VEGAS TEAM PRELIMINARY REPORT

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EDUCATIONAL CENTER: IES Federico García Lorca

AUTONOMOUS COMMUNITY: Granada, Andalusia

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INTRODUCTION

The team**Vegas Team** It is made up of 5 students from the 4th year of Compulsory Secondary Education in the**IES Federico Garcia Lorca**, of **Churriana de la Vega**, a population of the metropolitan area of Granada. Our objective is to face the challenges proposed in the CANSAT Spain Challenge and it is the first experience of this type that we have faced and we plan to overcome it with a large dose of motivation, work and learning from our failures.

The **CanSat Challenge involves** overcoming numerous collective and individual challenges. To achieve them, we have chosen to apply a work methodology appropriate to our circumstances and possibilities, combining online work, through the NOTION platform, with face-to-face sessions in class and outside of it for the manufacture, assembly and testing of the different elements: capsule (which we have named **LORCA-SAT I**), electronics, programming and parachuting, with a dedication of 4 hours a week in person and countless hours online.

Among the objectives that we set out in the project we highlight the following:

1º Collect as much data as possible from the installed sensors in relation to ultraviolet radiation, atmospheric gasses and light intensity.

2nd study **and analyze** the relationship of the data obtained with the starting parameters indicated in our secondary mission, in order to establish reliable conclusions.

install a system of mini-cameras for study the behavior of LORCA-SAT I at launch, monitor and propose future improvements, as well as use the images to continue promoting our projects and share with our sponsors and collaborators.

However, our main objective since we began this exciting journey is to learn as much as we can and have fun during this exciting journey.

To achieve these objectives, we start from a series of premises, from our point of view, inalienable:

1º Fit our project on some of the Sustainable Development Goals (SDG) of the UN 2030 Agenda, which we work on at our center.

2nd care and respect the environment, using reused, recycled and recyclable materials. SDG 12 and 13

3º Employ the scientific method as the backbone of the work: research, data collection, reflection on the results obtained and the formulation of new questions that will imply new working hypotheses. SDG 4

4th Apply technological development to reduce inequalities and inclusion. Participation in the project for disadvantaged groups. SDG 10

5º Share the knowledge and experience acquired in the development of the project. Using “Open Source” software and hardware resources. whenever possible. Committing ourselves, once the challenge is over, to document every project and make it available to the community so that it can be used and improved by other teams that wish to participate and do not for various reasons SDG 4 and 10.

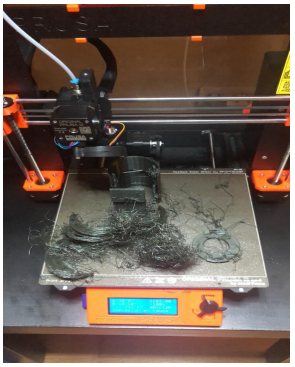
6th Gender equality. We start from the premise that science and STEAM teachings have no gender. We are committed to working on this aspect in the dissemination phase of the project. SDG 5

Finally, we want to highlight that the motivational engine that moves us to participate and carry out this project is not only to win in all phases, but to be able to continue learning in a different way than usual. We consider ourselves an extremely curious, creative and persevering team, which is why it will take more than one failure to get us out of the ring. We believe that our project is very good and we are going to work as hard as it takes to prove that it is. We want to make our dreams come true. In addition, our approach to the project is not only through learning in the field of STEAM, but we also want to know how a project of these dimensions is carried out in real life. Briefly stated, we are a team of small philanthropists inveterate by knowledge.

DEVELOPMENT OF LORCA-SAT I

STRUCTURAL DESIGN

For the **design and manufacture of LORCA-SAT I**, we have chosen the Autodesk design environment. Because some of our members had knowledge in handling AutoCad, all Lorca Sat designs were made using this software. For the laminate we use Prusa Slicer. So far we have made three capsule designs, starting from available models and making modifications that have led us to our own semi-definitive design.



