When the sky is NOT the limit

Analog astronauts

Cátedra Internacional Galileo

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Index

By way of introduction

"Looking up to the sky and dreaming of touching the stars is the longing to be part of the genesis again, of the whole.".

Aldebaran Martínez

Star Travelers, Space Travelers, two phrases that not only inspire, but also describe the desire of man to answer the ancestral questions that, since man raised his eyes in the mists of time and asked himself, what lies beyond?

It is possible to start by understanding that the word Astronaut finds its roots in the Greek terms astro (star) and nauta (navigator), being feasible to understand that we refer to astronauts as "Star Travelers".

In addition to this, the word Cosmonaut shares the same Greek roots, Kosmos (space) and nauta, being possible to identify it as "Space Travelers".

The foregoing gives us a beautiful vision of the desire of those who wish to be part of the group of those who are going to explore the boundaries of infinity and, it is feasible to consider becoming an analog astronaut as a first step to approach this dream. Certainly, participating in this type of training will provide them with a closer vision of the requirements and challenges that they will face as astronaut candidates and will broaden their vision of the aerospace field, being feasible to consider, depending on the selected program, the one that includes topics such as astrobiology, technology, geology, etc.

It is important to highlight that this book seeks to be an inspiration, contribute ideas and the experiences lived by the authors to help and encourage those who wish to be part of those who aspire to extend the borders of humanity, oblivious to small conflicts, free from ties of suffocating ideologies and, rather, embracing diversity, brotherhood and the inextinguishable flame of humanity to seek knowledge for the service of the greater good.

Figure 1.

Training in mangrove area.

1

A little history

"Recognizing and learning from those who preceded us is laying the foundations for our construction on firm foundations"

Aldebaran Martínez

A little history

An ancient look

If we close our eyes for a few moments, we can invite our mind to return to a scenario prior to the common era, it is possible to visualize a sunset when man still lived as a nomad in the extensive African savannahs and witness how he observed with amazement and perhaps, with a hint of envy the flight of birds, imagine that for a moment he extended his arms emulating the flight of birds and dreaming of being able to fly...

It is easy to imagine that this dream was constantly repeated throughout the history of mankind and, in some cases, this dream took more solid forms than just dreams, however, as far as the authors know, it has not been possible for us to identify trials or successful practices where humans have been able to take flight until shortly after the year 800 of the common era, however, these brief lines serve to describe the long dream of humanity to fly.

Opening arms to the sky from the east to Da Vinci

Abu al-Qāsim Abbās ibn Firnās, known as Abbas Ibn Firnas, (a name that is familiar to connoisseurs of the moon as one of its craters bears his name), was born in 810 of the common era of a Berber family, in the surroundings of the city of Ronda (current Malaga, Spain), builds, among many other inventions, his own planetarium and his own flying machine, with which, according to the stories, he achieves a sustained flight for several minutes before falling into the form uncontrolled, all this 675 years before Leonardo Da Vinci, who in the years from 1485 to 1490 in Milan, carried out studies that he largely failed to achieve due to the limitations of the materials of his time. Certainly there were a lot of innovators who drove important breakthroughs, but for the sake of being succinct we'll skip to the next topic.

From balloons to machines heavier than air

In this order of ideas, it is feasible to mention that Bartolomeu de Gusmao, (Brazilian priest), made a successful demonstration of an unmanned hot air balloon in the Casa de Indias in Lisbon, before the court of King John V of Portugal, the August 8, 1709, later, Montgolfier Joseph and Étienne Montgolfier, (France), carried out the first experiments with balloons in 1782 and in 1783 they made the presentation of a flight with passengers (which were a duck, a lamb and a rooster) .

Now, regarding heavier-than-air machines, it was not until 1804 that George Cayvel, (England), presented his prototype which he tested 5 years later (without a pilot) and thirty years later it was tested by another person.

Otto Lilienthal, (German), in 1874 designed artificial wings achieving small flights, improving in 1890 with guided devices and in 1892 he developed the Südende glider, in 1893 he built a flight station from which he achieved several flights and in 1894 he tested an engine that used carbonic acid.

Much later, in 1903, the Wright brothers achieved a brief take-off from the ground in their plane and, in 1906, Alberto Santos Dumont, (Brazilian), managed to carry out a formal circuit with a heavier-than-air vehicle (a plane with a motor).

Staring into space

In this way, we can see that, in a short period of time, man went from dreaming of flying to consolidating said dream and casting his gaze into space, in such a way that a short time (75 years) separates the first efforts of Otto Lilienthal, for using an engine in his plane when man landed on the moon.

To better understand the speed of development obtained in the last century, it will suffice to consider as a starting point the appearance of homo sapiens, approximately 300,000 years ago, considering the findings of Jean-Jacques Hublin, of the Department of Human Evolution of the Max Planck Institute, who in to the north of Morocco, in a site called Jebel Irhound, they identified the remains that allowed this dating. In this way, we can understand that humanity has achieved impressive advances that range from taking off the feet of the earth to reaching our natural satellite, to put it in perspective, if we consider that, since the appearance of homo sapiens, until the current era about a year, the time it has taken since the beginning of motor aviation to reach our satellite would occupy around the last two hours of December 31.

The previous image serves to understand the vertiginous scientific and technological progress in the last century, which allows us to infer that we must remain proactive to be not only spectators, but also protagonists of the next substantive advances of humanity.

Figure 2.

Meteor Shower and Comet Observation C/2021 A1, called Leonard.

II

Analog astronauts

"Commitment, discipline, vision and teamwork, ingredients for the formation of a crew"

Aldebaran Martínez

Analog astronauts

Who are analog astronauts?

It is feasible to start by understanding the analogous term which, etymologically, comes from the Latin analŏgus and corresponds to the Greek αναλογος (ανα ana meaning according to, according to, on and λογος logos meaning word/reason), being feasible to consider in literal terms as "conformity of reason", which allows us to understand it as correspondence or similarity of foreign objects. In the area of psychology, it is mentioned that when an individual learns something through experience, it is feasible to expect that he will act in a similar way under similar conditions, that is, analogous.

Therefore, it is possible to identify an analog astronaut as a person who receives training similar to that of an astronaut.

At this point the question arises, what is the importance of analog astronauts for space research?

The answers are multiple, although there is a limitation regarding how to emulate microgravity, there are many factors that, when studied under controlled conditions, allow not only to improve existing processes, but also to propose new ways to solve the problems. areas of opportunity identified and thereby create contributions to the body of knowledge.

Undoubtedly, one of the great challenges that we will face in carrying out space travel refers to the necessary mental strength that astronauts must have to carry out these trips with current technology. Considering that, at this time, a trip to Mars would last a little over a year and a half (as regards its transfer). At the terrestrial level, it would seem little more than an internship or a diploma (viewing it from the point of view of studies), however, this time is critical when translating it into the time that a person must spend in space.

Certainly, the effects that a prolonged stay in space can generate are highly significant, however, this item will not be considered in the training for analog astronauts due to the impossibility of creating environments without gravity on earth. Due to this, the training will focus on other factors such as the development of high-value skills for those who wish to undertake their training as analog astronauts.

Certainly, throughout the book, different training proposals will be presented for those who wish to develop the necessary skills to complete the profile related to being an analog astronaut. For now, let's start with the strength needed to stay in space.

We previously mentioned that a “round trip” trip to Mars would take us an average of a year and a half, putting this in context, we can see that we are currently very far from having information about what can happen to the body and mind. of us humans spending so much time in space. Suffice it to say that the human being who has been in space the longest is Sergey Konstantinovich Krikalev, since he has spent 803 days in space so far, surpassing the 748 days that Sergey Avdeyev had spent. At this moment, we could do a brief mental exercise and say, "hey, he spent more than two years in space", exceeding what was required to travel to Mars, the detail is that he added this time in different missions, since in his longest stay was 311 days in space. The longest stay in space corresponds to Scott Kelly, with 340 days. In this way, we can see that we are still far from being able to have an accurate idea regarding how it could affect not only the body, but also the mind of the crew members on long-term trips.

