# "CYTHEREAN SEP MISSION: VENUS EXPLORATION"
## A Novel Concept for High Altitude Planetary Atmospheric Exploration.

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***Abstract****-This proposed concept of planetary exploration focuses on the design of three aerial platforms raised as a different research alternative with unmanned ships to carry out studies related to astrobiology, through an Orbiter, a hybrid aircraft, and auxiliary drones; equipped with multispectral cameras, sensors, chromatographs, a spectrometer and a RAMAN to capture relevant data, such as the dark trace that is in the ultraviolet spectrum of possible organic compounds in the upper atmosphere of Venus, and can also take physical samples from the upper atmosphere for analysis in the laboratory on board, contributing to the data of the scientific community that help to solve questions and understand the aspects of thermal, chemical and atmospheric evolution of this planet. A synthetic aperture radar will be used to map the surface of Venus, and it will also have sensors on the thermal shield that will reach the surface after use as a protective shield at the entrance to the high atmosphere of Venus.*

**Introduction:** The present concept of planetary exploration, called CYTHEREAN SEP, aims to provide information to the current unknowns about the reason for the transformation of the planet Venus which led it to a hostile environment and to provide relevant and complementary data to the studies carried out on exploration past missions. Highlighting a research approach on *astrobiological* studies and analysis, leveraging the proposed exploration platforms for complete on-site research of physicochemical processes in Venus' upper atmosphere, which can catalyze organic compound formation processes.

According to recent studies by a team of Russian and American-scientists [1], including Limaye, who is a member of the Venera-D scientific team; detected in the ultraviolet spectrum certain spots in the clouds of the high atmosphere of Venus, which by the way has pressure and temperature conditions similar to those of the Earth at a height between 50 to 60 km, and possibly it is a formation of organic compounds that despite the presence of carbon dioxide, sulfuric acid among other compounds, could develop and survive, this arises considering the existence of complex organic compounds that develop and subsist in extreme environments in the Planet Earth. The planetary research scientific community has sufficient information to understand the origin and composition of dark traces detected in the ultraviolet spectrum, nor do they understand why they have not been mixed with the other particles present in the atmosphere and why they are absorbing ultraviolet light. Missions like Venera detected elongated particles in the high atmosphere of clouds that are about a micron long, partly the width of a small bacterium

**The instrument for meteorological and cartographic analysis:** The morphological study on the surface of Venus is a challenge for the scientific world, since, so far, it has only been possible to have some photographic fragments of places and physiological data of this hostile planet in the science part. Although with the information obtained in past missions, important details of this planet have been obtained.

It is important to note that scientific instruments will be equipped in the mothership and orbiter to obtain more data in various environments and angles of focus.

Name: image spectrum for ultraviolet and infrared radiation.

Main idea: Venusian cloud analysis.

The instrument contains:

- **V28:** The V28 camera uses a 24mm lens; that allows you to take ultraviolet photographs.
- **IF40:** Using to 24mm lens; infrared photographs provide a way to penetrate the cloudy part of Venus.
- **IF41:** Like the IF40, the IF41 features a 24mm lens; but uses a different frequency variation that would provide density and temperature information for cloud formations.
- **EV30:** For a perspective similar to human vision, visible spectrum (focal strait) photographs with a 1000mm lens are used
- **EV31:** Allows visible spectrum photography with an 8mm wide-angle lens for larger amplitude shots.
- **OSI32:** The display of the infrared solar concealment camera allows to possess accurate information about the ambient radiation and temperature of the planet, its design has a lens of 24mm that favors the taking of spectra.

The configurations of scientific cameras give a great contribution to the research since we can work with the information obtained from the Venusian atmosphere around climate changes (drastic), temperature gradients, topography and images in various color scales with great detail of possible discoveries for the scientific world.

