declined due to the gravitational force acting upon it.

Consequently, as the CanSat separates from the rocket, the vertical acceleration drops to -14 m/s^2, indicating a sudden reduction in the CanSat's velocity caused by the parachute's deceleration. Once the CanSat reaches a state of equilibrium between its weight and air resistance, the acceleration value becomes zero.

The minor fluctuations in the chart can be attributed to atmospheric conditions and the parachute's impact, especially considering the windy weather during launch day. Furthermore, during the CanSat's descent, the acceleration remained relatively low due to the drag of the parachute, slowing the CanSat's fall rate.

Vertical resulting force

The CanSat's vertical net force is determined by multiplying its mass with the vertical acceleration:

$$F_y = m \cdot a_y$$

The force graph is identical to the acceleration graph, but scaled by the acceleration value. By studying the chart, we can conclude that the CanSat experiences a maximum force of around 5N during its upward acceleration and a similar force during its deceleration phase.

VII. Conclusion

In summary, our team is delighted with the outcome of this project, as we were able to gain valuable insights from the collected data. Additionally, the project expanded our scientific knowledge in different fields that are not typically covered in conventional educational settings. Despite facing various challenges, we worked collaboratively to overcome them and emerged stronger as a team. We believe that these challenges strengthened our resolve and motivated us to deliver the best possible results.

VIII. Acknowledgments

We wish to express our heartfelt gratitude to those who have been instrumental in our success. First and foremost, we extend our sincere appreciation to our mentors, Rodriguez Gerson and Mengozzi Jonathan, for their unwavering support and guidance, which propelled us to persevere through the project's ups and

downs. Their wealth of knowledge has been invaluable to us. We also extend our gratitude to Gross Raul, whose invaluable contribution was crucial to the CanSat design. Lastly, we would like to thank our friends and family, whose unwavering support and encouragement motivated us throughout this journey.

IX. Refeferences

In order to complete this project, we consulted the following sources:

- https://www.esero.lu/wp-content/uploads/2022/10/Teams-Manual-2022-2023-Luxembourg-CanSat-Competition-v1.pdf
- https://www.esero.lu/wp-content/uploads/2021/10/Cansat_report_template.docx
- https://esero.kopernik.org.pl/wp-content/uploads/2019/06/CanSat_Parachute_Design.pdf
- https://wiki.mchobby.be/index.php?title=ENG-CANSAT-PICO-BELGIUM

X. Appendix

Raw data

Here are the outcomes of our data collection, which was carried out using the antenna:

```
[DATA](len=49,RSSI=-88)bytearray(b'4461 | 4946.0 s | 16.3 \xc2\xb0C | 876.9 hPa | 1153.2 m')
[MSG] 4461 | 4946.0 s | 16.3 °C | 876.9 hPa | 1153.2 m
[DATA](len=49,RSSI=-85)bytearray(b'4462 | 4947.0 s | 16.3 \xc2\xb0C | 869.1 hPa | 1217.9 m')
[MSG] 4462 | 4947.0 s | 16.3 °C | 869.1 hPa | 1217.9 m
[DATA](len=49,RSSI=-90)bytearray(b'4463 | 4948.0 s | 16.3 \xc2\xb0C | 862.5 hPa | 1272.1 m')
[MSG] 4463 | 4948.0 s | 16.3 °C | 862.5 hPa | 1272.1 m
[DATA](len=49,RSSI=-87)bytearray(b'4464 | 4950.0 s | 16.3 \xc2\xb0C | 857.6 hPa | 1312.8 m')
[MSG] 4464 | 4950.0 s | 16.3 °C | 857.6 hPa | 1312.8 m
[DATA](len=49,RSSI=-94)bytearray(b'4466 | 4952.0 s | 16.3 \xc2\xb0C | 851.4 hPa | 1364.1 m')
[MSG] 4466 | 4952.0 s | 16.3 °C | 851.4 hPa | 1364.1 m
[DATA](len=49,RSSI=-97)bytearray(b'4467 | 4953.0 s | 16.3 \xc2\xb0C | 850.3 hPa | 1373.3 m')
[MSG] 4467 | 4953.0 s | 16.3 °C | 850.3 hPa | 1373.3 m
[DATA](len=49,RSSI=-91)bytearray(b'4468 | 4954.0 s | 16.3 \xc2\xb0C | 850.5 hPa | 1372.4 m')
[MSG] 4468 | 4954.0 s | 16.3 °C | 850.5 hPa | 1372.4 m
[DATA](len=49,RSSI=-85)bytearray(b'4469 | 4955.0 s | 16.3 \xc2\xb0C | 851.1 hPa | 1367.0 m')
[MSG] 4469 | 4955.0 s | 16.3 °C | 851.1 hPa | 1367.0 m
[DATA](len=49,RSSI=-88)bytearray(b'4470 | 4956.0 s | 16.3 \xc2\xb0C | 851.6 hPa | 1362.6 m')
[MSG] 4470 | 4956.0 s | 16.3 °C | 851.6 hPa | 1362.6 m
[DATA](len=49,RSSI=-79)bytearray(b'4471 | 4957.0 s | 16.3 \xc2\xb0C | 852.5 hPa | 1355.7 m')
[MSG] 4471 | 4957.0 s | 16.3 °C | 852.5 hPa | 1355.7 m
[DATA](len=49,RSSI=-90)bytearray(b'4472 | 4958.0 s | 16.3 \xc2\xb0C | 853.5 hPa | 1347.1 m')
[MSG] 4472 | 4958.0 s | 16.3 °C | 853.5 hPa | 1347.1 m
[DATA](len=49,RSSI=-87)bytearray(b'4473 | 4960.0 s | 16.3 \xc2\xb0C | 854.4 hPa | 1339.7 m')
[MSG] 4473 | 4960.0 s | 16.3 °C | 854.4 hPa | 1339.7 m
[DATA](len=49,RSSI=-84)bytearray(b'4474 | 4961.0 s | 16.2 \xc2\xb0C | 855.2 hPa | 1332.9 m')
[MSG] 4474 | 4961.0 s | 16.2 °C | 855.2 hPa | 1332.9 m
[DATA](len=49,RSSI=-79)bytearray(b'4475 | 4962.0 s | 16.2 \xc2\xb0C | 856.2 hPa | 1324.4 m')
[MSG] 4475 | 4962.0 s | 16.2 °C | 856.2 hPa | 1324.4 m
[DATA](len=49,RSSI=-82)bytearray(b'4476 | 4963.0 s | 16.2 \xc2\xb0C | 857.1 hPa | 1317.4 m')
[MSG] 4476 | 4963.0 s | 16.2 °C | 857.1 hPa | 1317.4 m
[DATA](len=49,RSSI=-93)bytearray(b'4478 | 4965.0 s | 16.2 \xc2\xb0C | 858.8 hPa | 1303.3 m')
[MSG] 4478 | 4965.0 s | 16.2 °C | 858.8 hPa | 1303.3 m
```