Bearing this in mind, it is possible to consider environments that can provide great benefits to develop skills in the participants and, naturally, create research that allows obtaining high-value findings for the body of knowledge.

The first image that comes to mind when we talk about a habitat similar to what one would have on a space mission is to be part of a submarine crew, however, as is obvious, it is somewhat complex to be able to consider this option for analog astronauts (considering that most of them are young), bearing this in mind, options arise such as the bases installed in Antarctica, however, the problem of age coupled with the cost and the restrictions

of the two aforementioned environments arises again .

For this reason, options arise related to creating controlled habitats that seek to recreate conditions similar to those that would be found in a facility that is in space, considering caves, deserts or environments that add value to training to consolidate the desired skills, reaching to have among the options swimming pools, facilities that allow you to feel specific effects (such as the orbotron, also known as a gyroscope), even virtual reality through simulators of specific operations.

That is why for the development of the Genesis project, the competency model has been considered, since it allows evaluating how people act in specific conditions, seeking to predict future behavior.

Figure 3.

Identification and recognition of fossils.

It is feasible to consider the beginning of analog astronauts on a par with the beginning of the space program, considering 1959 as the shared starting point for both cosmonauts (Russian program) and astronauts (American program), in which space programs began. training on the ground seeking not only to find those who presented the best profile for the missions, but also to prepare them through simulations for the demands of the missions to be carried out.

What is its importance?

Finding ourselves at the dawn of a new era entails not only understanding the new demands, but also being able to respond effectively to them, in this order of ideas, it is essential to create and consolidate the necessary intellectual capital to meet the needs emanating from new technologies and processes, therefore, the programs aimed at creating analog astronauts comply with the following aspects, among others:

a) Creation of intellectual capital to meet the needs of this new era;
b) Approximation of a greater number of people to the necessary skills to be part of a space crew;
c) Dissemination and disclosure of topics related to science and in particular to sciences related to space;
d) Creation of hotbeds to identify talent that could participate in the near future in the selection of crews for space missions;
e) Develop a proactive attitude.

It is likely that to the kind reader it seems distant to think that space travel will become part of our daily lives, however, it is enough to remember how distant air travel used to be and now, it is a formidable industry in which many people Enjoy its great apps.

Figure 4.
Alpha mission crew.

Competencies proposed for their training

Competencies to develop:

Hard skills:

1.- Management and application of computer programs;
2.- Specific training (depending on the field to be developed);
3.- Reading, writing and comprehension;
4.- Two or more languages (English and Russian preferably);
5.- Mathematical abilities;
6.-Skills for repair and construction;

Figure 5.

Micro gravity simulation training in swimming pool.

Figure 6.

Material transfer training in microgravity simulation.

Soft skills:

1.- Commitment to do a good job;
2.- Good communication;
3.- Time management;
4.- Ability to solve problems;
5.-Teamwork;
6.- Self-confidence;
7.- Self-criticism and acceptance of constructive criticism;
8.-Adaptability to different scenarios;
9.- Ability to work under pressure.

Figure 7.

Armed and preparation of CANSAT.

Figure 8.

Armed and preparation of the CANSAT.

Among the skills considered of high value are:

1.- Being the pilot in command of a jet plane;

2.- Possess a master's degree in the fields of STEM (Science, Technology, Engineering and Mathematics), or STEM (science, technology, engineering and mathematics), which includes engineering, biological sciences, physical sciences, computer science or mathematics, graduated from a prestigious institution;

3.- Play an instrument, paint or master some kind of art in particular. They are considered great support skills for long trips.

Figure 9.

Interpretation of a piece of music on the piano.

Within the desired physical requirements for the categories of crew, the following are required:

1.- Walk 10 kilometers continuously;

2.- Swim continuously 500 meters using any of the swimming styles;

3.- Have a state of health that allows you to carry out the activities of your role in the crew without complications.

Figure 10.

10 kilometer test.

Figure 11.

Swimming test (500 continuous meters).

Figure 12.

Calisthenics test.

Figure 13.

Decision jump, three are made.

Figure 14.

Moment prior to one of the crew members entering the water.

Desirable Characteristics

Youth is a desirable characteristic since it allows them to be incorporated into programs to develop their skills and, in the future, they may choose to apply to be part of a selection program for astronauts, depending on the program they wish to join. age is an important factor since there are different criteria for each agency, finding that in some of them their income is considered as of 26 years of age and a preferential factor is provided for those who have not exceeded 37 years of age, while in others are accepted up to 46 years.

Having a physical condition that allows them to face challenges successfully is a "sine qua non" condition, that is, without which they cannot be considered for any program, in such a way that their physical condition must be excellent, attached to it, It is important to consider that some agencies have preferential ranges in terms of height, fluctuating between 1.50 and 1.90 centimeters, having a weight according to their age and height fluctuating between 50 and 90 kilos, not having hearing difficulties, having clear vision. 20/20 with or without correction, no color blindness;

Psychologically stable;

With ease of speech and gift of command;

Proactive;

Highly motivated to achieve goals;

Ability to work in a team, and;

Being a person of integrity.

Figure 15.

Receipt of your certifications.

III

GENESIS

Project

"The creation of a new paradigm is rowing against the current one and being able to share the vision of the new one with others"

Aldebaran Martínez

GENESIS Project

International cooperation to form Genesis Project

Analog astronaut training program.

Objective: Consolidate a comprehensive training program for analog astronauts focused on developing critical skills.

Duration: Modular programs lasting one week each.

Competencies to develop (see the previous chapter, pages 13 and 14).

Levels considered within the feasible certifications to carry out:

Considering certification as an evaluation process to identify the specific competencies in the participants in a specific period of time, we have to consider the following:

Basic certifications:

a) Looking up at the stars;
b) Basic principles for traveling to space:
c) The CANSAT, an alternative to start;
d) Rockets and balloons, starting the adventure.

Intermediate certifications:

a) First aid;
b) fire fighting and prevention;
c) Evacuation and rescue;
d) Management of autonomous breathing equipment;
e) Handling of hazardous materials;
f) Operation and maintenance of machinery for logistics (forklifts, platforms);
g) Warehouses, inventories and logistics;
h) Repair and maintenance of machinery and equipment.

Advanced Certifications:

a) Microscopy;
b) Sample collection and handling;
c) Geology;
d) Mountaineering, caving;
e) Aquatic rescue;
f) Aircraft piloting;
g) Mathematics applied to space;
h) Design and development of experiments;
i) Proactive stay in habitat.

Certifications as an analog astronaut:

Basic:

a) Astrobiologist;
b) Crew Paramedic Officer;
c) Bio-medical engineer;
d) Responsible for communication;
e) Responsible for transportation;
f) Habitat Manager;
g) Maintenance responsible.

Advanced: Mission Commander.
For each of them, it is required to cover the specific profile of each area and in the case of Mission Commander, at least three roles must be fulfilled and strong leadership and vision must be shown.

Figure 16.

Transfer by boat to the training area.

Prior to carrying out the missions, medical, psychological and physical evaluations are carried out. During the missions, there is a 24/7 team that accompanies the participants, made up of a surgeon and a specialist in evaluation centers, with all the equipment to attend to the activities and emergencies that may arise.

The role of mission commander has a series of demands that, in the case of analog astronauts, are not so much related to being an aviator pilot, but to their ability to command, make decisions, create teams and Problem resolution. Later chapters will delve into this process.

To give a closer look at this process and how training missions for analog astronaut mission commanders can be developed, the Alpha mission is presented.

Alpha Mission

The Genesis project is the crystallization of international cooperation to create a high-level program with specific objectives in each of the 24 missions planned in the first stage (according to the Greek alphabet).

The first of these missions is the Alpha mission, whose guiding axis is the consolidation of Mission Commanders capable of directing the new generations of analog astronauts.

It is a type certification: Advanced.

Name: Mission Commander.

The mission contemplated different stages that included:

a) Medical, psychological and physical evaluations;
b) Training in the mangrove, cenote, impact zone, sea, diving pool, pool and exercises on land;
c) Astronomical observations (including C/2021 A1, named Leonard, and a meteor shower);
d) Identification and understanding of the impact of stellar phenomena on human activity (solar minimums);
e) Evaluation of sensory abilities;
f) Astrobiology topics (Archaea, microbialites, tardigrades);
g) Assesssment center for competency evaluation.

