EnVision: Understanding Why our most Earth-like Neighbour is so Different

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Venus is our most Earth-like twin, from a geological standpoint: it is very similar in size and probably in bulk composition, and it is very likely to be geologically active today. Several Venus Express observations hint at active volcanism, including transient increases in thermal emission and high surface emissivities consistent with fresh lava flows, as well as episodic injections of sulphurous gases to the upper atmosphere.

The science case is broad: to measure current volcanic, seismic, atmospheric and climatic activity; deduce its geological history to understand how and why Venus and Earth became so different; identify volatile sources and sinks; and infer its interior structure and dynamics.'

EnVision therefore has four major science themes:
• Activity (volcanism, tectonism, mass wasting, weathering, sedimentation, volatile sources and sinks)
• History (stratigraphy, past environments, ancient terrains, signatures of past oceans, climate change)
• Volatiles (water, sulphur dioxide, clouds, volcanic gases, dynamic processes)
• Planet (geodesy, spin, organisation, tectonics, internal structure and long-term evolution)

and three main instruments:
• VenSAR, the primary synthetic aperture radar
• SRS, the subsurface radar sounder
• VenSPEC, the Venus IR emission mapper, IR and UV spectrometer

which combined with radio science using the 3 m X- and Ka-band high gain antenna. Together, these will provide an unprecedented view of the interior, surface and atmosphere of Venus.

The Phase 0 baseline study demonstrated that the mission can successfully achieve its targets within the design to cost envelope, for a baseline launch date in 2032 using chemical propulsion and 12 to 24 months aerobraking. The nominal science mission starts in June 2035, with four Cycles (one Cycle is a 243-day Venus day) providing 278 Tbits of data return. Coverage is >60% for IR mapping and subsurface sounding, and >15% for InSAR and polarimetry at 30 m resolution. Up to 2% of the surface will be imaged at ∼2 m resolution or better.

EnVision is one of three M5 missions in Phase A study with a final down-selection expected in June 2021