Announcement of Opportunity (AO) to international science community for Space-Based Experiments to Study Venus

ISRO solicits proposals in response to this Announcement of Opportunity call for science payloads on its planned Venus mission, scheduled for mid-2023 launch.

1. Introduction

Solar system studies have seen a remarkable growth in the last few decades, due to advances in space technology, observational capabilities and computational technologies. This has enhanced our knowledge and understanding of the diversity of complex processes across the Solar system. Planetary exploration provides opportunities to find clues to the origin and evolution of planetary systems and how they are different or similar to each other.

Venus is often described as the "twin sister" of the Earth because of the similarities in size, mass, density, bulk composition and gravity. It is believed that both planets share a common origin, forming at the same time out of a condensing gas cloud around 4.5 billion years ago. Since the 1960s,Venus has been explored by flyby & orbiter missions, a few lander missions and atmospheric probes. In spite of some progress in exploring Venus at recent times, gaps existsin our understanding about its formation, spin, surface evolution and runaway greenhouse phenomenon. surface/sub-surface features and processes, super rotation of Venusian atmosphere and its evolution and interaction with solar radiation/solar wind.

2. Broad research areas of interest

- Surface/sub surface features and re-surfacing processes
- Atmospheric Chemistry, dynamics and compositional variations
- Interaction with solar radiation/solar wind

3. Details of Satellite

The payload capacity of the proposed satellite is likely to be ~100 kg with ~500W of power. The proposed highly inclined orbit is expected to be around 500x60,000 km around Venus. This orbit is likely to be reduced gradually, over several months to a lower apoapsis. However

these values are likely to be tuned based on the final spacecraft configuration.

4. Objective of the AO

This Announcement of Opportunity (AO) for Space-Based Experiments to Study Venus is open to international scientists from the Space Agencies/ Research Laboratories/Academic Institutions/Universities. Proposals are solicited from International Scientific Community for novel space based experiments to study specific areas of science interest on Venus. This AO has a specific objective to identify important science experiments that strengthens / complements overall science from the suite of pre-selected proposals from India (listed in Annexure -A) on ISRO's Venus mission.

5. Experimental categories

S.No	Categories
1.	Surface/Subsurface
2.	Atmosphere(Chemistry/Dynamics/ Structure)
3.	Ionosphere
4.	Plasma
5.	Sun-Venus Interaction
6.	Others (Specify)

6. Eligibility Criteria:

Proposers are expected to be currently involved in planetary exploration studies / the development of science instruments for space / willing to develop space worthy experiments and have access to associated facilities for test and instrument calibration.

Each proposal shall clearly identify a Principal Investigators (PI) and a Funding Agency for the proposed Instrument. The Principal Investigator of the proposal should be capable of (i) providing necessary details of the instrument which can address proposed scientific problems and (ii) assembling a capable instrument team and lead the team to deliver a space-qualified instrument.

7. Modes of Collaboration:

Collaborations with teams from India on the design and development of instrument hardware, science modelling, simulations and joint calibration activities are strongly encouraged. Sharing science data, interpretation of results are envisaged to result in joint publications.

8. Submission of the proposal:

All proposals should be submitted through respective space agencies/Institutions/Research Laboratories and must be signed by an official authorised to certify and support the sponsorship of the investigation and the management and financial aspects, on behalf of the space agency/institution/research laboratory.

The proposal is to be submitted in the specified format given in Annexure-B. The summary table given in Annexure-C must also be filled. The complete proposal with all the relevant details to be submitted through the Head of the institution (send the advance copy in word and the signed pdf copy by email/post) to :

Director,
Space Science Programme Office,
ISRO HQ, Antariksh Bhavan,
New BEL Road,
Bangalore-560231
Email: sspo@isro.gov.in **Sub:** Attn: Venus AO

Proposals are accepted until midnight (IST) of Dec 20, 2018. A confirmation of receipt of the proposal will be provided. Questions and clarifications canbesend to the above email address.

9. Selection process:

Proposers who satisfy the eligibility criteria and whose proposal is recommended for further consideration by the ISRO selection committee will be contacted by the Space Science Programme Office. An Implementation arrangement may have to be signed between ISRO and

respective Space Agency/ Research Laboratory/Academic Institution/University after the final selection of the payload.