The physical activities were carried out in Yucatan, there was a 24/7 team that accompanied the participants, made up of a surgeon and a specialist in evaluation centers, with all the equipment to attend to the activities and emergencies that might arise. The mission lasted a total of one month.

Figure 17.
Alpha crew on the last day of training. Team morale is a fundamental issue.

Certainly each mission is projected and integrated with the most important elements for the desired objective, in the case of the Alpha mission, the agenda and objectives were carefully selected and carried out, mentioning among them:

Water training

It is feasible to consider training in water as the closest and cheapest environment to simulate microgravity conditions.

This included without limitation:
Microgravity simulation exercises in a swimming pool.

Figure 18.
Simulation in microgravity.

Note: Mobility practice in limited spaces. It is interesting to comment that the temperature of the water was very cold to see the control of the participants in adverse situations.

Figure 19.
Search and identification of small pieces.

Note: Once again, the mettle of the participants in adverse and extremely demanding conditions is re-identified.

Figure 20.
Exercise with apnea practice.

Figure 21.

Assembly of parts and creation of connections.

Figure 22.

Rotation sequence in water to develop the sense of orientation.

Figure 23.

Preparation of guide pipe to lead a flexible conduit from one space to another.

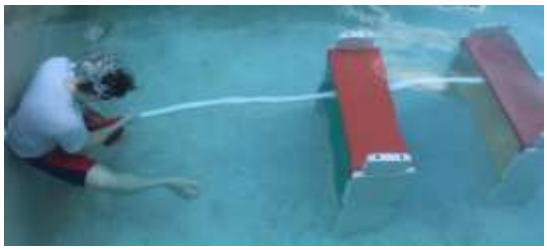


Figure 24.

Assembly of small parts under water with pre-established patterns.

Figure 25.

Development of sea snorkeling skills.

Figure 26.

Development of mobilization and transfer exercises on the beach.

Figure 27.

Development of coordination exercises on the beach.

Figure 28.

Development of swimming tests in the sea.

Ground training

The exercises that were performed on land included but not limited to walking, aerobic exercises and calisthenics.

Figure 29.

10 kilometer walk.

Figure 30.

Calisthenics tests.

Astronomical observations (including C/2021 A1, named Leonard, and a meteor shower).

Figure 31.

Developing skills in the use of the telescope.

In the particular case of the Alpha mission, there was a great opportunity to make two special observations, the Leonard Comment and the meteor shower, the activity had the additional attraction that being early in the morning represented an incentive for the crew due to its schedule.

Mangrove training

The mangrove training was developed using a technique where the presence of analog astronauts goes unnoticed by their surroundings, they move with extreme stealth without hurting the mangrove and moving in an agile way.

Figure 32.

Mangrove mobilization techniques with extreme stealth.

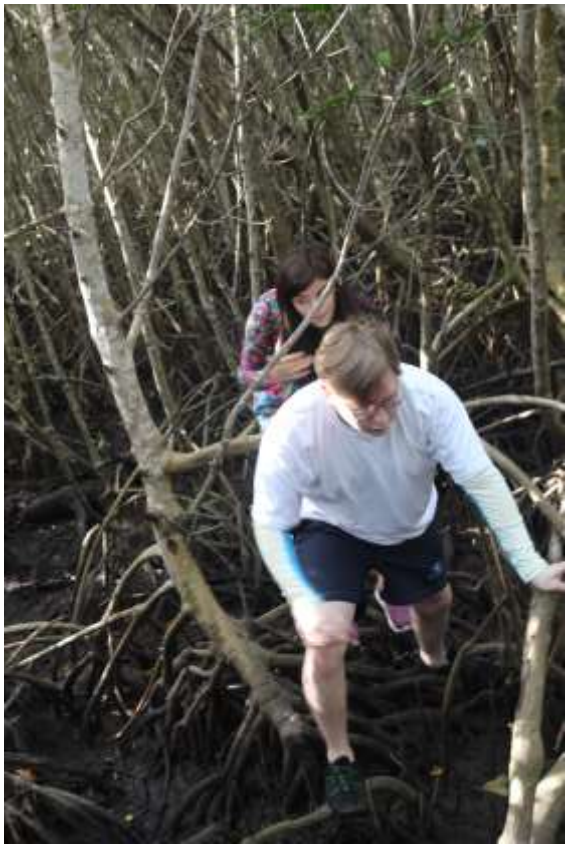


Figure 33.

Mangrove training.

Figure 34.

Mangrove training.

Figure 35.

Mangrove training.

Figure 36.

Mangrove training.

Figure 37.

Mangrove training.

Cave training

A great attraction for the development of analog missions is having the possibility of entering cenotes (in this case of the grotto type), for the development of skills.

Figure 38.

Training in grotto type cenote.

Note: Carrying the flags of the participating countries is always a great incentive for the crew members.

Figure 39.

Training in grotto type cenote.

Figure 40.

Obtaining samples in cenote.

Figure 41.

Entrance to the grotto-type cenote.

Figure 42.

Departure from the cenote.

Figure 43.

Preparation for obtaining samples.

Figure 44.

Preparation for entering the cenote.

High mountain training

This type of training provides great advantages by developing skills that are useful for analog astronauts.

Figure 45.

First rock of the Nevado de Toluca.

Figure 46.

Ascent training to the Nevado de Toluca.

Figure 47.

Preparation for the ascent.

Note: Carrying out these types of activities gives participants the opportunity to develop team spirit.

Figure 48.

Snowy aspect of one of the faces.

Figure 49.

Ascent using technique for snowy areas.

Note: The challenges of promotion provide the effort factor that helps temper character.

Figure 50.

Planning of the route for ascent.

Note: The visualization of the route is a good exercise to project the necessary foresight skills.

Figure 51.

Facing intense cold with light clothing.

Note: Developing activities above 4680 meters allows you to identify the complications of having less air than you are used to.

Figure 52.

Making top.

Note: Reaching the top provides a sense of victory that solidifies the character of the members of the mission.

Habitat training

The abilities that can be developed within the habitat are as diverse as each mission. Within them we have:

Collection, preparation, analysis and disposal of samples.

Astrobiology topics (Archaea, microbialites, tardigrades) were previously reviewed.

Figure 53.

Containers as samples.

Note: Samples obtained in cenotes to search for tardigrades.

Figure 54.

Photograph of a tardigrade in samples obtained.

Figure 55.

Sample preparation for microscope observation.

Figure 56.

Use of the microscope for observation.

Figure 57.

Observation of geological samples.

Figure 58.

Training for the observation and identification of geological samples.

Figure 59.

Identification of geological samples.

Figure 60.

Preparation for sensory test.

Figure 61.

Sensory test. Crew members are able to take their meals deprived of the sense of sight.

Figure 62.

Sensory test.

Figure 63.

Armed with a CANSAT.

Figure 64.

Armed with a CANSAT.

Figure 65.

Review of CANSAT parameters.

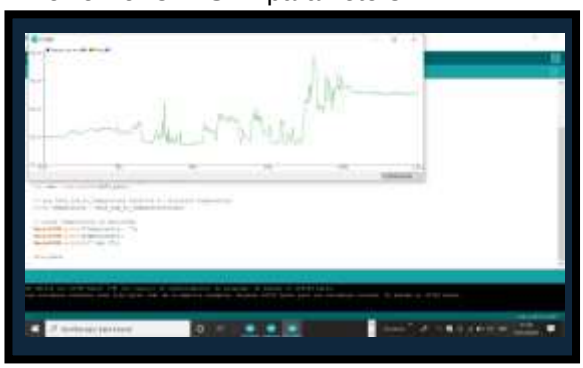


Figure 66.

CANSAT test.

Figure 67.

Armed with a CANSAT.