In the manufacture we have used recycled PLA from the Prusa brand, which certifies its origin. We sacrifice the most attractive and striking aesthetics and decoration, in order to comply with our aforementioned premises. PLA is also a recyclable material once discarded. Although small failures are always present, as can be seen, we are trying not to use screws or to use them to a minimum, to guarantee the safety and success of our project, as long as it is technically feasible.

ELECTRONICS

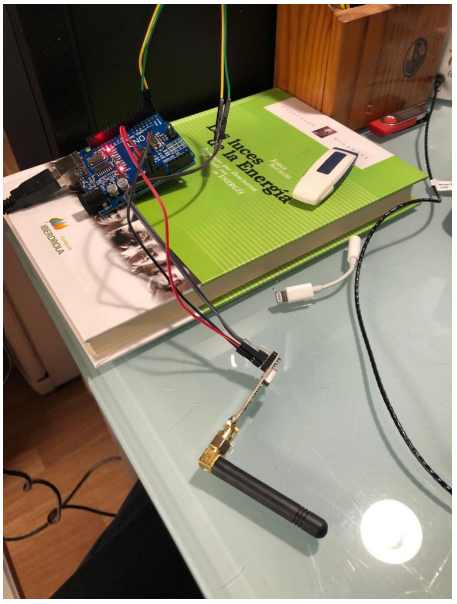
CONTROL AND COMMUNICATIONS

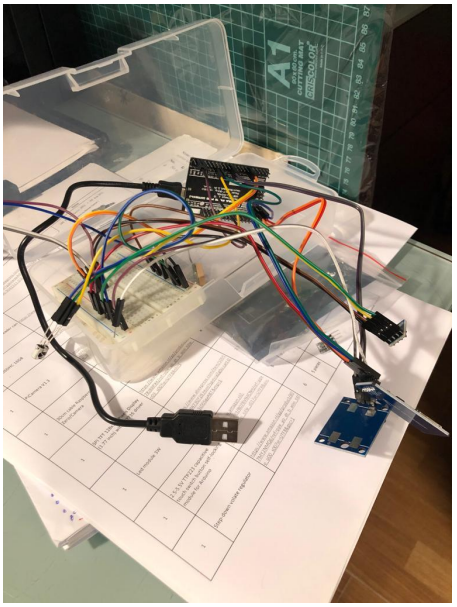
In control electronics, sensors and communication, we have opted for components that integrate as many elements as possible for reasons of space and weight.

Electronics and communication. Our first choice was to use an Arduino Mega Mini-Pro and communicate via APC220. This option implied the construction of a Yagi antenna, an aspect that we wanted to avoid, given the inexperience and lack of time available. The board is based on **ESP 32 LILYGO TTGO LORA-32**. This board not only has a much more powerful microprocessor than a conventional Arduino board but also includes a quarter wave strip. It also includes some extra features such as 0.96-inch OLED screen, bluetooth antenna and WI-FI antenna. Communication via radio seems to us to be the most reliable option, due to its range and security in the transmission-reception of data. So far the long-range tests have given acceptable results, although not satisfactory, we continue with new tests in other conditions.

All listed electronics are reusable both for class work, practices or projects, as well as for future events in which we can participate.

Due to the requirements of the Challenge, we have to work with materials such as lithium polymer, which are highly toxic and sometimes dangerous. We have chosen lithium batteries due to their characteristics of energy density, life cycle (>2000 cycles), lightness and size. We have also reduced battery risks by choosing batteries with electronic protection.