Special Notes:

1. There will be no exchange of funds between agencies for the international proposals.
2. Additional changes / modifications (if any) in the proposalsubmissionprocess (prior to submission deadline) willbe made visible on the ISRO website. Proposing teams are expected to regularly check the website for additionaldetails and updates.
3. More details onpayload interfaces with spacecraft will be discussed after shortlisting of payloads.
4. Scientific experiments to be conducted by selected payloads shall not be allowed to carry any chemical or nuclear substances, biological samples that are prohibited by the COSPAR guidelines on planetary protection.
5. It shall be ensured by the PIs of the selected payloads, that any/all experiments proposed to be conducted onboard Indian mission shall not result in any harmful contamination of the outer space environment.
6. The selected payloads shall be designed and fabricated by adhering to the space debris mitigation guidelines prescribed by ISRO.
7. ISRO reserves the right to cancel the AO call anytime, choose not to select any payload under this AO call and shall not be held liable.

The format for preparation of proposal is given in Annexure-B.

The summary table is given in Annexure-C.

The last date for receiving the proposal is 20 December 2018.

Annexure-A

Primary Payloads from India

S. No	Title
1.	S-Band Synthetic Aperture Radar (SAR)
2.	Advanced Radar for Topside Ionosphere and subsurface sounding
3.	Ultra Violet (UV) Imaging Spectroscopy Telescope
4.	Thermal Camera
5.	Cloud Monitoring Camera
6.	Venus Atmospheric SpectroPolarimeter
7.	Airglow photometer
8.	Radio Occultation Experiment
9.	Ionospheric Electron Temperature Analyser
10.	Retarding Potential Analyser
11.	Mass Spectrometer
12.	Plasma Wave Detector (Langmuir Probe, Electric Field Sensor and Magnetometer)

Annexure-B

Proposal Preparation Format

1. Cover Page should include the following:
    - Complete Title of the Proposal
    - Nameandaddress of Principal Investigator including e-mail and telephone number
    - Name of Co-PIs, their address, e-mails etc.
    - Original signed hard copy of the cover page should be submitted

2. Executive Summary of the proposal (~Two A4 size pages in 12 point font)

    (A brief description of the proposal stating the broad scientific objectives and specific aims of the proposed work. It should include a concise description of instrument design and methods for realising the hardware and software components)

3. Science objectives including statement of hypothesis and how it will be addressed

4. Basic concept and description of the payload instrumentation (include line diagrams or schematic) with details on measurement procedure.

5. Description of heritage and past experience in payload development, if any

6. Broad specifications of the payload/experiment including dimensions, weight, power, parameters to be measured (including measurement accuracies), data rates etc.

7. Anticipated new technology development to realise the payload and back up strategies in the event of non availability of the expected technology

8. Design approach and specifications, development process, test, evaluation and calibration procedures

9. Development strategy -Technical Readiness level-4 and above

10. Traceability matrix of science goals to instrument specifications

11. Plans for data processing, management and archival

12. Description of requirement for post-launch ground operation support, if any.

13. Any special requirement of payload interfaces from spacecraft

14. Time schedule

15. Mode of participation in the final integration, testing, calibration and checkout at U. R. Rao Satellite Centre, Bangalore, India

16. Complete list of names, with affiliation and e-mail addresses of the Co-Is with specification of their expertise and roles in the Payload development

17. Delivery of the payload to ISRO should be by June 2022.

Annexure-C

Summary Table

1.	Title of Payload Proposed		
2.	Principal Investigator and official designation		
3.	Category (see section 5)		
4.	Science objectives		
	i. Unique science		
	ii. Extension/ Improvisation to the previous findings		
5.	Technical Aspects of the payload		
	i. Mass (kg)		
	ii. Raw Power (W)		
	iii. Volume (mm x mm x mm)		
	iv. Parameters to be measured		
6.	Science Data		
	i. Storage requirements per orbit from S/C		
	ii. Data generated per orbit		
	iii. Latency		
7.	Requirements from S/C		
	i. Orbit preferred (acceptable range)		
	ii. Attitude requirement		
	iii. Pointing requirement		
	iv. Mounting requirement (if any)		
	v. Field of View (FOV) requirements		
	vi. Contamination requirements (if any)		
	vii. Grounding requirements		
	viii. Temperature control required (YES/NO) If yes, details thereof		
	ix. Telecommand and health monitoring requirements		
8.	Schedule – delivery time frame	Qualification Model	Flight Model
9.	List of non-space grade and non-radhard components		
10.	Any other specific requirements		