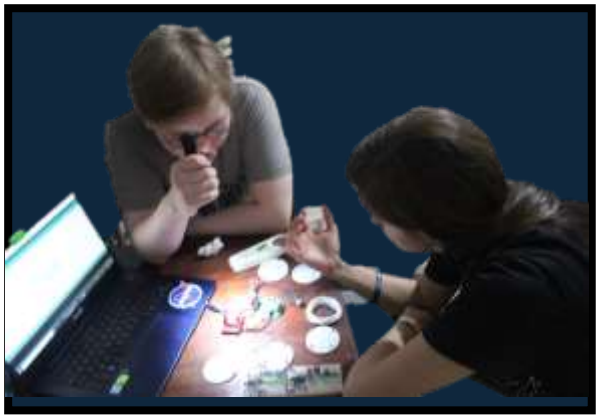


Figure 68.

Circular bandage practice.

Figure 69.

Practice of a herringbone bandage.

Figure 70.

Bandage on upper extremities.

Figure 71.

Capelin bandage.

Figure 72.

Rescue breathing technique.

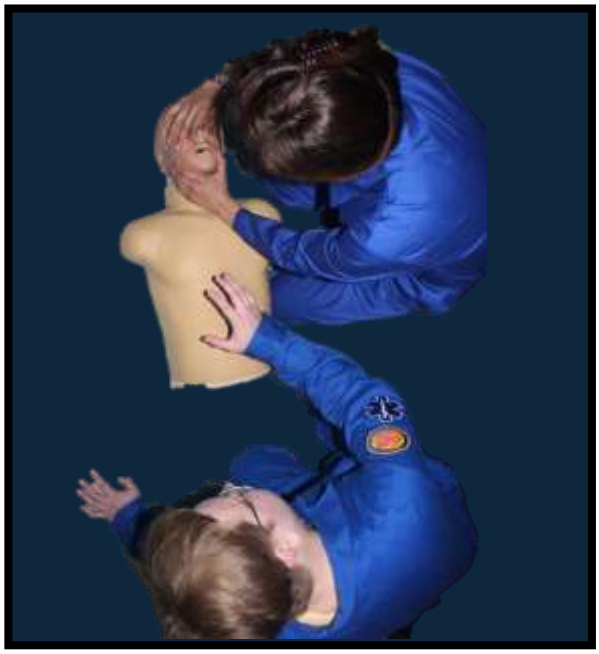


Figure 73.

CPR with two participants.

Figure 74.

CPR with a participant.

Figure 75.

Airway clearance technique in babies.

Figure 76.

Baby rescue breathing technique.

Figure 77.

Baby CPR technique.

Figure 78.

Heimlich technique.

Visit of archaeological zones

It allows visualizing the effects of solar minima on a civilization, not only provides the possibility of understanding the scope of these phenomena in human activity, but also includes a highly attractive factor for the members of the mission.

Figure 79.

Visit to the Mayapan area.

Figure 80.

Visit to the Mayapan area, substructure of the Kukulcan castle, with reliefs modeled with stucco.

Figure 81.

Visit to the Mayapan area.

Figure 82.

Visit to the Mayapan area.

Figure 83.

Visit to the Mayapan area.

Integration activities and closing

Considering carrying out activities focused on the integration and formation of team spirit throughout the mission is essential for its success.

Figure 84.

Crew reception in Mérida.

Figure 85.

Return by boat from training at sea.

Figure 86.

Visit to the Mayapan area.

Figure 87.

Recreation in beach area.

Figure 88.

Recreation in beach area.

Figure 89.

Recreation in beach area.

Figure 90.

Recreation in beach area.

Figure 91.

Recreation in beach area.

Figure 92.

Recreation in the beach area sharing food and celebrating the end of training.

Figure 93.

Celebration cake.

Figure 94.

Recreation in beach area.

Figure 95.

Photograph of the last day of the mission.

Certainly it is possible to understand that all the previously described training sessions have the purpose not only of developing the necessary skills to be part of a crew, but also of creating the bonds so that the participants become the crew.

Being the crew is making the words of Alexander the Great his own, "The destiny of all depends on the conduct of each one", therefore, those who make up a crew have a deep sense of interdependence and proactivity.

Activities as part of a crew

Now, what are the most common activities that an analog astronaut should practice in their training:

Let's start with those that seem more mundane in nature but whose value is critical:

a) Cleaning work. These include weekly vacuuming of the entire habitat to recover skin shed by the astronauts themselves, which can damage equipment, facilities, and create unsanitary conditions;
b) Interact in a constant and harmonious manner with the crew and with those who interact by electronic or other means (light signals, flag signals, etc.);
c) Proactivity and maintenance of order at all times (collect your dishes, always leave everything in its place, avoid clutter);
d) Able to stay for a long time in confined spaces;
e) Perform maintenance and repairs, these are critical activities for the proper functioning of the ship (habitat);
f) Keep and maintain the log;
g) Transport, store and safeguard both standard and scientific-specialized equipment and tools;
h) Maintain an exercise regimen of two and a half hours each day.

In terms of specific activities that everyone should try are found.

Attend, follow and perform:

a) takeoff procedures;
b) Steer and pilot the ship;
c) Operate the controls when flying to and in space;
d) Maneuver the spacecraft within the assigned coordinates to have a successful connection with the International Space Station or with a designated satellite or structure;
e) Follow flight patterns and routes;
f) Applicable procedures to prepare for re-entry into the atmosphere;
g) Procedures to locate the position and status of the ship;
h) Applicable procedures to prepare for landing;
i) Ability to calculate and redesign flight routes and to plan fuel consumption;
j) Procedures for emergency care;
k) Communications with the space mission crew at headquarters to coordinate future assignments;
l) Management of software used in the mission;
m) In the case of analogous missions, it is very important that the participants be able to design, execute, control and successfully conclude one or more experiments during the development of the mission.

Although each crew is unique, it is feasible to consider that it can be made up of four to six participants based on the commander, pilot and two to four specialists.

It is essential to remember that the activities listed are descriptive rather than limiting and that the crew must be highly proactive to achieve success.

Regarding communication, in the case of crews that come from the same country, the mother tongue will be used, if the crew is made up of people of different nationalities, the English language will be used (we reiterate that it is in the case of analogous missions) .

Communication

For communication, conventional voice systems, written and electronic media will be used, which must have the following characteristics:
Be precise, complete and avoid the use of abbreviations that are not common to others (parsimony is an essential element for communication).

With regard to electronic means, it is feasible to use any means previously agreed upon with the participants, preserving parsimony (the preference for the simplest explanation) at all times.

Oral communication is suggested when:

a) An immediate response is required;
b) These are simple instructions;
c) It is a subject that requires explanation;
d) It will be accompanied during a procedure;
e) Activities will be carried out (for example, maintenance or manual work while the explanation is given).

An audio visual communication is suggested:

a) To give instructions that require a demonstration;
b) You want to physically present an action, object or situation;
c) Diagrams, mockups, or charts are required;
d) It seeks to negotiate, share personal messages, be part of an event.

A written communication is suggested:

a) When the topic is long;
b) Requires record keeping;
c) It carries numbers, data that must be evaluated or preserved;
d) There is a lot of noise or conditions that do not allow good auditory or visual communication;
e) They include graphs, tables or other explanatory elements;
f) An immediate response is not required.

A very useful element in communications will be the radio, which is why some guidelines are given for its use.

Before carrying out an activity that involves the use of the radio, it is important to verify that:

a) Have full charge;
b) Works correctly;
c) It is in the right tune;
d) It is clean and intact (no damage).

Regarding its use:

When more than two people use a channel to be in communication at the same time, it is important to take into account:

a) Always speak clearly, precisely and briefly;
b) Wait for a pause in communication before making an intervention;
c) When pressing the communicator, wait a second before starting the conversation and release it a second after having finished the speech;
d) If it is a handheld device, keep it at a distance of 8 centimeters away from the lips;
e) Although the radios used for the evaluation center have a limited range to the habitat or place of the exercise, the aim is to avoid any confusion, therefore, in the emergency drills, international codes will not be used, but, without waiting for the customary pause in conversation, press button and repeat, TIME, TIME;
f) To ask a question, a previous sentence is normally used, such as interrogation..., example.
   -I'm taking supplements to the lab.
   -I ask, what supplements are you going to take?
g) To give an affirmative answer, one normally says AFFIRMATIVE or SIERRA;
h) For a negative answer, say NEGATIVE or NOVEMBER;
i) If something is not understood, you can say, NEGATIVE REPEAT;
j) To transmit exact data, the code developed by the International Civil Aviation Organization (ICAO) can be used.