Figure 33: results of our data collection realised via antenna

Below, you will find the outcomes of the data we gathered through the CanSat's backup mechanism:

Team	Package	Global time (s)	Time (s)	Temperature (°C)	Pressure (hPa)	Altitude (m)
SevenToHeaven	4448	4932	0	16,3	946,8	572,5
SevenToHeaven	4449	4933	1	16,3	946,8	572,9
SevenToHeaven	4450	4934	2	16,3	946,8	572,8
SevenToHeaven	4451	4935	3	16,3	946,8	572,9
SevenToHeaven	4452	4936	4	16,3	946,8	572,9
SevenToHeaven	4453	4937	5	16,3	946,8	572,9
SevenToHeaven	4454	4938	6	16,3	945,4	584,2
SevenToHeaven	4455	4939	7	16,3	941,0	621,1
SevenToHeaven	4456	4941	9	16,3	932,4	692,3
SevenToHeaven	4457	4942	10	16,3	921,2	784,8
SevenToHeaven	4458	4943	11	16,3	909,4	883,1
SevenToHeaven	4459	4944	12	16,3	897,6	981,1
SevenToHeaven	4460	4945	13	16,3	886,6	1072,6
SevenToHeaven	4461	4946	14	16,3	876,9	1153,2
SevenToHeaven	4462	4947	15	16,3	869,1	1217,9
SevenToHeaven	4463	4948	16	16,3	862,5	1272,1
SevenToHeaven	4464	4950	18	16,3	857,6	1312,8
SevenToHeaven	4465	4951	19	16,3	853,8	1344,7
SevenToHeaven	4466	4952	20	16,3	851,4	1364,1
SevenToHeaven	4467	4953	21	16,3	850,3	1373,3
SevenToHeaven	4468	4954	22	16,3	850,5	1372,4
SevenToHeaven	4469	4955	23	16,3	851,1	1367,0
SevenToHeaven	4470	4956	24	16,3	851,6	1362,6
SevenToHeaven	4471	4957	25	16,3	852,5	1355,7
SevenToHeaven	4472	4958	26	16,3	853,5	1347,1
SevenToHeaven	4473	4960	28	16,3	854,4	1339,7
SevenToHeaven	4474	4961	29	16,2	855,2	1332,9
SevenToHeaven	4475	4962	30	16,2	856,2	1324,4
SevenToHeaven	4476	4963	31	16,2	857,1	1317,4
SevenToHeaven	4477	4964	32	16,2	858,0	1309,7
SevenToHeaven	4478	4965	33	16,2	858,8	1303,3
SevenToHeaven	4479	4966	34	16,2	859,8	1295,1
SevenToHeaven	4480	4967	35	16,1	860,6	1288,2
SevenToHeaven	4481	4968	36	16,1	861,5	1280,9
SevenToHeaven	4482	4969	37	16,1	862,2	1274,5
SevenToHeaven	4483	4971	39	16,1	863,0	1268,2
SevenToHeaven	4484	4972	40	16,1	863,7	1262,5
SevenToHeaven	4485	4973	41	16,1	864,6	1255,0
SevenToHeaven	4486	4974	42	16,1	865,4	1248,1
SevenToHeaven	4487	4975	43	16,0	866,3	1240,9
SevenToHeaven	4488	4976	44	16,0	867,2	1233,4
SevenToHeaven	4489	4977	45	16,0	868,1	1225,7
SevenToHeaven	4490	4978	46	15,9	869,0	1218,2

SevenToHeaven	4491	4979	47	15,9	870,0	1210,1
SevenToHeaven	4492	4981	49	15,9	871,0	1201,7
SevenToHeaven	4493	4982	50	15,8	872,0	1193,8
SevenToHeaven	4494	4983	51	15,8	872,9	1186,3
SevenToHeaven	4495	4984	52	15,8	873,8	1178,5
SevenToHeaven	4496	4985	53	15,7	874,7	1171,4
SevenToHeaven	4497	4986	54	15,7	875,6	1163,4
SevenToHeaven	4498	4987	55	15,7	876,6	1155,4
SevenToHeaven	4499	4988	56	15,6	877,4	1148,7
SevenToHeaven	4500	4989	57	15,6	878,3	1141,4
SevenToHeaven	4501	4990	58	15,6	879,3	1132,8
SevenToHeaven	4502	4992	60	15,5	880,2	1125,4
SevenToHeaven	4503	4993	61	15,5	881,1	1118,2
SevenToHeaven	4504	4994	62	15,5	882,0	1110,2
SevenToHeaven	4505	4995	63	15,5	883,0	1101,8
SevenToHeaven	4506	4996	64	15,4	883,9	1094,6
SevenToHeaven	4507	4997	65	15,4	884,9	1086,6
SevenToHeaven	4508	4998	66	15,3	885,9	1078,5
SevenToHeaven	4509	4999	67	15,4	886,7	1071,5
SevenToHeaven	4510	5000	68	15,3	887,6	1064,3
SevenToHeaven	4511	5002	70	15,3	888,4	1057,1
SevenToHeaven	4512	5003	71	15,3	889,3	1050,0
SevenToHeaven	4513	5004	72	15,3	890,3	1041,9
SevenToHeaven	4514	5005	73	15,3	891,0	1035,7
SevenToHeaven	4515	5006	74	15,3	891,8	1029,4
SevenToHeaven	4516	5007	75	15,2	892,4	1023,9
SevenToHeaven	4517	5008	76	15,2	893,2	1017,3
SevenToHeaven	4518	5009	77	15,2	893,9	1011,6
SevenToHeaven	4519	5010	78	15,1	894,5	1006,6
SevenToHeaven	4520	5012	80	15,1	895,3	1000,2
SevenToHeaven	4521	5013	81	15,1	896,1	993,8
SevenToHeaven	4522	5014	82	15,1	896,8	987,4
SevenToHeaven	4523	5015	83	15,1	897,7	980,3
SevenToHeaven	4524	5016	84	15,0	898,4	974,3
SevenToHeaven	4525	5017	85	15,0	899,1	968,2
SevenToHeaven	4526	5018	86	15,0	899,8	963,1
SevenToHeaven	4527	5019	87	15,0	900,4	957,5
SevenToHeaven	4528	5021	89	15,0	901,2	951,0
SevenToHeaven	4529	5022	90	14,9	902,0	944,8
SevenToHeaven	4530	5023	91	14,9	902,7	939,1
SevenToHeaven	4531	5024	92	14,9	903,3	933,5
SevenToHeaven	4532	5025	93	14,9	904,2	926,1
SevenToHeaven	4533	5026	94	14,8	905,0	919,4
SevenToHeaven	4534	5027	95	14,8	905,9	911,9
SevenToHeaven	4535	5028	96	14,8	906,6	906,5
SevenToHeaven	4536	5029	97	14,8	907,1	902,1
SevenToHeaven	4537	5031	99	14,8	908,0	895,2
SevenToHeaven	4538	5032	100	14,8	908,5	890,3