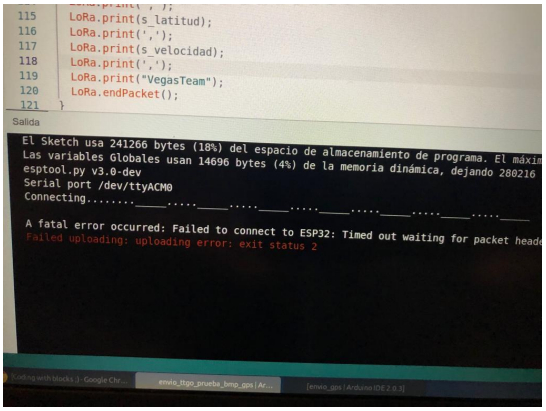




DISTRIBUTOR	COMPONENT	FUNCTION
BASE SENSORIZATION		
AMAZON	LILYGO®TTGO LORA32 868/915Mhz.ESP32 LoRa, Bluetooth WIFI ESP32. Módulo con antena	CONTROL AND COMMUNICATIONS
AMAZON	LITHIUM BATTERIES - SANYO-PANASONIC (NCR 18650 - 3.7V, 3450 mAh)	FEEDING
ARDUINER	2Mpx CAMERA	CAPTURE IMAGES AND VIDEOS
PRIMARY SENSING		
AMAZON	BMP 280	TEMPERATURE, PRESSURE AND HUMIDITY
AMAZON	GPS	LONGITUDE, LATITUDE AND HEIGHT
AMAZON	ACCELEROMETER	Z AXIS SPEED
AMAZON	SD CARD MODULE	READING AND RECORDING OF DATA
SECONDARY SENSING		
AMAZON	GUVA-S12SD UV (240 nm-370 nm)	SPECIFIC SPECTRUM OF UVA RADIATION
AMAZON	WAVESHARE UV (200 nm-370 nm)	SPECIFIC SPECTRUM OF UVA & UVB RADIATION
ARDUINER	7Mpx CAMERA	CAPTURE IMAGES AND VIDEOS

PROGRAMMING

For the **programming** of our LORCA-SAT I we are going to use a combination of the platform**Arduino Blocks**, along with the Arduino IDE. The chosen Arduino Blocks is due to its ease of use (block programming), with a view to fulfilling the objective of documenting and sharing the project with the community in an affordable and simple way possible.Although we have to show that the message of *"fatal error",* during the tests He accompanies us more often than we would like.

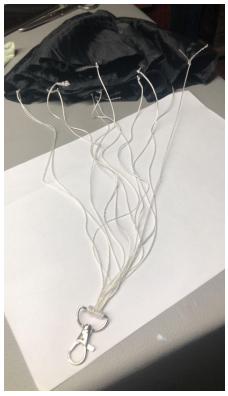


CONTROLLED LANDING SYSTEM

Considering our inexperience, we have opted for the design of a classic parachute for the controlled landing system of our LORCA-SAT I. specifically one hemispherical of 12 gores To carry out the calculations we have consulted various works, such as those of the Granada Robotics Club and the Nakka-Rocketry website and the manual provided in the resources of**CELL**.

The first tests have been carried out with a model made of umbrella cloth and kite string. The result has been unsuccessful.

We are going to make the final design with a used **paraglider canvas**. In preparation, we have the collaboration of **VALE** (Association in favor of people with intellectual disabilities Valle de Lecrín), which has an occupational sewing center.



SCIENTIFIC PROJECT

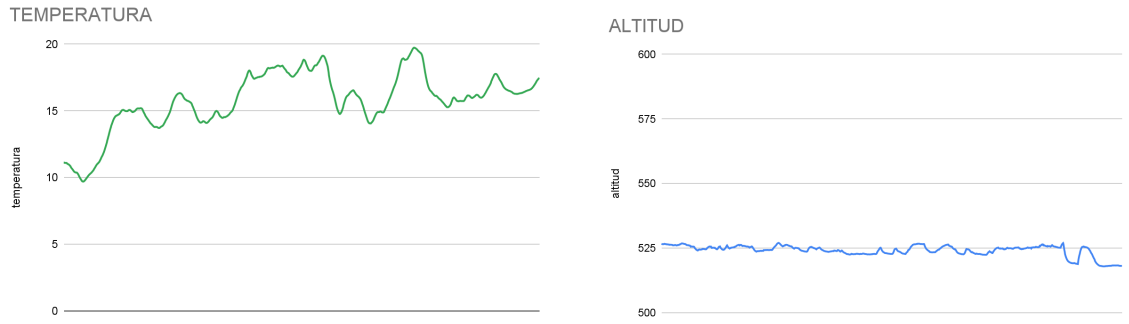
Our project consists of collecting a series of data that allow us to obtain conclusions with scientific support. To do this, we have investigated space missions carried out by ESA and other governmental and private space agencies. All of them reiterate the fact that technology is available **to science**. Since we consider the reason for our project a fundamental piece, we have divided this section into subsections.