Table 1. ICAO.

T O	Alph a	B.	Bravo	C	Charli e
D	Delt a	AN D	Threw out Écou	F	Foxtro t
G	Golf	H	hotel	I	India
J	Julie tt	K	Kilo	L	lime
M	Mike	N	novemb er	O R	Oscar
P	Dad	Q	Quebec	R	Rome o
ye s	saw	T	Tango	O R	Unifor m
V	Victo r	W	Whiske y	X	X ray
Y	Yanke e	Z	Zulu		

Table 2. ICAO.

one	First	two	Second
3	Third	4	Bedroom
5	Fifth	6	Sixth
7	Seventh	8	Eighth
9	Nineth	0	Negative

Other codes used are:

Place. Please wait to reply. Usually said when someone is busy and still can't answer properly;

Copied. Message heard and understood;

In that. You are in the process of completing the task that was asked of you;

On hold. Waiting for further instructions;

Understood. Idem;

Out of. I'm done communicating for the time being;

Strong and clear. Common response to someone requesting a radio check;

Indifference. Ignore the previous message;

Repeat. Request repetition of previous message;

Finished. Message finished, waiting for response;

It goes again. Repeat the last message;

Radio check. Checking if your radio is working properly.

The schedule will be expressed in a 24-hour schedule, that is, 8 in the morning will be 08:00, while 8 at night will be 20:00.

Time to eat

The time dedicated to the consumption of food is highly significant, not only to cover food needs, which can vary between 1,900 to 3,200 calories (depending on personal variables such as weight, gender or specific conditions), therefore, each crew member has a pre-programmed menu, which may include food specially prepared for them (for example, a barbecue specially made by their parents or partner, which is dehydrated and packaged so that they can consume it in the space).

As we mentioned previously, mealtime is very important for the coexistence of the crew, therefore, it is sought that all but one of the members take their meals at the same time (one person must always be on duty, attentive to the indicators, radio, etc.). The role of the security guard will rotate.

Three times are considered to take food (breakfast, lunch and dinner), plus a free time to take the so-called collation (a small appetizer or "craving"), unlike the meal times, the collation or "cravings", they have a free schedule that is adapted to the programs of each crew member, being possible to coordinate two or more crew members to coincide in said time, remembering that there must always be a person on duty.

The suggestion is to allocate a time of 45 minutes for breakfast, one hour for lunch and 45 minutes for dinner. For the collation it is suggested to consider a time of 30 minutes.

With the intention of making the evaluation center as real as possible, it is suggested to enter standard "containers", whether they are plastic boxes or other suitable material for food preservation, equipped with lids and identified for each crew member. which will contain the food that you can consume during your stay in the habitat (of course the water will be found in previously loaded and identified community containers).

Two boxes of different colors will be delivered to each participant, one to be kept in a previously designated cool and dry place, while the other will be placed in the designated refrigerators.

Inside each box you will find an inventory of the same which will have among other data:

a) The name of the crew member;
b) Quantity and content of each package;
c) Suggested menu for each meal (changes can naturally be made, but always looking for these changes to be equivalent to that day's menu).

Although, due to economic reasons, it is not feasible to consider dehydrated foods such as those consumed by astronauts, it is sought to achieve the maximum approximation by delivering food in small packages for each meal, for this, it is important to find that food selected have characteristics such as:

a) Be light. Each gram that goes up into space has a high cost;
b) Thermo stabilized or irradiated. In such a way that they last beyond the time scheduled for the mission;
c) Compact. The smaller the better;
d) Nutritious. In short, the food must cover the nutritional needs of the crew;
e) To the liking of the crew. Food should be a small oasis for the taste of each one of them and, if possible, remind them of the reason why they make their maximum effort every moment;
f) Prevent them from disintegrating into small "lumps" or fragments. Preferably they are moist and sticky, for example, in space, tortillas are used instead of bread to avoid crumbs that could damage the equipment.

The standard process for preparing food in space is:

a) Identify the foods you are going to consume;
b) Take them to the preparation area;
c) Reheat the food in the conduction oven or rehydrate it according to the instructions;
d) If this is the case, prepare your drink by rehydrating it with hot or cold water;
e) Cut the packaging correctly using the scissors indicated for this process;

f) They take their food using the appropriate cutlery or straws, preventing small portions from escaping.

Naturally, in the case of fresh fruits and vegetables, the packages are simply opened and enjoyed.

At the end of each meal, the facilities are cleaned, maintaining the established cleaning standards.

Preserving the spirit of achieving the maximum experience in the evaluation center (the habitat), it will be sought that the foods align as much as possible with what is described above and, if possible, comply with small individual packages. For the sake of ecology, it is preferred that the portions be stored in reusable plastic or glass containers, so that after consuming the foods they contain they can be washed and reused for later exercises.

An important question as to why the food boxes for the entire mission are delivered to the crew members at the time they start their evaluation center, is because they seek to emulate as much as possible the conditions they will face in space. This way you can see:

a) The possible exchanges of food between the crew members;
b) Respect for other people's food;
c) If they become anxious at any time (either because they see that supplies run out, some food deteriorates and this decompletes their diet, etc.), see their actions in such a situation;
d) Care and application of established processes.

Physical activity

During the stay in the habitat, it is important to schedule an average of two and a half hours each day, so that the evaluation center approaches the activities carried out by astronauts in space.

The suggestion is to use stationary bicycles, elliptical trainers, treadmills and, if possible, consider calisthenics exercises (since you have the advantage of gravity).

Naturally, as during the entire stay, medical surveillance must be constant and it is important that the exercises are performed as a couple, so that habits can be created.

Although it is important to remember that all the members of the mission have been previously evaluated, you must be attentive to the development of the exercises and remind the participants that these are maintenance exercises.

Performing the exercises as a couple also allows you to see the interaction of the crew members during their development. Sometimes it is observed that they exchange music, ideas, stories, etc. Which is a highly appreciated factor during missions.

At the end of the exercises, hygiene should be scheduled.

Personal hygiene

Regarding personal hygiene, only a few points will be considered.

Regarding tooth brushing, it is possible to consider the use of edible toothpaste, however, it is recommended that members continue with their cleaning habits, using their usual toothpaste, brush and dental floss (unlike the conditions in the space, they will be provided with adequate facilities for cleaning).

Following the same criteria, participants will be allowed to use showers, considering that (as far as the authors know), it is not yet possible to emulate the conditions of weightlessness in habitats, using cleaning mechanisms such as wet towels to cleaning processes do not provide an advantage to the development of skills and if it becomes an important generator of waste (to share the appropriate technique for hygiene processes, this will be done through videos and explanations on site).

The use of the showers must be programmed in such a way that its use can be maximized and the procedure for its maintenance and cleaning explained (for example, the obligatory use of sandals with non-slip soles).

Regarding clothing, in space, astronauts dress it until it is very dirty and simply discard it, for reasons of economy, in the case of the crew they are asked to bring change of clothes for the time they go to be in the habitat, in such a way that laundry processes will not be carried out inside the habitat.

Although the temperature on the International Space Station fluctuates between 18 and 23 degrees Celsius, the habitat temperature will remain at 24 degrees Celsius (which is considered a comfort temperature).

Before entering the habitat, members are requested to carry out their own personal hygiene activities to have a good development during their stay, this includes shaving, cutting their hair, nails, etc. Well, these activities cannot be carried out in the habitat.

In case of special requirements (eye drops, allergies, inhalers, etc.), these must be communicated to the medical personnel and the information shared with the crew member who acts as commander to know where their medications will be if they are required (this information will be kept confidential and used only if necessary).

Regarding the sanitary facilities, the bathrooms for common use will be used following the established processes for hygiene and maintenance.