SevenToHeaven	4539	5033	101	14,7	909,2	884,4
SevenToHeaven	4540	5034	102	14,7	909,8	879,6
SevenToHeaven	4541	5035	103	14,7	910,4	874,8
SevenToHeaven	4542	5036	104	14,6	910,9	870,7
SevenToHeaven	4543	5037	105	14,6	911,5	866,1
SevenToHeaven	4544	5038	106	14,6	912,0	861,5
SevenToHeaven	4545	5040	108	14,6	912,7	856,0
SevenToHeaven	4546	5041	109	14,6	913,2	852,0
SevenToHeaven	4547	5042	110	14,6	913,8	846,5
SevenToHeaven	4548	5043	111	14,6	914,7	838,9
SevenToHeaven	4549	5044	112	14,5	915,5	832,1
SevenToHeaven	4550	5045	113	14,5	916,2	826,3
SevenToHeaven	4551	5046	114	14,5	917,1	819,4
SevenToHeaven	4552	5047	115	14,5	918,0	811,8
SevenToHeaven	4553	5048	116	14,5	918,8	804,8
SevenToHeaven	4554	5050	118	14,4	919,7	797,9
SevenToHeaven	4555	5051	119	14,4	920,4	791,6
SevenToHeaven	4556	5052	120	14,4	921,2	785,3
SevenToHeaven	4557	5053	121	14,4	921,8	779,9
SevenToHeaven	4558	5054	122	14,4	922,5	774,3
SevenToHeaven	4559	5055	123	14,4	923,3	767,8
SevenToHeaven	4560	5056	124	14,4	924,0	761,6
SevenToHeaven	4561	5057	125	14,4	924,8	755,1
SevenToHeaven	4562	5058	126	14,3	925,5	749,2
SevenToHeaven	4563	5059	127	14,3	926,3	742,8
SevenToHeaven	4564	5061	129	14,3	927,1	736,5
SevenToHeaven	4565	5062	130	14,4	927,8	730,3
SevenToHeaven	4566	5063	131	14,4	928,6	723,3
SevenToHeaven	4567	5064	132	14,4	929,5	716,1
SevenToHeaven	4568	5065	133	14,4	930,4	708,6
SevenToHeaven	4569	5066	134	14,4	931,2	702,1
SevenToHeaven	4570	5067	135	14,4	932,1	694,9
SevenToHeaven	4571	5068	136	14,3	932,8	688,8
SevenToHeaven	4572	5069	137	14,3	933,7	681,6
SevenToHeaven	4573	5071	139	14,3	934,4	675,5
SevenToHeaven	4574	5072	140	14,3	935,1	669,6
SevenToHeaven	4575	5073	141	14,3	935,7	664,6
SevenToHeaven	4576	5074	142	14,3	936,4	658,8
SevenToHeaven	4577	5075	143	14,3	937,2	652,6
SevenToHeaven	4578	5076	144	14,4	937,7	647,8
SevenToHeaven	4579	5077	145	14,4	938,4	642,7
SevenToHeaven	4580	5078	146	14,4	939,0	637,1
SevenToHeaven	4581	5079	147	14,4	939,7	631,7
SevenToHeaven	4582	5080	148	14,4	940,3	626,4
SevenToHeaven	4583	5082	150	14,4	941,2	619,0
SevenToHeaven	4584	5083	151	14,4	942,1	612,0
SevenToHeaven	4585	5084	152	14,4	942,9	604,9
SevenToHeaven	4586	5085	153	14,4	943,8	597,8

SevenToHeaven	4587	5086	154	14,4	944,7	590,0
SevenToHeaven	4588	5087	155	14,4	945,6	583,0
SevenToHeaven	4589	5088	156	14,4	946,3	577,0
SevenToHeaven	4590	5089	157	14,4	947,0	571,0
SevenToHeaven	4591	5090	158	14,4	947,4	567,6
SevenToHeaven	4592	5092	160	14,4	947,6	566,5
SevenToHeaven	4593	5093	161	14,5	947,4	567,4
SevenToHeaven	4594	5094	162	14,5	947,5	567,2
SevenToHeaven	4595	5095	163	14,5	947,4	567,3
SevenToHeaven	4596	5096	164	14,5	947,5	567,0
SevenToHeaven	4597	5097	165	14,5	947,5	567,0
SevenToHeaven	4598	5098	166	14,5	947,5	566,8
SevenToHeaven	4599	5099	167	14,5	947,5	566,8
SevenToHeaven	4600	5100	168	14,5	947,5	566,9
SevenToHeaven	4601	5102	170	14,4	947,5	567,1
SevenToHeaven	4602	5103	171	14,5	947,5	566,9

Bills

These are the project expenses we incurred:
We arrived at a grand total of 1057 euros, which is divided among three groups, resulting in 352.33 euros for our specific group.