PRIMARY MISSION

Our Primary mission is to capture and send temperature and atmospheric pressure data to our ground station-base. These will serve as the basis, among others, to calculate parameters such as altitude and speed and also to support our secondary mission.

During the fall of Lorca-Sat I we intend to measure these parameters with the sensors shown in basic **sensorization**. In order to carry out this mission, we soldered the sensors on a prototype board, to later connect them to the control unit. Once we receive data from the minisatellite we want to be able to graph it in real time using the “Serial port utility” and “KST " software, as shown in the table. The first ground tests are promising.

Likewise, using GPS, we want to be able to determine the trajectory that Lorca-Sat I followed during its fall, with the help of Google-Earth. The conclusions we reach in the secondary mission depend to a certain extent on the data collected in the primary mission, because some parameters such as pressure or temperature will be required to understand the behavior of ultraviolet radiation in certain conditions.

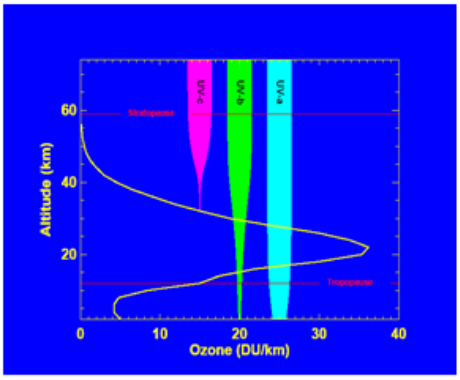


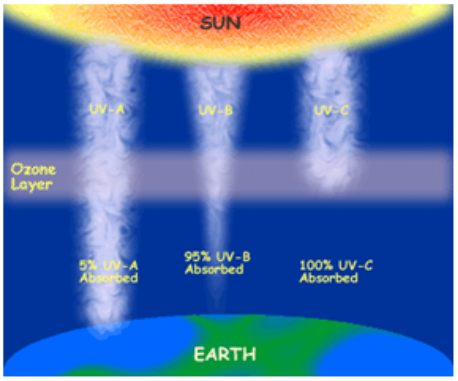
Independent variable: Time (s); Dependent variable: Altitude and temperature (meters and degrees)

SECONDARY MISSION

Our Secondary mission is based on the measurement of ultraviolet radiation, its analysis and reflection, in order to establish scientific conclusions. For its realization, we require the components that are specified in **advance sensorization.** These will help us to carry out the relevant measures.

This mission is focused on the detection of **ultraviolet radiation spectrum,** in order to draw different conclusions. The data collected will form the ultraviolet radiation index. usWe will be these data registered by the*BMP280* to see how it affects the temperature and pressure atmospheric in its tropospheric penetration.





Due to the wide **range of possibilities** that offers us to study ultraviolet radiation, we still need to finish outlining the focus of our scientific project. However, we have been developing two hypotheses which we will probably integrate for the completion of our scientific project. Currently we continue in research **status** since we want to make **strong arguments** that support these hypotheses.

- ULTRAVIOLET RADIATION AND ITS DYSFUNCTIONAL AND IMMUNODEFICIENT EFFECTS ON LIVING BEINGS

The objective of our mission is the detection of ultraviolet radiation, both in the UVA and UVB spectrum, to determine the ultraviolet index under specific atmospheric conditions and a certain time of year. Because we will only carry out data collection, we will rely on data previously collected by real satellites in order to guarantee the reliability of our data. Graphing this data will lead us to answer these questions:

Our objective is to warning about possible **negative consequences** both for the biosphere and for all the ecosystems that make it up and for humans themselves. Some of these consequences are:

1º The harmful impact on plants by receiving excessive UVA or UVB radiation. This affects your productivity, **growth and organic development**. Some of them, like the simplest algae, can see the action of this radiation spectrum altered genetically.

