EnVision: Undestanding why Earth's closest neighbour is so different. T. Widemann[1], R.C. Ghail[2], C. F. Wilson[3], D.V. Titov[4], W. S. Kiefer[5], B. Campbell[6], S. Hensley[7], A. Le Gall[8], E. Marcq[8], J. Helbert[9], D. Breuer[9], A. C. Vandaele[10], L. Bruzzone[11], V. Ansan[12], C. Dumoulin[12], P. Rosenblatt[12], G. Komatsu[13], F. Bovolo[14]. [1]Paris Observatory, Meudon, France; [2]Royal Holloway, University of London, UK; [3]University of Oxford, UK; [4]ESA-ESTEC, Noordwijk, Netherlands; [5]Lunar and Planetary Institute, Houston, TX; [6]National Air & Space Museum, Wash. DC; [7]Jet Propulsion Laboratory, Pasadena, CA; [8]LATMOS, IPSL, France; [9]DLR Institute of Planetary Research, Berlin, Germany; [10]Royal Belgian Institute for Space Aeronomy, Belgium; [11]Università di Trento, Italy; [12]LPG, Nantes University, France; [13]CICT, Fondazione Bruno Kessler, Italy.

Introduction: EnVision [1,2] is a Venus orbiter mission proposal that will determine the nature and current state of geological activity on Venus, and its relationship with the atmosphere, to understand how and why Venus and Earth evolved so differently. EnVision is one of three competing ESA M5 mission concepts currently in their study phase (A1-A2) with a final down-selection expected in 2021. The EnVision mission is studied in collaboration with NASA, with the potential sharing of responsibilities currently under science, technical and programmatic assessment.

If selected, the proposed international mission will launch in 2032 on Ariane 62. Following orbit insertion and periapsis walk-down, orbit circularisation will be achieved by aerobraking over a period of several months, followed by a nominal science phase lasting at least 6 Venus days (4 Earth years).

EnVision will use a number of different techniques to search for active geological processes, constrain style and occurrence rate of current-day volcanism on Venus, by searching for thermal, morphological and volatile signatures in repeated observations of the surface and of the atmosphere. It will characterise regional and local geological features, determine crustal support mechanisms and constrain mantle and core properties:

The **Synthetic Aperture Radar, VenSAR**, will address the key science objectives of the EnVision mission. It will:

- Obtain images at a range of spatial resolutions from regional coverage to images of targeted localities;
- Search for changes in surfa&ce radar imagery;
- Measure surface topography regionally by means of stereo radar imaging; and globally by means of nadir altimetry;
- Characterize surface polarimetric reflection and emission properties using both SAR and radiometer measurements.

The **Subsurface Sounder, SRS,** will be the first instrument to investigate the subsurface structure of Venus and acquire fundamental information on subsurface geology; it will:

- Characterize the vertical structure and stratigraphy of geological units including volcanic flows; and
- Determine the depths of weathering and aeolian deposits.

The **Venus Spectrometer suite, VenSpec,** will:

- Obtain global maps of surface emissivity in five wavelength bands in the near-infrared to constrain surface composition and inform evolution scenarios [3]; and
- Measure variations of SO_2, SO and chemically-related gaseous species in the mesosphere and nightside troposphere, in order to link these variations to atmospheric dynamics, chemistry and volcanism.

The **Radio Science** experiment will:

- Constrain crustal & lithospheric structure at finer spatial scale than Magellan;
- Measure spin rate and spin axis variations to constrain interior structure; and
- Measure spatial and temporal variations of H_2SO_4 liquid and vapor at 55-35 km.

EnVision will produce a huge dataset of geophysical data of a quality similar to that available for Earth and Mars, and will permit investigation across a large range of disciplines. Lab-based and modelling work will also be required to interpret results from the mission. We therefore invite scientists from across planetary, exoplanetary and Earth science disciplines to participate in the analysis of the data.

References:

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