MediaMarkt

MEDIAMARKT ESCH/ALZETTE
7 Avenue du Rock n'Roll
L-4361 Esch Sur Alzette
Tel +352-266566566
TVA: LU 225 44 811

1954006 (3 x 39,00)= 117,00 b
APPLE
MX532ZM/A AIRTAG (1 PACK)
4253 TRACKERS

Total EUR 117,00

VISA_ELECTRON 117,00

incl. 16,00% TVA (b) 16,14
Net (Hors TVA) (b) 100,86

TICKET = GARANTIE 2 ANS
RETOUR/ECHANGE 30 JOURS
NON DEBALLE - NON UTILISE
DANS L'EMBALLAGE D'ORIGINE
TOUTE L'EQUIPE MEDIAMARKT
VOUS REMERCIE DE VOTRE VISITE
ET A BIENTOT

73749 L501 103 100122 26.04.2023 16:50

7374900298103202304261650 5

amazon.de

Final Details for Order #306-6115858-1002706

Order Placed: 16 February 2023
order number: 306-6115858-1002706
Order Total: €74,76

Dispatched on 16 February 2023

Items Ordered	**Price**
4 of: *Ockered soldering iron set, pyrography soldering iron set.* Sold by: Dacufe Bricolage SARL (seller profile) Condition: New	€18,69

Shipping Address:
Jonathan Mengozzi
2, place Léon Jouhaux
Esch-sur-Alzette, 4155
Luxembourg

Shipping Speed:
Priority Delivery

Payment information

Payment Method:
Visa/Delta/Electron ending in 0458

Invoice Address:
Jonathan Mengozzi
2, place Léon Jouhaux
Esch-sur-Alzette, 4155
Luxembourg

Item(s) Subtotal: €74,76
Postage & Packing: €0,00

Total: €74,76

Grand Total:€74,76

Credit Card transactions — Visa ending in 0458: 16 February 2023:€74,76

To view the status of your order, return to Order Summary.

Please note: this is not a VAT invoice.

Rechnung

Zahlungsreferenznummer 10FNdY1V5GvdVsnviA7p
Verkauft von anhuitiewodianzishangwuyouxiangongsi

Rechnungsdatum /Lieferdatum	26.01.2023
Rechnungsnummer	DS-ASE-INV-LU-2023-221174
Zahlbetrag	5,83 €

JONATHAN MENGOZZI
2, PLACE LÉON JOUHAUX
ESCH-SUR-ALZETTE, 4155
LU

Umsatzsteuer erklärt durch Amazon Services Europe S.a.r.L.
USt-IDNr. LU19647148

Um unseren Kundenservice zu kontaktieren, besuche www.amazon.de/contact-us

Rechnungsadresse
Jonathan Mengozzi
2, place Léon Jouhaux
Esch-sur-Alzette, 4155
LU

Lieferadresse
Jonathan Mengozzi
2, place Léon Jouhaux
Esch-sur-Alzette, 4155
LU

Verkauft von
anhuitiewodianzishangwuyouxiangongsi
yonghejiayuan3qiC18dong804
hefei, gaoxinqu, anhui, 230000
CN

Bestellinformationen

Bestelldatum	25.01.2023
Bestellnummer	306-7615444-9001115

Rechnungsdetails

Beschreibung	Menge	Stückpreis (ohne USt.)	USt. %	Stückpreis (inkl. USt.)	Zwischensumme (inkl. USt.)
Reinigungsschwamm Ersatzschwamm Industrial Schwämme Lötkolben Lötschwamm für Lötstationen Reinigungsdraht Scrubber Lötschwämmchen Lötkolben-Reinigungsschwamm für Werkbänke und Werkstätten 30PCS | B09V7WKX8V ASIN: B09V7WKX8V	1	5,03 €	16%	5,83 €	5,83 €
Versandkosten		0,00 €		0,00 €	0,00 €

Gesamtpreis **5,83 €**

	USt. %	Zwischensumme (ohne USt.)	USt.
	16%	5,03 €	0,80 €
USt. Gesamt		5,03 €	0,80 €

Rechnung

Zahlungsreferenznummer 1ejR85hx0G83WijnRNKf
Verkauft von Shenzhen Lvbangyuan E-commerce Co., Ltd

Rechnungsdatum /Lieferdatum	27.01.2023
Rechnungsnummer	DS-ASE-INV-LU-2023-237905
Zahlbetrag	12,67 €

JONATHAN MENGOZZI
2, PLACE LÉON JOUHAUX
ESCH-SUR-ALZETTE, 4155
LU

Umsatzsteuer erklärt durch Amazon Services Europe S.a.r.L.
USt-IDNr. LU19647148

Um unseren Kundenservice zu kontaktieren, besuche www.amazon.de/contact-us

Rechnungsadresse

Jonathan Mengozzi
2, place Léon Jouhaux
Esch-sur-Alzette, 4155
LU

Lieferadresse

Jonathan Mengozzi
2, place Léon Jouhaux
Esch-sur-Alzette, 4155
LU

Verkauft von

Shenzhen Lvbangyuan E-commerce Co., Ltd
Nanshanqu Xiljiedao Xinwucunxiqu 57dong 401
Shenzhen, Guangdong, 518000
CN

Bestellinformationen

Bestelldatum	27.01.2023
Bestellnummer	306-5074060-7117928

Rechnungsdetails

Beschreibung	Menge	Stückpreis (ohne USt.)	USt. %	Stückpreis (inkl. USt.)	Zwischensumme (inkl. USt.)
Abma Cord 2mm Paracord Schnüre 100% Nylon Seil mit 1 Strängen Type I Fallschirmschnur | B082M88LKQ ASIN: B082M88LKQ	1	10,92 €	16%	12,67 €	12,67 €
Versandkosten		0,00 €		0,00 €	0,00 €

Gesamtpreis **12,67 €**

	USt. %	Zwischensumme (ohne USt.)	USt.
	16%	10,92 €	1,75 €
USt. Gesamt		10,92 €	1,75 €

Rechnung

Zahlungsreferenznummer xytDFEoVjPLamYUI7nJV
Verkauft von Wu han pin sheng ke ji you xian gong si

Rechnungsdatum /Lieferdatum	16.02.2023
Rechnungsnummer	DS-ASE-INV-LU-2023-422115
Zahlbetrag	7,98 €

JONATHAN MENGOZZI
2, PLACE LÉON JOUHAUX
ESCH-SUR-ALZETTE, 4155
LU

Umsatzsteuer erklärt durch	Amazon Services Europe S.a.r.L.
USt-IDNr.	LU19647148

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Rechnungsadresse

Jonathan Mengozzi
2, place Léon Jouhaux
Esch-sur-Alzette, 4155
LU

Lieferadresse

Jonathan Mengozzi
2, place Léon Jouhaux
Esch-sur-Alzette, 4155
LU

Verkauft von

Wu han pin sheng ke ji you xian gong si
zhongnanlujie minzhulubei789hao
nanguoyuegongguan17ceng11shi
wu han shi, wuchangqu, hu bei sheng, 430000
CN