Annexed to the facilities that would not normally be counted in the space but that for reasons of hygiene and comfort will be inside the habitat are:

a) Sinks in areas for food consumption and bathrooms;
b) The sinks in the laboratory area.

These facilities must be kept clean and functional at all times, remembering that courtesy in their use is essential for a good coexistence.

Time to sleep and relax

Certainly there are two fundamental moments to preserve the balance of the crew, sleep and personal time.

Let's start with sleep.

Roles will be performed to rest in such a way that each crew member can enjoy eight and a half hours of sleep every day, it is important to remember that there must always be at least two active people at all times, therefore, soft roles are established, in such a way that "gentle rotations" can be carried out, which follow the natural rotation of the circadian cycle, in such a way that the crew members are allowed to enjoy a restful rest.

Within the preparation for falling asleep, the use of sleeping bags is included with the particularity that in their design the arms can be removed. Because the habitat is not free from gravity, the use of pillows will be allowed and light mats will be used for personal capsules. It is possible to have extra blankets available if necessary.
To sleep, it is necessary to use earmuffs and a mask for the eyes (this will allow the crew to isolate the ambient noise of the habitat during their sleep period).

The personal capsules, whose size is very small, will be a personal space in which each crew member will be able to place photographs or small personal objects and will have a support so that it is possible to place their portable personal computer, with adequate electrical installation to have light. personal reading and access to power for your computer.

Regarding personal time, crew members may spend it in the common areas or in their capsule. The time allotted for each participant is one and a half hours each day.

In order to achieve maximum efficiency of the test center, the use of cell phones will not be allowed except during personal time. These phones will be placed in the common area for recharging and can only be removed from it during your personal time or in case of emergency. Prior notice to the mission commander.

Now it's time to identify the roles of the crew.

Mission commander

He is the strategist of the crew, although he can carry out several of the activities of the rest of the crew, his critical function is decision making and he is the first contact with mission control. For analog commanders, the desirable profile is to have knowledge of mathematics, physics, chemistry, biology, and engineering. It would be highly desirable if the participants could have flight experience and preferably, have served as a pilot in a previous mission.

Figure 96.

The youngest analog astronaut from Mexico.

Among the main activities to be carried out are:

a) Identification of the objectives to be achieved in the mission;

b) Identification of intellectual capital of those who make up the mission;

c) Having the parameters described above, they carry out the following critical activities:

1.- Identification of areas of opportunity and strengths of:

Habitat. Inventory of supplies (food, medical, energy, equipment, etc.);

Crew. Illnesses, limitations, strengths;

Risk areas. Storage of sensitive chemical materials.

2.- Development of KPIs, for the mission;

3.- Development of the strategic plan.

d) Habitat development;

e) Executive meeting with the members to assign roles and achieve points of agreement;

f) Programming of activity diagrams, which must be visible and with control panel-type indicators and established verification times;

g) Schedule and chair executive meetings;

h) Promotes and encourages organizational learning with special emphasis on the development of team membership;

i) He presides over and promotes the meetings of "the meaning of our mission for those who are on earth";

j) He is considered as the first intervener to solve complications or disagreements in the crew;

k) It is the first contact with the control center;

l) Plan, follow up and close the drills that will be carried out.

Figure 97.

Alpha crew.

Figure 98.

Alpha crew.

Pilot

It is feasible to identify him as the second in command in relation to the control and operation of the ship, he has a similar training to that of the commander, but his specialty is fundamentally in the topics of flight since his responsibility is the integral operation of the ship, remembering that although he performs all the flight processes, he does not make decisions regarding the mission, these fall to the commander.

Among the main activities to be carried out are:

a) Being second in the chain of command, in the event that the commander is incapacitated or relieved of duty, he will take command;
b) Support in monitoring and maintenance of the control panel;
c) Constantly checks the inventory of supplies using the rotating inventory system;
d) Verifies what is related to hygiene and safety issues;
e) Check the SOLES system;
f) Participates and follows up on exercise programs and ensures that the times assigned for personal time are respected, which are only interrupted in the event of a drill;
g) Keeps the log and ensures that the critical systems for survival are within parameters (air, water, temperature, etc.).

Each of the following specialists masters, in addition to their specific activities, knowledge of mathematics, physics, chemistry, biology and engineering, on-board operations, protocols, regulations.

There are two large groups of specialists for missions called:

a) Mission Specialists;
b) Cargo specialists.

The latter refer to personnel highly specialized in a specific cargo (telescopes, computers, equipment, etc.).

The former are subdivided depending on the specific functions to be performed.

Astrobiologist specialist

Personnel with knowledge to design, prepare, execute, monitor and consolidate experiments aimed at identifying, understanding and inferring the possibility of life.

Among the main activities to be carried out are:

a) Identification, collection, protection, processing, disposal and reports of samples;
b) Inventory, protection, use and maintenance of the laboratory and its equipment;
c) Participation in carrying out the verification of the good condition of the PPE (Personal Protection Equipment).

Beyond the functions related to obtaining and processing samples, one of its substantive functions is the ability to glimpse and establish experiments that allow the identification of life forms. For this, their training entails knowing in depth both life as we know it and that of the organisms identified with the name of extremophiles. That is, organisms that live in conditions that seem impossible for any other organism such as high or low temperatures.

Figure 99.
Alpha crew.

Paramedical specialist

We refer to personnel who have the skills to assist and resolve medical emergencies when they have the appropriate equipment and assistance.

Among the main activities to be carried out are:

a) Verify and keep under control the vital signs of the crew;
b) Identify and be attentive to previously identified health conditions and diseases of the participants;
c) He is assigned to verify the food for the crew (this means that he verifies its correct state, not that he prepares the food, this task is assigned either on a rotating or specific basis depending on the skills of the crew members) ;
d) It keeps track of the uses used by the crew (water, energy, internet connections, etc.);
e) Collection, custody and delivery of biological samples of the participants if this function is assigned in the particular mission.

Figure 100.

Alpha crew.

Communications specialist

We refer to the personnel capable of establishing, reestablishing, maintaining the necessary communications for the development of the mission, this includes operating, maintaining, repairing or making the necessary equipment for it, as well as obtaining the supplies (energy, for example) and the necessary facilities.

Among the main activities to be carried out are:

a) Responsible for telemetry;
b) Programming of the communication program with the command center;
c) Obtaining, preparing and disseminating the material, whether photographic, audiovisual or any other means developed within the habitat to disseminate or publicize the activity of the crew members;
d) Collaborate in the necessary revisions and repairs of the habitat.

habitat specialist

We refer to the personnel with the ability to ensure that the habitat not only fulfills the necessary functions to provide life support and conditions for the operations that must be carried out, but is also capable of identifying, anticipating, executing the corresponding maintenance and carry out activities necessary to promote harmony and a good environment in the habitat.

Among the main activities to be carried out are:

a) Review, forecast and repair of habitat conditions;
b) In coordination with the crew, he remains vigilant to ensure that the habitat's resources are sufficient for the scheduled mission.

Remembering the origin of the Command Centers

In order for the crew to achieve a successful simulation, it is necessary to have contact with the Command Center (CM), which has the objective of simulating the functions of the Mission Operations Control Room (SCOP), because, in order to analog astronauts, training can cover many more conditions than just those related to flight and stay in habitat we have preferred to use the name of CM.

It is important to make a brief stop at this point, we must remember that the analogous mission is developed under the evaluation center scheme, in such a way that, to achieve the maximum level of approximation to reality, it will be sought that the CM adjusts to the folder designed for the mission and, considering that only the person in charge of the Communication Capsule (CC), is the only person besides the DV, who can have direct communication with the crew, it is possible to perform all the roles with two people in extended roles, considering that the surgeon must be in the CM 24/7, that is, he must have all the facilities and comforts necessary to carry out his work within his reach.

Taking the above into consideration, it is possible to mention that the 12 roles are divided into one direction and three departments:

Direction.

1.- Flight Director (DV):

Alpha department.

2.- Propulsion System Officer (OSP);

3.- Dynamic Flight Officer (OVD), the only officer who, together with the DV, can give the order to abort the mission;

4.- Return Officer (OR), responsible for the safe return;

5.- Guide Officer (OG);

Beta Department.