2º Human beings are also seriously affected by these radiations. These radiations essentially affect the outer **layers of skin** causing severe damage to them. The main affected are the cells of*Langerhans*, which are responsible for the external **protection against pathologies and infections**. A considerable dose of UVA combined with UVB can completely inhibit our defensive capacity against external pathogens.

3º Ultraviolet radiation has negative effects on living beings, although viruses are not, they are also affected. According to*Research Results Transfer Office*(OTRI) of the*Complutense University of Madrid*, this spectrum of radiation can be used for disinfecting, with a effectiveness **up to 99%**, closed spaces instrumental.

- MECHANICAL, TECHNICAL AND STRUCTURAL PROPERTIES OF BIOMATERIALS AND BIOPLASTICS AGAINST ULTRAVIOLET RADIATION

This second hypothesis focuses on the study of biodegradable cutting materials to meet 2 premises:

1st**Replace current materials** which are not disposable and reusable, in most cases polluting and harmful to living beings. An example of this are nanomaterials (eg TiO2), these have incredible photoprotective capacities but are highly polluting.

2º Use these biomaterials with the aim of repelling **ultraviolet radiation and its negative repercussions** in living beings. In addition, these materials could be applied in the field of aerospace engineering with the aim of promoting space exploration based on true innovation from a sustainable and renewable perspective.

We are currently working on the feasibility of using a compound called Palitana, which comes from the red algae*Chondrus Go ahead,* fotoprotector. According to a study carried out in 2017, these types of compounds are ideal for repelling UVA and UVB and therefore inhibiting their action on Langerhans cells in our body. Because of this, the Palitina is a molecule that has demonstrated a high photoprotective capacity, thus constituting an example of possible **natural and biocompatible alternative** versus synthetic UV filters.

Other less attractive solutions from an environmental point of view are plastics. These are very light and resistant, although not all of them behave the same in the face of these radiations. Polyetherimide (PEI) or polyphenylene **sulfide** (PPS) are plastics with fascinating UVA, UVB and UVC resistance capabilities compared to their counterparts. Polyetherimide is currently used in the construction **and coating of spacecraft**, specifically of the capsules that enter the earth's atmosphere.

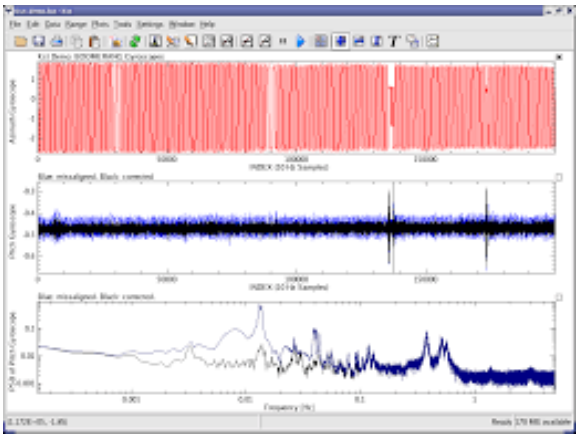
If we are looking for an alternative more aligned with the environment, we can highlight the bioplastics**.** Bioplastic can be considered any material with polymer **structure**, whose basis **is biological**, and also be biodegradable. The most prominent are polylactic acid (PLA),**polyhydroxyalkanoate**(PHA) and polysuccinate **butylene** (PBS). These plastics, in addition to having the previously mentioned characteristics, are easily manageable and incorporate more than decent mechanical characteristics.