Bestellinformationen

Bestelldatum	16.02.2023
Bestellnummer	306-7717974-2843529

Rechnungsdetails

Beschreibung	Menge	Stückpreis (ohne USt.)	USt. %	Stückpreis (inkl. USt.)	Zwischensumme (inkl. USt.)
10 Stücke 900M-T-I Kupfer Base bleifreie galvanisch Eisen und Nickel austauschbar Lötkolben Tipps Niedrigtemperatur Lötstation Werkzeug Form I | B0746DM4C8 ASIN: B0746DM4C8	1	6,88 €	16%	7,98 €	7,98 €
Versandkosten		0,00 €		0,00 €	0,00 €

Gesamtpreis **7,98 €**

	USt. %	Zwischensumme (ohne USt.)	USt.
	16%	6,88 €	1,10 €
USt. Gesamt		6,88 €	1,10 €

Rechnung

Zahlungsreferenznummer R1wZ6V3QfKWCTaH1WvAw
Verkauft von XinYuShi QiMei KeJiYouXian GongSi

Rechnungsdatum /Lieferdatum	20.02.2023
Rechnungsnummer	DS-ASE-INV-LU-2023-441794
Zahlbetrag	8,67 €

JONATHAN MENGOZZI
2, PLACE LÉON JOUHAUX
ESCH-SUR-ALZETTE, 4155
LU

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USt-IDNr. LU19647148

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Rechnungsadresse

Jonathan Mengozzi
2, place Léon Jouhaux
Esch-sur-Alzette, 4155
LU

Lieferadresse

Jonathan Mengozzi
2, place Léon Jouhaux
Esch-sur-Alzette, 4155
LU

Verkauft von

XinYuShi QiMei KeJiYouXian GongSi
GaoXinKaiFaQu DongXingLu 2003
HuaYangNianHua11-20Dong132Hao
XinYuShi, JiangXiSheng, 338000
CN

Bestellinformationen

Bestelldatum	18.02.2023
Bestellnummer	306-0268605-7248308

Rechnungsdetails

Beschreibung	Menge	Stückpreis (ohne USt.)	USt. %	Stückpreis (inkl. USt.)	Zwischensumme (inkl. USt.)
Jumper Kabel Kit Breadboard Jumper Wires Male zu Male 14 Verschiedene Längen Sortiert mit Kunststoffbox 560 Stück | B08PF2W1RF ASIN: B08PF2W1RF	1	7,47 €	16%	8,67 €	8,67 €
Versandkosten		0,00 €		0,00 €	0,00 €

Gesamtpreis **8,67 €**

	USt. %	Zwischensumme (ohne USt.)	USt.
	16%	7,47 €	1,20 €
USt. Gesamt		7,47 €	1,20 €

Rechnung

Zahlungsreferenznummer 2gkjsHDAH4QDznTycnRi
Verkauft von Hunan xitao dianzi shangwu youxian gongsi

Rechnungsdatum /Lieferdatum	28.03.2023
Rechnungsnummer	DS-ASE-INV-LU-2023-780257
Zahlbetrag	9,73 €

JONATHAN MENGOZZI
2, PLACE LÉON JOUHAUX
ESCH-SUR-ALZETTE, 4155
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USt-IDNr.	LU19647148

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Rechnungsadresse

Jonathan Mengozzi
2, place Léon Jouhaux
Esch-sur-Alzette, 4155
LU

Lieferadresse

Jonathan Mengozzi
2, place Léon Jouhaux
Esch-sur-Alzette, 4155
LU

Verkauft von

Hunan xitao dianzi shangwu youxian gongsi
yueyangshiyueyanglouqu wulipailuguojidasha
(yuanwulimingdi)1703shi(gaoshanposhequbawangge)
Hunansheng, China, 414000
CN

Bestellinformationen

Bestelldatum	28.03.2023
Bestellnummer	306-5947289-3492368

Rechnungsdetails

Beschreibung	Menge	Stückpreis (ohne USt.)	USt. %	Stückpreis (inkl. USt.)	Zwischensumme (inkl. USt.)
Lötzinn, Bleifreies Lot mit Kolophonium Kern (Sn99 Ag0,3 Cu0,7/0,8mm,50g) | B07Z7JQ4SX ASIN: B07Z7JQ4SX	1	8,39 €	16%	9,73 €	9,73 €
Versandkosten		0,00 €		0,00 €	0,00 €

Gesamtpreis 9,73 €

	USt. %	Zwischensumme (ohne USt.)	USt.
	16%	8,39 €	1,34 €
USt. Gesamt		8,39 €	1,34 €

LU-BIO-04

Amazon Services Europe S.à r.l., 38 avenue John F. Kennedy, L-1855, Luxembourg
R.C.S. Luxembourg: B 93815; Business license number: 100416 VAT number LU19647148

Umsatzsteuer erklärt durch Amazon im Lieferland

Seite 1 von 1

Rechnung

Zahlungsreferenznummer 1o9etcw5724iDJilJGTx
Verkauft von Wu han jian fen wang luo ke ji you xian gong si

Rechnungsdatum /Lieferdatum	28.03.2023
Rechnungsnummer	DS-ASE-INV-LU-2023-779471
Zahlbetrag	7,01 €

JONATHAN MENGOZZI
2, PLACE LÉON JOUHAUX
ESCH-SUR-ALZETTE, 4155
LU

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USt-IDNr. LU19647148

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Rechnungsadresse

Jonathan Mengozzi
2, place Léon Jouhaux
Esch-sur-Alzette, 4155
LU

Lieferadresse

Jonathan Mengozzi
2, place Léon Jouhaux
Esch-sur-Alzette, 4155
LU

Verkauft von

Wu han jian fen wang luo ke ji you xian gong si
lumoluzhongguodizhidaxuedongermen
Zhubaokeyandalou7lou701shiqiyoubangzhongchuangkongjian189hao
Wu han shi, Hongshanqu, Hu bei sheng, 430070
CN

Bestellinformationen

Bestelldatum	28.03.2023
Bestellnummer	306-1413622-9687504

Rechnungsdetails

Beschreibung	Menge	Stückpreis (ohne USt.)	USt. %	Stückpreis (inkl. USt.)	Zwischensumme (inkl. USt.)
10 Stücke 900M-T-I Kupfer Base bleifreie galvanisch Eisen und Nickel austauschbar Lötkolben Tipps Niedrigtemperatur Lötstation Werkzeug Form I | B0746DM4C8 ASIN: B0746DM4C8	1	6,04 €	16%	7,01 €	7,01 €
Versandkosten		0,00 €		0,00 €	0,00 €

Gesamtpreis 7,01 €

	USt. %	Zwischensumme (ohne USt.)	USt.
	16%	6,04 €	0,97 €
USt. Gesamt		6,04 €	0,97 €

