

BIJAYAN VENUS: TERRAFORMING MISSION

Concept Note | Web: iarc.res.in/bijayan

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SYNOPSIS

Bijayan Venus will be a nano-spacecraft sent to Venus by 2030. Bijayan will inject an assortment of microorganisms (non-pathogenic, primarily extremophiles) in the Venusian atmosphere with the primary aim of initiating terraforming of Venus.

Bijayan comes from two Sanskrit words, *bij*, seed + *ayan*, journey; it is the journey of the seed.

Bijayan Venus Mission is primarily a demonstration of intent.

NANO SPACECRAFT

Bijayan Venus will be a nano-spacecraft (lower limit, 3kg and upper limit, 10kg) built at facilities in Mumbai and Surat, India.

Bijayan Venus will be launched as a payload aboard a traditional rocket. However, as it is a nano-spacecraft other options such as space-based launch systems are being considered. The final values for the orbit and mass of the nano-spacecraft will be based on configuration of microbe payload.

Note - A traditional spacecraft (100-200 kg) will be simultaneously designed. This is to factor-in the possibility that the orbital transfer mechanism for the nano-spacecraft is not figured out by 2022. The main impact foreseen in this scenario is budgetary in nature.

SELECTION OF MICROORGANISMS

Microorganisms (non-pathogenic) will be selected specifically keeping in mind the atmospheric composition of Venus; most of these microorganisms will be extremophiles.

MARKING OF MICROORGANISMS

The possibility of Venus harboring indigenous microbial life is very unlikely although there is an ever so slight chance of an interesting precursor chemistry at work (Venus is classified as COSPAR, Category II object).

Microorganisms that will travel on-board Bijayan will be genetically marked.

Hence, future sample missions will be able to ascertain their identity and differentiate them from any possible indigenous Venusian life forms. In addition, the spectral signatures of these microorganisms will be studied and noted before launch.

INJECTION

Bijayan Venus will inject microbes within the Sphere of Influence (SOI) of Venus.

The injection will be undertaken through a timed spray-trap mechanism while the nano-spacecraft is in Venusian orbit (in case, Venusian orbital insertion is opted for and achieved) and or through an empty-tank-at-once decision. In either case, the microbes will get delivered to Venusian atmosphere.

SURVIVAL ON VENUS

It is presumed that Bijayan microbes will survive on Venus, and perhaps thrive as well. This can be ascertained by future sample investigations and perhaps by spectral signatures as well.

FOLLOW-UP MISSIONS

Bijayan Venus 1 Mission is primarily a demonstration of intent. Similar follow-up missions – based on learning of Bijayan Venus 1 - will be sent to Venus.

FUNDING

Primary projected allocation is USD 250,000. The funds for the mission will be primarily raised by Indian Astrobiology Research Foundation (IARF).

ANNOUNCEMENT OF OPPORTUNITY (AO)

Announcement of Opportunity (AO) will done in 2019 across various aspects of the mission.

MISSION CHALLENGES

Primary Challenge: Orbital transfer of the Nano-Spacecraft to Venus

Secondary Challenge: Survivability of Microbes en route to Venus

TEAM

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