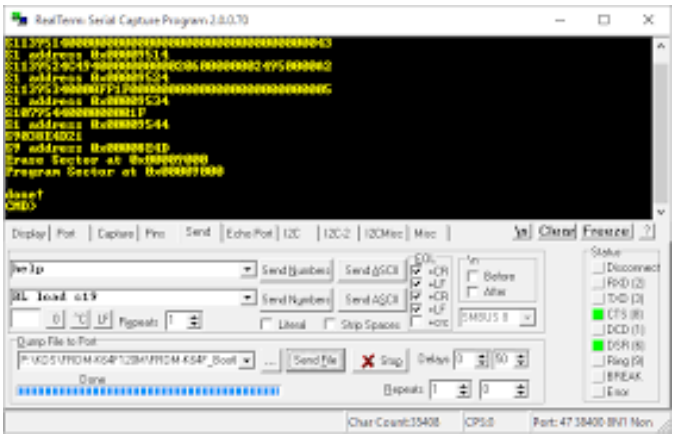
METHODOLOGY APPLIED TO OBTAINING CONCLUSIONS

Once we have received and graphed the real **time data** or, recovered the LORCA-SAT I, recorded in the module **SD**, we will proceed to the analysis and reflection on them in order to confirm our hypotheses or suggest new questions in case we cannot confirm them.

We want to guarantee the reliability in obtaining the data and we are aware that **wireless communications may interfere with other equipment**. For this reason, we have integrated into our programming functions that allow us to verify and filter the data received, encoding our own. We are working on a second mission to capture and verify the data **quality** in its transmission-reception.

In order to interpret these data obtained we will make use of*KST* and*RealTerm* as fundamental instruments for obtaining conclusions. These programs allow us to obtain data in real time from the serial port and graph it, in addition to saving a backup copy in a csv file for later editing in programs such as*Excel* O*Google Sheets*. Our final objective is to be able to graph the flight trajectory ofLorcaSat I in real time, thus corseting the in-flight **telemetry**.





Images captured from our computer in the 2nd telemetry and data interpretation test.

ORGANIZATION AND ENTREPRENEURSHIP

BUDGET

We have tried to optimize **our budget to the maximum**. We are a rather low economic cut center for which we are especially **moved by the economic savings and the reuse of materials**. Although we have a wealthy number of taxpayers,**we don't lose our spirit and remember where we came from**.

In the following link, we attach our **preliminary budget** To give you an idea of the cost of LorcaSat I. This budget does not include expenses such as maintenance, transportation or allowances, since we still do not have enough data to forecast the operational cost of Vegas Team.

https://drive.google.com/drive/folders/1geW410O7qUI6ZrIlm_nBhSZLyZuOlnaa?usp=sharing

ORGANIZATIONAL STRUCTURE

We have created a***Gantt diagram*** to visually express our planning during these last **4 months.** In addition, we have to highlight the importance of meetings, both face-to-face and by video call, in our project. However, we have had quite **limited time for the requirements of this project.**

KEY NAMES: D- DAVID; C- CALEB;J- JAVIER; L-LUCAS; F-FAVIO

ORGANIZATIONAL PARAMETERS					PROJECT MONTHS								
TASK	TIME TAKEN	START	FINAL	MEMBER CHARGE	NOV	DIC	ONE	FEB	MAR	ABR	MAY	JUN	JUL
TIRED PROJECT	220 D	NOV	¿?	ALL									
FOUNDATION VEGAS TEAM	1 D	1 NOV	1 NOV	D, C Y J									
ORGANIZATION I	7 D	1 NOV	8 NOV	DAVID									
DIRECTOR MEETING	1 D	26 ONE	26 ONE	ALL									
AMPA MEETING	1 D	21 FEB	21 FEB	ALL									
SEARCH FOR SPONSORS I	30 D	11 IN	10 FEB	D Y C									
COMMUNICATIONS TEST I	7 D	26 ONE	3 FEB	M, C Y J									
COMMUNICATIONS TEST II	7 D	20 FEB	27 FEB	M, D, C Y J									
PRELIMINARY REPORT	21 D	13 FEB	27 FEB	ALL									
ASSEMBLY LORCSAT I V2	7 D	13 FEB	20 FEB	DAVID									
PARACHUTE TESTS I	14 D	19 FEB	3 MAR	M, L , D Y C									
SHOOTING PROMOTIONAL VIDEOS	30 D	1 FEB	3 MAR	ALL									
RADIOABLE MEETING	1 D	2 MAR	2 MAR	M, D, J Y C									
SEARCH FOR SPONSORS II	30 D	3 MAR	31 MAR	D, C Y J									
ELECTRONICS ASSEMBLY I	21 D	3 MAR	10 MAR	MENTOR									
MAYOR MEETING	1 D	14 MAR	14 MAR	ALL									
ELEMENTARY CONFERENCES	3 D	20 MAR	23 MAR	ALL									
SCIENCE WEEK	7 D	25 MAR	31 MAR	ALL									
PTS MEETING	1 D	5 ABR	5 ABR	M, D, C Y J									
FINAL REPORT	50 D	13 FEB	25 MAR	ALL									
ULTIMATE PARAMETERS	14 D	15 MAR	1 ABR	M, L Y F									
ELECTRONICS & PROGRAMMING	30 D	3 MAR	2 ABR	D, C Y J									
FINAL DESIGN	14 D	15 MAR	1 ABR	DAVID									