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Rechnung

Zahlungsreferenznummer 1j0OKh4sdy2R7YJgiNX4
Verkauft von Amazon EU S.à r.l.
USt-IDNr. LU20260743

Rechnungsdatum /Lieferdatum	05 April 2023
Rechnungsnummer	LU3JR8VAEUI
Zahlbetrag	5,65 €

JONATHAN MENGOZZI
2, PLACE LÉON JOUHAUX
ESCH-SUR-ALZETTE, 4155
LU

Um unseren Kundenservice zu kontaktieren, besuche www.amazon.de/contact-us

Rechnungsadresse

Jonathan Mengozzi
2, place Léon Jouhaux
Esch-sur-Alzette, 4155
LU

Lieferadresse

Jonathan Mengozzi
2, place Léon Jouhaux
Esch-sur-Alzette, 4155
LU

Verkauft von

Amazon EU S.à r.l.
38 avenue John F. Kennedy
L-1855
Luxemburg
USt-IDNr. LU20260743

Bestellinformationen

Bestelldatum	05 April 2023
Bestellnummer	306-3461643-9889159

Rechnungsdetails

Beschreibung	Menge	Stückpreis (ohne USt.)	USt. %	Stückpreis (inkl. USt.)	Zwischensumme (inkl. USt.)
Becks Plastilin B100492 Knete, Weiss, 1000 g ASIN: B005N2ULHW	1	4,87 €	16%	5,65 €	5,65 €
Versandkosten		0,00 €		0,00 €	0,00 €

Gesamtpreis 5,65 €

	USt. %	Zwischensumme (ohne USt.)	USt.
	16%	4,87 €	0,78 €
USt. Gesamt		4,87 €	0,78 €

Rechnung

Zahlungsreferenznummer 1j1eks0VA22T1OpzAluX
Verkauft von Shenzhen Lvbangyuan E-commerce Co., Ltd

Rechnungsdatum /Lieferdatum	05.04.2023
Rechnungsnummer	DS-ASE-INV-LU-2023-855997
Zahlbetrag	12,67 €

JONATHAN MENGOZZI
2, PLACE LÉON JOUHAUX
ESCH-SUR-ALZETTE, 4155
LU

Umsatzsteuer erklärt durch	Amazon Services Europe S.a.r.L.
USt-IDNr.	LU19647148

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Rechnungsadresse

Jonathan Mengozzi
2, place Léon Jouhaux
Esch-sur-Alzette, 4155
LU

Lieferadresse

Jonathan Mengozzi
2, place Léon Jouhaux
Esch-sur-Alzette, 4155
LU

Verkauft von

Shenzhen Lvbangyuan E-commerce Co., Ltd
Nanshanqu Xilijiedao Xinwucunxiqu 57dong 401
Shenzhen, Guangdong, 518000
CN

Bestellinformationen

Bestelldatum	05.04.2023
Bestellnummer	306-3846978-9906723

Rechnungsdetails

Beschreibung	Menge	Stückpreis (ohne USt.)	USt. %	Stückpreis (inkl. USt.)	Zwischensumme (inkl. USt.)
Abma Cord Paracord 2mm Nylon Seil Paracord 100 Schnüre mit 1 Kern-Strängen Type I Survival Fallschirm Schnur - Max. 45kg (100lbs) | B082M88LKQ ASIN: B082M88LKQ	1	10,92 €	16%	12,67 €	12,67 €
Versandkosten		0,00 €		0,00 €	0,00 €

Gesamtpreis 12,67 €

	USt. %	Zwischensumme (ohne USt.)	USt.
	16%	10,92 €	1,75 €
USt. Gesamt		10,92 €	1,75 €

Rechnung

Zahlungsreferenznummer mrrwUL7aDrrfvri0Gm54
Verkauft von shenzhenshi yuhaiteng keji youxiangongsi

Rechnungsdatum /Lieferdatum	05.04.2023
Rechnungsnummer	DS-ASE-INV-LU-2023-854751
Zahlbetrag	29,24 €

JONATHAN MENGOZZI
2, PLACE LÉON JOUHAUX
ESCH-SUR-ALZETTE, 4155
LU

Umsatzsteuer erklärt durch	Amazon Services Europe S.a.r.L.
USt-IDNr.	LU19647148

Um unseren Kundenservice zu kontaktieren, besuche www.amazon.de/contact-us

Rechnungsadresse

Jonathan Mengozzi
2, place Léon Jouhaux
Esch-sur-Alzette, 4155
LU

Lieferadresse

Jonathan Mengozzi
2, place Léon Jouhaux
Esch-sur-Alzette, 4155
LU

Verkauft von

shenzhenshi yuhaiteng keji youxiangongsi
baililu 6hao xinyi yulonghaoyuan 2dong C zuo 2420
longgangqu bantianjiedao
Shenzhen, longgangqu bantianjiedao, Guangdong, 518129
CN

Bestellinformationen

Bestelldatum	04.04.2023
Bestellnummer	306-5852131-2306754

Rechnungsdetails

Beschreibung	Menge	Stückpreis (ohne USt.)	USt. %	Stückpreis (inkl. USt.)	Zwischensumme (inkl. USt.)
Yuhtech Kugellager Kugeln, 580 Pcs Edelstahl Metallkugeln Stahlkugeln Kugellager aus Edelstahl für Fahrrad Rad Ersatzteile | B089SVSS45 ASIN: B089SVSS45	2	12,60 €	16%	14,62 €	29,24 €
Versandkosten		0,00 €		0,00 €	0,00 €

Gesamtpreis 29,24 €

	USt. %	Zwischensumme (ohne USt.)	USt.
	16%	25,20 €	4,04 €
USt. Gesamt		25,20 €	4,04 €

Facture

GERSON RODRIGUES
43, RUE JEAN PESCHONG
BASCHARAGE, 4938
LU

Payé

Référence de paiement 18rGtOjLTgoh6pu0Nzli

Vendu par Discount Fabrics LTD

Date de la facture/Date de la livraison	16.02.2023
Numéro de la facture	DS-ASE-INV-LU-2023-420300
Total à payer	36,44 €

TVA déclarée par	Amazon Services Europe S.a.r.L.
TVA	Import-OSS

Veuillez contacter le Service Client en visitant le lien suivant: www.amazon.fr/contact-us