6.- Mission Doctor (MM);

7.- Communication Capsule (CC);

8.- Life Support (SV);

9.- Auxiliary Guide Systems (SGA);

10.- Telemetry and External Support (TSE);

Gamma Department.

11.- Assistant Director (AD);

12.- Public Relations (PR);

Due to the nature of the evaluation center, there are two positions with greater specific weight, which will be briefly described:

Flight Director (DV):

We can visualize his position as that of the general director of an organization, in which he must maximize his intellectual capital so that he can carry out the original processes of the operation, directing resources strategically to achieve pre-established objectives, having a firm leadership. and professional.

His decision is absolute, in such a way that the chain of command, without being military, is very close to him.

Considering that while the analog astronauts are inside the habitat, they must be in contact with them 24/7, the participation of 3 DVs is considered, who can be assigned colors to make their identification easier. Gold DV for the morning shift, Red DV for the afternoon shift, and Black DV for the night shift.

Although the three have the same rank in their respective shifts, it is considered that the golden DV is the one who coordinates the other two, having functions such as the assignment of roles and mission stages that they must carry out in their respective shifts, all of which corresponds to the pre-set control box.

The DV, has within its assignments:

Review, approve and follow up:

a) logistics master program;
b) mission folder;
c) Habitat protocols;
d) bioethics protocols;
e) Repair and/or maintenance procedures;
f) Drill procedures;
g) Program of experiments to be carried out;
h) Addresses any condition outside the program;

The Mission Doctor (MM)

It is recommended that the position be held by a doctor graduated from one of the five best universities in the country where the evaluation center is held or from the crew's countries of origin (considering world-class rankings), who has experience not only in hospital care, but also in pre-hospital care.

He will be responsible for being 24/7 attentive to the welfare of the crew members.

Based on the mission program and the control panel, the operations are rotated and under the figure of the CC, contact is established with the crew at the planned times, when there are conditions not considered and when the drills are carried out (although, these naturally are planned, no prior notice is given to the crew, so they leave the times previously arranged with them).

Figure 101.

Alpha crew.

IV

Dissemination and dissemination

"Knowledge that is not shared is like a dream that lives in the mind of the one who conceived it and part with it when he dies."

Aldebaran Martínez

Dissemination and dissemination

The commitment to share

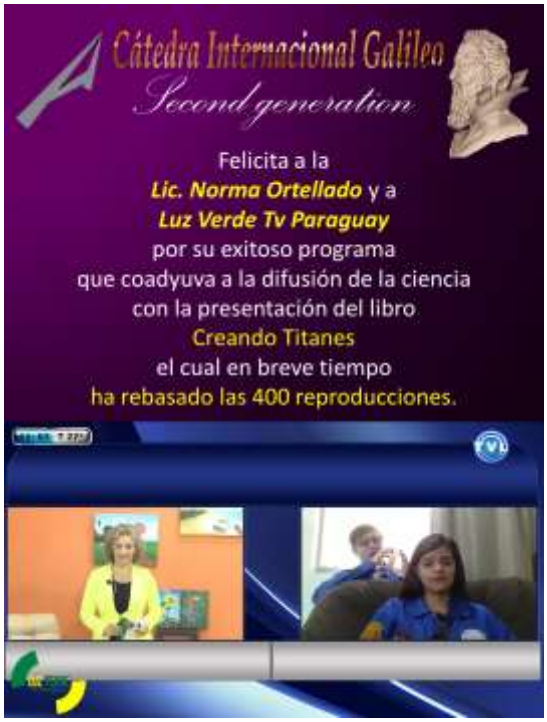
Knowledge that is not shared is diluted over time until it disappears.

A hallmark of those who love science is that, like lovers, they seek to tell everyone about their romance. Somehow, those who are passionate about science want to share their findings, their processes, contributions and provide a real vision for those who want to be part of this world.

In this order of ideas, it is certainly possible to remember that a large part of the prestigious educational institutions, research centers and world-class organizations establish open door processes, conferences of their members or some program to approach the interested population at no cost. . In the event that analog astronauts share their experiences and thus provide an idea to those who wish to know about this subject, it is important that in case of belonging to an institution they will normally have mechanisms to carry out the corresponding diffusion and, in case of not have institutional support, seek to approach science groups, libraries, museums or organizations that allow you to share your message,

Figure 102.

Presentation on TV Paraguay.



The dissemination of science can be supported in multiple ways, but before entering into them it is important to make a small distinction between dissemination and disclosure.

Diffusion, we refer to sharing specialized knowledge with peers, that is, seeking to share findings with people in the same field.

Divulgation, it seeks to bring knowledge to the general public, it is very important to be able to adapt the presentations for each audience.

Regarding how to be able to disclose, some of the most used mechanisms are:

a) Conferences (either face-to-face or electronically);
b) Courses, workshops or seminars;
c) Creation of videos, capsules;
d) Participation in radio programs;
e) Participation in books, magazines or other mechanisms.

With regard to disclosure, the mechanisms described above are also applicable, being possible to extend them to:

a) Demonstrations of the "sensational science" type, with experiments that allow participants to use their senses;
b) Creation of group activities aimed at developing skills or approaching a particular knowledge;
c) Creation of reading and conversation circles, etc.

Certainly the examples cited are a good start for sharing findings and information.

Figure 103.

Presentation on TV Paraguay.

A brief note to close this chapter is the importance that a message, a conference or an email can have on people. In this context, it is of great value to share the experience that one of the members of the Alpha mission (Aldebaran) has had with people who not only have a great intellect, but also have an extraordinary human quality.

In February 2016, Aldebaran had the opportunity to attend a conference given by Dr. John C. Mather (Nobel Prize in Physics 2006), who not only had the courtesy of giving an interesting and enjoyable conference (since part of the auditorium was made up of children and young people who were enthusiastic about science), but prior to the conference he gave Aldebaran the opportunity to speak with him and at the end of his conference in the question and answer session he gave a beautiful answer to the question he asked. allowing him to accompany him along with a "cloud" of enthusiastic young people who escorted Dr. Mathers to the elevator that would take him to the vehicle that would take him to his hotel.

Until this moment, the narrative tells us about a great scientist who possesses great human quality, however, the example becomes highly significant when in November 2021, when writing an email to Dr. Mather, he answers the email congratulating Aldebaran for their progress and remember the event in which they coincided. This is simply extraordinary when a Nobel Prize winner takes the time to write to a young man in training and remembers a 14-year-old boy who is now on the path of science.

There is the possibility that someone thinks, well, it is an isolated case, however, it is possible to say that, in the case of Aldebaran, it is a constant that he has been able to verify throughout his life, that people with greater intellect are always those of greater human quality and exceptional treatment, such is the case of:

Dr. Nadima Simón Domínguez, Professor Emeritus of the National Autonomous University of Mexico (UNAM).

Dr. Enrique Galindo Fentanes, National Science Award, Researcher at the UNAM Institute of Biotechnology.

Dr. Randall Loaiza Montoya, Director of the National Center for Biotechnological Innovations (CENIBiot).

All of them have as a common factor not only being great researchers and human beings, but also that they have not only provided support and advice in their areas of expertise, but also, by example, testify to the most important qualities that those who should have they aspire to be part of the crew that will take humanity beyond our planet of origin, being these:

A. The ability to communicate concretely and simply;
B. Being able to form and work as a team;
C. To be trainers of new generations;
D. Able to encourage (motivate) other people;
E. Have a sense of humility (simplicity);
F. Being able to create high-quality human relationships with the people they interact with.

V

developing projects

"Moving from words to deeds, a decisive step to obtain results"

Aldebaran Martínez

Developing projects

Undoubtedly, one of the great questions of humanity is: Are we alone? This question has accompanied us since ancient times and now, armed with a broader vision and frontier technology, we have broken the old paradigms where we were looking for life similar to life. ours, limiting this search to environments or conditions conducive to our species and we have turned our eyes to beings that, although they share the earth with us, inhabit and proliferate in conditions that would seem simply impossible, this is the case of the so-called extremophiles.