- **Gas analysis chamber (RAG):** The explorer will be equipped with a gas analysis system composed of a chromatograph, allowing deep molecular analysis of the various gas particles and aerosols found in the Venus clouds. The gas will be sucked by a turbine where it will enter a ream with corrosion protection (critical deterioration), the chamois has a "diaphragm" mechanism type door thus allowing the closure and opening efficiently, quickly and airtightly.
- After the entire gas analysis process using of the chromatograph, the data will be sent to the analysis facilities attached to Nasa.
- **Navigation cameras:** The unmanned vehicle has 4 cameras for dynamic navigation in the Venus atmosphere since in the field of research Venus has drastic climate changes and are dangers to the vehicle, in its field of view it has an angle of 60 o with the type of wide-angle lens so you can see greater area than linking it to an artificial vision system will allow evading the possible risks to the vehicle.

- **Cloud mapping and weather radar:** The aerial explorer will have weather radar which will allow the mapping of cloud formations; allowing the safe movement of the vehicle, it will also show us the behavior of the atmosphere for further studies and analysis of it.
- **Radioactivity Meter:** The aerial explorer will have the instrument in measurement on the highest and lowest peaks in radioactivity since the planet has critical indices, this radiation is presented even on the planetary surface and thus with the data provided by this team may be raised new hypotheses or knowledge in the area of radioactivity in the field of Venus.

**(SOCSV) Venusian space communication system:** In a space exploration mission communication has a fundamental role for the success of the same, for this case it is proposed to use three types of ships (Orbiter, ASISF, and AVEV), each with its communication instruments to ensure a safe take of data and real-time monitoring for the study of our sister planet Venus.

The ships will have dual-band transponders. These have an X-band transmission and receiver, allowing you to send and receive 8giga Hertz signals, and you will also have another S-band system that handles 2giga Hertz frequencies. On the other hand, a redundant system will be implemented for the mothership and the orbiter, so that it works omnidirectionally and links the ships in case of phenomena or problems during the mission.

The orbiter will be the link between the mothership and the (DSN) Deep Space Network. It will perform a triangulation with trajectory calculated between three points the earth, the orbiter which rotates with Venus taking advantage of its slow cycle of rotation and finally the naves on the surface of Venus.

**Solar cells for afisv, assumptions/goals for the air explorer vehicle:**

| | |
|---|---|
| Power | 10 kW/h SOP<br>7,628 kW/h SOP, assuming 33% worst-case degradation |
| Deployed area (4 wings section) | 48 m^2, assuming 7,628 kW/h SOP |
| Deployed stiffness | > 0,05 Hz |
| Deployed strength | > 0,1 g |
| Specific power | > 120 W/kg SOP |
| Stowed volume | > 40 kW/m^3 |
| Voltage | 100 - 160 V |
| Blanket | Flexible substrate, assuming < 1 kg/m^2 areal density, 0,03" thick |
| Planar vs concentrator | Assuming planar arrays will be used |
| Deployment reliability | Goal: "100%" - Deployment is highest perceived project risk |

**Solar cells for orbiter and protective thermal shield, assumptions/goals for the orbiting vehicle:**

| | |
|---|---|
| Power | 5 kW/h BOL<br>3.8 kW/h EOL, assuming 33% worst-case degradation |
| Deployed area (4 wings section) | 24 m^2, assuming 3.8 kW/h BOL |
| Deployed stiffness | > 0,05 Hz |
| Deployed strength | > 0,1 g |
| Specific power | > 120 W/kg BOL |
| Stowed volume | > 40 kW/m^3 |
| Voltage | 100 - 160 V |
| Blanket | Flexible substrate, assuming < 1 kg/m^2 areal density, 0,03" thick |
| Planar vs concentrator | Assuming planar arrays will be used |
| Deployment reliability | Goal: "100%" - Deployment is highest perceived project risk |

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## References

[1] K. Cooper, «Astrobiology at Nasa LIFE IN THE UNIVERSE,» astrobio.net, 1 Febrauary 2017. [En línea]. Available: (https://astrobiology.nasa.gov/news/could-dark-streaks-in-venus-clouds-be-microbial-life/), .