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Russian mission Venera-D – new conception

Zasova L.V. (1), Zelenyi L.M. (1), Korablev O.I. (1), Khartov V.V. (2), Pichkhadze K.M. (2), Vorontsov V.A. (2), Marov M.Ya. (3), Elkin K.S.(4), Sanko N.F.(1), Voron V.V. (5), Basilevsky A.T.(3), Gavrik A.L.(6), Khavroshkin O.B. (7), A. Skalsky (1), Tuchin A.N. (8), and the Venera-D Team.
(1) IKI RAS, (2) Lavochkin Assoc., (3) GEOKHI RAS, (4) TSNIIMASH, (5) Roscosmos, (6) FIRE RAS, (7) IFZ RAS, (8) IAM RAS, Moscow, Russia. E-mail: zasova@iki.rssi.ru

Abstract

The mission Venera-D is included in the Russian Federal Space Program (2006-2015), being in phase A now. The aim of the mission is investigation of the surface, atmosphere and plasma environment of Venus to understand the formation and evolution of the planet and its atmosphere.

1. Introduction

Venus was actively studied by Soviet and US missions in 60-90-th years of the last century. The investigations carried out both from the orbit and *in situ* were highly successful. After a 15-years break in space research of Venus, the ESA Venus Express mission, launched in 2005, successfully continues its work on orbit around Venus, obtaining the spectacular results. However, many questions concerning the structure and evolutions of the planet Venus, which are the key questions of comparative planetology and very essential for understanding the possible evolution of the terrestrial climate, cannot be solved by observations only from an orbit. Russian mission Venera-D is aimed for both *in situ* and remote investigations of Venus

2. Conception of the mission and scientific goals

This mission includes the lander, orbiter and sub satellite. A current conception of the mission differs from the initial one. The balloon was excluded (it may be realized in the next missions after 2020). Instead a principally new element – a sub-satellite was added to the mission for plasma studies.
Scientific goals of the mission are counted below:
-investigation of structure, chemical composition of the atmosphere, including noble gases, abundance and isotopic ratio;
-structure and chemistry of the clouds;
- study of dynamics and nature of the superrotation, radiative balance, nature of an enormous greenhouse effect;
- study of structure, mineralogy and geochemistry of the surface, search for seismic and volcanic activity, the lightening, interaction of the atmosphere and the surface;
- investigation of the upper atmosphere, ionosphere, magnetosphere, and the escape rate of the atmosphere.

3. Scientific payload

One of the most important element of the mission is the lander. It will land at the surface of Venus after more than 30 years-gap (the last landing on the surface of Venus - VEGA1-2 - took place in 1985). The complex of experiments is aimed to measure the light and noble gases and its isotopes abundance, composition, chemistry and microphysics of clouds, PTW, chemical, elemental, mineralogical composition of the surface material, natural radioactive elements, and oxide state of the surface, etc. The proposed set of experiments on the lander includes: GC-MS, PTW (meteo), nephelometer and the particle sizes spectrometer, optical package, active gamma spectrometer, Mossbauer spectrometer, MTDL (Multichannel Tunable Diode Laser Spectrometer), LIPS (Laser-Induced Plasma Spectrometer), TV-complex, containing panoramic, high resolution and descending cameras.
The complex of experiments on the orbiter includes, among the others, several spectrometers in the spectral range from UV to MM, the mapping spectrometers, monitoring camera and the plasma package. Sub-satellite is aimed for joint plasma investigations, simultaneous measurement with plasma instruments on orbiter. Orbiter is planned to be inserted on the one day polar orbit. Landing site is preliminary chosen as one of tesseras, the oldest areas, where non- basaltic material may be found, existing before the period of high volcanic activity around 700 million years ago.

4. Conclusion

Successful realization of the project Venera-D will allow to solve the important scientific problems of comparative planetology, to understand why do Venus and Earth (sister-planets), similar in many aspects, being formed at similar conditions in the protoplanet disc, evolved by such a different way.

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