Extremophiles

This denomination is given to beings that can live in extreme temperatures (either very high or close to freezing), in places with pressures impossible to imagine or places with a total absence of sunlight. Although we will dedicate more space to comment on them later, it is important to start by talking about the discipline dedicated to searching for life outside our planet, we are referring to astrobiology.

It is possible to conceptualize astrobiology considering its Greek etymological roots, where astro is star, bio is life and logos is treatise or study, resulting in astrobiology being conceptualized as the study of life in the stars, or the study of life off earth.

It is certainly a great challenge and, in order to carry it out, terrestrial beings that live in extreme conditions are being considered and, by analogy, could be found in worlds with similar characteristics.

Certainly this discipline is as fascinating as it is novel, which is why the creation of hotbeds that can carry out research that will be critical in the near future is especially important.

Now, astrobiology has a role that goes beyond looking for life outside the earth, in addition, it has a critical role in the decision to consider planets where we could establish colonies to give continuity to humanity. As always, science is based on facts and evidence, therefore, at this time, there is a special emphasis on the so-called exoplanets that are found in what is known as the "goldilocks" strip, that is, planets in around its star that are not too close to it so as not to have a temperature

incompatible with our parameters or that are not too far from it to avoid entering icy conditions.

But let's go in parts, it is possible to mention that exoplanets are any planet that orbits around a star other than our sun, that gives us a huge number of them, however, many of them present unsuitable conditions for our species, for this reason, there is a special interest in finding planets capable of supporting life as we know it. That is why a set of seven planets orbiting around a dwarf star called Trappist-1 aroused great interest, since three of these planets are in the comfort zone capable of supporting life (which was previously mentioned as "goldilocks"), having as a bonus that the planets are of a size comparable to the earth, they are rocky and there is the possibility that some of them harbor water.

In this order of ideas, the news does not stop being generated, it was recently announced that the spectral signature of the phosphine on Venus had been identified, however, its presence has not been confirmed and, until the closing of this book, the investigation and the debate continues. The reason for mentioning this note is that this is precisely how science should be, sharing findings and being able to verify them. Serve this example to share that we are in a historical moment of discoveries and advances where we have the tools and methods that allow us to make discoveries and, as important as this, the power to verify them and, if necessary, reject or confirm them.

Without wishing to be reductionist, but succinct in an effort to speed up the reading of this book, we will touch briefly on the case of extremophiles, which will allow us to cover topics of great interest a little later.

We will begin by conceptualizing the extremophile organisms (cells, plants or animals), as those capable of living in conditions that, as their name indicates, are extreme and could be considered incompatible with the standards of life that we are usually accustomed to, their study has a significant value because it is not possible to recognize what is not known and, if we limit our search parameters for life on other planets to those beings that we commonly see, it is likely that we will go unnoticed many forms of life existing in environments that we consider hostile on a daily basis and sterile. The information presented below regarding the

extremophiles is not intended to be exhaustive, but rather to provide a first approximation so that,

Within the known extremophiles we have some examples such as:

Table 3. Examples of extremophiles.

Extremophile	Environment where they have been found
Anhydrobiotics, Xerophiles	On the ground of the Atacama desert. They do not require water to live or resist desiccation.
Acidophilic	With high acidity, with a pH less than 3.
alkaliphile	In very alkaline environments, with a pH greater than 9.
Anaerobe	It requires very little or no oxygen.
barophile, piezophile	They thrive in environments with very high liquid or gaseous pressures.
halophilic	Very salty.
hyperthermophiles	Capable of proliferating in environments with high temperatures (over 100° centigrade).
Hippolytus	On rocks of cold deserts.
cryptoendoliths	They have been found in deep soil and inside rocks. These organisms are of particular interest due to the hypotheses that point to the possibility that, if there is life on Mars, part of it has taken refuge inside the rocks and crusts of the planet.
lithoautotrophs	In the deep underground. They get their energy from the reduction of mineral compounds.
Metallotolerant	They can develop in environments with high concentrations of metals.
Oligotrophs	They can develop in environments with significant nutrient limitations.
Osmophiles	They thrive in environments with a high concentration of sugars.
psychrophiles, psychrotolerant	They can develop in environments with very low temperatures below -15° Celsius.
Radiophilic, Radioresistant	They thrive in environments with high levels of radiation.
thermophiles	Capable of proliferating in environments with high temperatures (more than 40° and less than 100° centigrade).

Certainly these are only some of the most well-known extremophiles, however, for the sake of being succinct, we are going to consider one of the most extraordinary beings in the world due to its characteristics (and certainly, also one of

the most beautiful), we refer to tardigrades, also known as water bears.

There are different discussions regarding whether water bears can be classified as extremophiles since extremophilic microorganisms are considered as those that require extreme values of physical and/or chemical factors for their optimal growth that are considered unfavorable for most beings. alive we know. That is, they are microorganisms that develop in extreme environments, characterized by hostile conditions for the life of other organisms. However, there are also microorganisms that tolerate extreme conditions, but do not require them for optimal development; are the microorganisms extremotrophs, in this case, the tardigrades (water bears). To survive all these conditions, the water bear uses mechanisms such as anabiosis (from the Greek roots ana, backwards and biosis, means of subsistence, which can be translated as a return to vital activity after a period of accidental suspension of it) is the phenomenon in which an organism decreases its metabolism in order to survive environmental conditions. And cryptobiosis when a tardigrade is in a cryptobiotic state, it can withstand environments that are lethal to many other organisms. This is because the "tuns" produced by the body are very hard and resistant to any external agent. And cryptobiosis when a tardigrade is in a cryptobiotic state, it can withstand environments that are lethal to many other organisms. This is because the "tuns" produced by the body are very hard and resistant to any external agent. And cryptobiosis when a tardigrade is in a cryptobiotic state, it can withstand environments that are lethal to many other organisms. This is because the "tuns" produced by the body are very hard and resistant to any external agent.

Developing experiments

One of the experiments developed during the Alpha mission referred to the identification of tardigrades in one of the cenotes visited.

To give a brief vision of how the experiment was integrated, it is possible to see the following, it is important to highlight that this research has the purpose of developing or perfecting the skills of the participants to develop experiments from their design, execution, to the reporting of results.

Qualification. Identification of the existence of tardigrades in the selected cenote.

The methodological design used is briefly described.

Kind of investigation: It is a cross-sectional descriptive observational study.

Variables:
Qualitative type variables.
Variable: Identification of tardigrades.

Shows:
Intentional or convenience non-probabilistic field sampling was performed; considering a cenote located in Yucatan, of the cavern type.
The type of simple or punctual sample was used.

Process:
In the cenote, the samples taken were from left to right and from front to back.
Sampling control and surveillance procedures were followed, as well as preservation and analysis, including:
1.- Labels. The following information was affixed to the test tubes at the time of sampling with waterproof ink:
Cenote from where the sample was obtained;
Sample number, all were taken from left to right and from front to back, coding each zone as I for the shore, B for the center and R for those close to the rock wall at the bottom of the cenotes, remaining as I1. I5, B1,… B3, R1...R5.

When the water and flora samples were taken, the test tubes were immediately corked, labeled and stored in the cooler for preservation.

2.- Field book. All information pertinent to field observations and sampling was recorded, including:

to) Sampling purpose;

b) Location of the study unit selected for sampling;

c) Sampling Method (Manual);

d) Collection date and time;

and) Identification of the sample collector(s);

F) Distribution and method of transportation of the sample;

g) References such as maps or photographs of the sampling site;

i) Field observations and measurements;

i) Signatures of the personnel responsible for the observations.

Sample Preservation:

The samples were kept during the time of the analysis and 72 hours later they were poured into a pot from the researchers' botanical garden, considering the procedures of biosafety level 1.

Results:

Once the observations have been made, it is possible to share the following findings: In addition to identifying a large number of microfauna, it was feasible to: Identify the presence of tardigrades

Conclusions:

By identifying the presence of tardigrades (water bears) in one of the cenote samples, it allows us to make a contribution to the existing microfauna species in Yucatan and verify that the objective of this part of the mission was achieved.

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