Adresse de facturation

Gerson Rodrigues
43, rue Jean Peschong
Bascharage, 4938
LU

Adresse de livraison

Gerson Rodrigues
43, rue Jean Peschong
Bascharage, 4938
LU

Vendu par

Discount Fabrics LTD
27
Broxburn Close
Leicester, Leicestershire, LE4 7PS
GB

Informations de la commande

Date de la commande	16.02.2023
Numéro de la commande	171-6561462-5969915

Détails de la facture

Description	Qté	Prix Unitaire HT	Taux TVA	Prix Unitaire TTC	Total TTC
Tissu imperméable en nylon indéchirable tissé teint, résistant aux déchirures, 150 cm de large (rouge, demi-mètre) | B08NBZPD59 ASIN: B08NBZPD59	1	3,01 €	16 %	3,49 €	3,49 €
Tissu imperméable en nylon indéchirable tissé teint résistant aux déchirures 150 cm de large (rouge, mètre complet) | B08NCKX4NL ASIN: B08NCKX4NL	1	3,87 €	16 %	4,49 €	4,49 €
Tissu imperméable en nylon indéchirable tissé teint résistant aux déchirures 150 cm de large (blanc, mètre complet) | B08NCTT6S1 ASIN: B08NCTT6S1	2	3,87 €	16 %	4,49 €	8,98 €

Produits expédiés à partir de : Royaume-Uni

Nos prix des équipements électriques et électroniques incluent l'éco-participation, conformément à l'article L. 541-10-2 du code de l'environnement.

LU-BIO-04

Amazon Services Europe S.à r.l., 38 avenue John F. Kennedy, L-1855, Luxembourg
R.C.S. Luxembourg: B 93815; Business license number: 100416 VAT number LU19647148

TVA déclarée par Amazon dans le pays de livraison

Facture

Numéro de la facture DS-ASE-INV-LU-2023-420300

Description	Qté	Prix Unitaire HT	Taux TVA	Prix Unitaire TTC	Total TTC
Tissu imperméable en nylon indéchirable tissé teint résistant aux déchirures 150 cm de large (cerise, mètre complet) | B08NC7S1NJ ASIN: B08NC7S1NJ	1	3,87 €	16 %	4,49 €	4,49 €
Livraison		12,94 €		14,99 €	14,99 €

Facture Total 36,44 €

Taux TVA	Total HT	TVA
16 %	31,43 €	5,01 €
Total	31,43 €	5,01 €

Produits expédiés à partir de : Royaume-Uni

Nos prix des équipements électriques et électroniques incluent l'éco-participation, conformément à l'article L. 541-10-2 du code de l'environnement.

LU-BIO-04

Amazon Services Europe S.à r.l., 38 avenue John F. Kennedy, L-1855, Luxembourg
R.C.S. Luxembourg: B 93815; Business license number: 100416 VAT number LU19647148

TVA déclarée par Amazon dans le pays de livraison

Facture

GERSON RODRIGUES
43, RUE JEAN PESCHONG
BASCHARAGE, 4938
LU

Payé

Référence de paiement 32tQW0KdQqnoMROjJQkb
Vendu par Discount Fabrics LTD

Date de la facture/Date de la livraison	31.03.2023
Numéro de la facture	DS-ASE-INV-LU-2023-807025
Total à payer	50,91 €

TVA déclarée par	Amazon Services Europe S.a.r.L.
TVA	Import-OSS

Veuillez contacter le Service Client en visitant le lien suivant: www.amazon.fr/contact-us

Adresse de facturation

Gerson Rodrigues
43, rue Jean Peschong
Bascharage, 4938
LU

Adresse de livraison

Jonathan Mengozzi
2, Place Léon Jouhaux
Esch-sur-Alzette, Esch-sur-Alzette, 4155
LU

Vendu par

Discount Fabrics LTD
27
Broxburn Close
Leicester, Leicestershire, LE4 7PS
GB

Informations de la commande

Date de la commande	30.03.2023
Numéro de la commande	403-5474707-5230722

Détails de la facture

Description	Qté	Prix Unitaire HT	Taux TVA	Prix Unitaire TTC	Total TTC
Tissu en nylon indéchirable imperméable et résistant aux déchirures - 150 cm de large - Jaune, au mètre entier | B08ND5L4NK ASIN: B08ND5L4NK	1	3,87 €	16 %	4,49 €	4,49 €
Tissu imperméable en nylon indéchirable tissé teint résistant aux déchirures 150 cm de large (cerise, mètre complet) | B08NC7S1NJ ASIN: B08NC7S1NJ	1	3,87 €	16 %	4,49 €	4,49 €
Tissu imperméable en nylon indéchirable tissé teint résistant aux déchirures 150 cm de large (rouge, mètre complet) | B08NCKX4NL ASIN: B08NCKX4NL	2	3,87 €	16 %	4,49 €	8,98 €

Produits expédiés à partir de : Royaume-Uni

Nos prix des équipements électriques et électroniques incluent l'éco-participation, conformément à l'article L. 541-10-2 du code de l'environnement.

LU-BIO-04

Amazon Services Europe S.à r.l., 38 avenue John F. Kennedy, L-1855, Luxembourg
R.C.S. Luxembourg: B 93815; Business license number: 100416 VAT number LU19647148

TVA déclarée par Amazon dans le pays de livraison

Facture

Numéro de la facture DS-ASE-INV-LU-2023-807025

Description	Qté	Prix Unitaire HT	Taux TVA	Prix Unitaire TTC	Total TTC
Tissu imperméable en nylon indéchirable et résistant aux déchirures 150 cm de large (orange, mètre complet) | B08NC3C338 ASIN: B08NC3C338	1	3,87 €	16 %	4,49 €	4,49 €
Tissu imperméable en nylon indéchirable tissé teint résistant aux déchirures 150 cm de large (blanc, mètre complet) | B08NCTT6S1 ASIN: B08NCTT6S1	2	3,87 €	16 %	4,49 €	8,98 €
Tissu imperméable en nylon indéchirable et résistant aux déchirures 150 cm de large (vert citron, mètre complet) | B08NCXT13F ASIN: B08NCXT13F	1	3,87 €	16 %	4,49 €	4,49 €
Livraison		12,91 €		14,99 €	14,99 €

Facture Total 50,91 €

	Taux TVA	Total HT	TVA
	16 %	43,87 €	7,04 €
Total		43,87 €	7,04 €

Produits expédiés à partir de : Royaume-Uni

Nos prix des équipements électriques et électroniques incluent l'éco-participation, conformément à l'article L. 541-10-2 du code de l'environnement.