PROMOTION PLAN

Vegas Team has established as absolute **priority** its dissemination and promotion plan in order to maximize the impact of our project. Because of this,**we have developed a marketing doctrine that allows us to achieve our goals** in an organized and efficient way. We have divided this plan into two forms of contact according to our interests and the nature of our recipients:

1º This form is especially dedicated **to normal people who use social networks**. Therefore, it is a general dissemination of content through our social networks to reach the maximum number of people possible. This part of the promotion needs to be synthetic and not enter into technical frameworks. We have tried to be as visual and attractive as possible.

2º This second form focuses on contact with the objective of searching **for sponsors and collaborators** that can contribute their grain of sand and help us reach the stars. Due to this, the way to contact is in meetings or videoconferences in order to lay the foundations of said agreements.

Although we will cover this in more detail in the final report, we are carrying out a series of promotional **videos to advertise us** and Reach new sponsors. These videos will give us the boost we need to finish closing the sponsorship section, although it's never too late to get on our ship headed for the stars.

To carry out this task we **have founded a film crew affiliated with Vegas Team within our center**. This team will not only be in charge of making our videos but also of other cinematographic matters of the center. We are very **proud to have left our mark** in such a creative way in our institute.

Finally, we would like to highlight that our dissemination **plan goes** through the narrowing between women and science. Although we are not an example of this, we have a very **strong team philosophy** and we believe that women have a transcendental role in the STEAM field. For it,**we have developed a campaign** between the 3 educational centers of our town with the motto "THE CHROMOSOME XX IS ALSO IN SCIENCE ". If you want to see the projection of our complex promotion doctrine, check our social networks.

OUR SPONSORS & COLLABORATORS

Vegas Team The search for sponsors and collaborators has been taken seriously both at the municipal and regional level. Due to this, we have developed two distinctions for those institutions or corporations interested in our project. Our Heading **are the stars** but to reach them we need a little **impulse** in economic matters, the sponsors they will supply our part of our economic and material needs. On the other hand we have the collaborators, they will help us with the diffusion of the project.

SPONSORS

COLLABORATORS

BIBLIOGRAPHY& ACKNOWLEDGEMENTS

For the development **of our scientific project** We have gone to a series of highly reliable web pages regarding science and technology. In addition, these highly scientific resources have helped us to inspire ourselves and to be able to conclude our scientific project.

Although we have not only had the help of external links, we have also relied on the teachers of our educational center. The departments **of physics, biology and technology** have been at our full disposal for the approach of how we should carry out this project. What we can highlight the most, the insistence on the use of the scientific method as a fundamental tool to draw a logical and rational conclusion about what surrounds us.

For the technical and scientific refinement of our project, we have turned to some of our collaborators **specialized in these disciplines**.

LINKS

https://www.esa.int/

https://news.virginia.edu/content/nasa-aids-uva-grad-student-soil-research-satellite

https://science.nasa.gov/ems/10_ultravioletwaves

https://www.cimel.fr/rima-nasa-aeronet-network/

https://www.nature.com/

https://www.science.org/

DRIVE

https://drive.google.com/drive/folders/1eipaZixeAE8zgGnEocODzuahCQWdH99f?usp=sharing

SOCIAL NETWORKS