LU-BIO-04

Amazon Services Europe S.à r.l., 38 avenue John F. Kennedy, L-1855, Luxembourg
R.C.S. Luxembourg: B 93815; Business license number: 100416 VAT number LU19647148

TVA déclarée par Amazon dans le pays de livraison

FACTURE
23/02/2023
#FW-231050

Adresse de livraison

Gerson Rodrigues
MEA CULPA
RUE DE LA RESISTANCE 1
4942 BASCHARAGE
Luxembourg
691104226

Adresse de facturation

Gerson Rodrigues
43, rue Jean Peschong
4938 Bascharage
Luxembourg

Numéro de facture	Date de facturation	Réf. de commande	Date de commande
#FW-231050	23/02/2023	42350	16/02/2023

Référence	Produit	Taux de taxe	Prix unitaire (HT)	Quantité	Total (HT)
ADF-GPS-PASS-ANT-uFL	Antenne GPS passive uFL - gain 2dBi	17 %	5,26 €	3	15,78 €
GPS-ANT-TAOGLAS	Antenne GPS externe - Taoglas - 26 dBi	17 %	22,57 €	3	67,71 €
IMU-9DOF-BNO055-BRK	BNO055 - 9-DOF Absolute Orientation IMU	17 %	37,60 €	3	112,80 €
PBOOST-1000-CHG-SPARKFUN	PowerBoost 1000 Chargeur - SparkFun	17 %	19,95 €	1	19,95 €

Détail des taxes	Taux de taxe	Prix de base	Taxe totale
Produits	17.000 %	216,24 €	36,76 €
Livraison	17.000 %	6,00 €	1,02 €

Total produits	216,24 €
Frais de livraison	6,00 €
Total (HT)	**222,24 €**
Taxe totale	**37,78 €**
Total	**260,02 €**

Moyen de paiement	Paiement VISA	260,02 €
Transporteur	Mondial Relay	

FACTURE
23/02/2023
#FW-231051

Adresse de livraison

Gerson Rodrigues
MEA CULPA
RUE DE LA RESISTANCE 1
4942 BASCHARAGE
Luxembourg
691104226

Adresse de facturation

Gerson Rodrigues
43, rue Jean Peschong
4938 Bascharage
Luxembourg

Numéro de facture	Date de facturation	Réf. de commande	Date de commande
#FW-231051	23/02/2023	42352	16/02/2023

Référence	Produit	Taux de taxe	Prix unitaire (HT)	Quantité	Total (HT)
IT-CANSAT-PICO-KIT	Kit CANSAT avec Raspberry-Pi Pico (MicroPython)	17 %	99,75 €	1	99,75 €

Détail des taxes	Taux de taxe	Prix de base	Taxe totale
Produits	17.000 %	99,75 €	16,96 €
Livraison	17.000 %	6,00 €	1,02 €

Total produits	99,75 €
Frais de livraison	6,00 €
Total (HT)	**105,75 €**
Taxe totale	**17,98 €**
Total	**123,73 €**

Moyen de paiement	Paiement VISA	123,73 €
Transporteur	Mondial Relay	

FACTURE
24/03/2023
#FW-231446

Adresse de livraison

Jonathan Mengozzi
2, Place Léon Jouhaux
4155 Esch-sur-Alzette
Luxembourg
+352621134675

Adresse de facturation

Jonathan Mengozzi
2, Place Léon Jouhaux
4155 Esch-sur-Alzette
Luxembourg
+352621134675

Numéro de facture	Date de facturation	Réf. de commande	Date de commande
#FW-231446	24/03/2023	42761	19/03/2023

Référence	Produit	Taux de taxe	Prix unitaire (HT)	Quantité	Total (HT)
IT-CANSAT-PICO-KIT	Kit CANSAT avec Raspberry-Pi Pico (MicroPython)	17 %	99,75 €	1	99,75 €

Détail des taxes	Taux de taxe	Prix de base	Taxe totale
Produits	17.000 %	99,75 €	16,96 €
Livraison	17.000 %	6,00 €	1,02 €

Total produits	99,75 €
Frais de livraison	6,00 €
Total (HT)	**105,75 €**
Taxe totale	**17,98 €**
Total	**123,73 €**

Moyen de paiement	Paiement VISA	123,73 €
Transporteur	Mondial Relay	

MCHobby - Vente de Raspberry Pi, Arduino, ODROID, Adafruit - Clos de la Giberne, 3 - 1410 Waterloo - Belgique
Pour toute assistance, merci de nous contacter :
Tél. : +32 496928320
TVA BE0538.615.264 - RPM Nivelles - IBAN BE41 0017 0629 8910 - BIC GEBABEBB

LANGLITZ METALLE

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LANGLITZ Metalle GmbH

Siemensweg 6
48493 Wettringen

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Web: www.alu-messing-shop.de
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BIC: COBADEFFXXX
IBAN: DE69403400300220350300

Registernummer: HRB 10351
Registergericht: Amtsgericht Steinfurt
Steuernummer: 311/5870/2354
USt-IdNr.: DE815150624

LANGLITZ Metalle GmbH - Siemensweg 6 - 48493 Wettringen
Falls verzogen, bitte Anschriftenberichtigungskarte mit Angabe der Kundennummer 270623 zurück.

Herr Gerson Rodrigues
43, rue Jean Peschong
4938 Bascharage
Luxemburg

Rechnung

Seite: 1 von 1

Rechnungs-Nr: 22R142719
Ext. Nr.: 65058
Datum: 25.11.2022
Kunden-Nr: 270623

Pos	Menge	Art. Nr.	Bezeichnung	Gesamt (Netto)	MwSt	E-Preis	Gesamt (Brutto)
1	**3**	LM-17152-004	Anzahl: 3 - Kupfer Rundstange 5 mm || Länge: 1000mm | Material: LM-17152-004 | Produktionskosten: 3x 0,22 €	35,95	17%	11,98	42,06
		ArtNr: 60ST0005					
2	**1**		Versand	17,09	17%	17,09	20,00

Gesamtpreis Netto	**53,04 EUR**
MwSt. 17,00%	9,02 EUR
Gesamtpreis Brutto	**62,06 EUR**
Zahlung (PayPal-Plus) vom 21.11.2022	62,06 EUR
offener Betrag	**0,00 EUR**

Lieferung	Datum	LieferNr
Tracking-ID: 45196881470	25.11.2022	22A-43677-001

Tel.: +352691104226

Europa - GLS 1,20 - 2,00 m
Wir bedanken uns für Ihren Auftrag und das in uns gesetzte Vertrauen.

"Lieferdatum entspricht dem Rechnungsdatum"