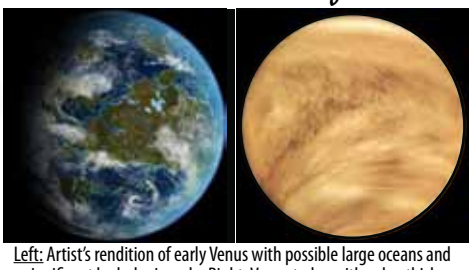
Venus Mobile Explorer

fact sheet

Mission Concept Study Report to the NRC Decadal Survey
Inner Planets Panel • December 18, 2009
Concept Maturity Level: 4 • Cost Range: Low End Flagship
GSFC • JPL • ARC

Nominal Mission:

- Atlas V 551 Short Fairing Launch Vehicle
- Type II trajectory
- Launch on 5/27/2023
- Venus fly-by 10/27/2023
- Landed science 2/15/2024
  - atmospheric chemistry
  - surface chemistry in 2 locations
  - 8 - 16 km aerial imaging traverse



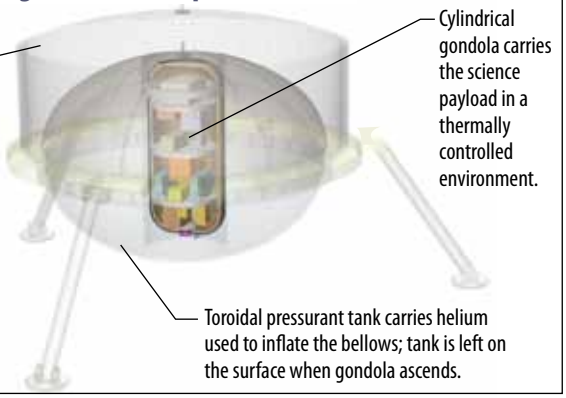
Left: Artist's rendition of early Venus with possible large oceans and a significant hydrologic cycle; Right: Venus today with a dry, thick CO_2 greenhouse atmosphere resulting in surface temperatures of 450°C and pressures in excess of 90 bar.

Mission Driving Science Objectives	Measurement	Instrument	Functional Requirement
Determine the origin and evolution of the Venus atmosphere, and rates of exchange of key chemical species between the surface and atmosphere	In situ measurements of Noble gas isotopes, trace gas mixing ratios and trace gas isotopic ratios	Neutral Mass Spectrometer (NMS) combined with Tunable Laser Spectrometer (TLS)	In situ sampling of the atmosphere as functions of altitude and time
Characterize fundamental geologic units in terms of major rock forming elements, minerals in which those elements are sited, and isotopes	Identify mineralology and elemental chemistry of surface rocks in 2 locations separated by > 8 km	Laser Raman/Laser Induced Breakdown Spectrometer (LIBS)	Land in 2 locations, ~2 m path-length for compositional observation; stable platform for measurement duration
Characterize the geomorphology and relative stratigraphy of major surface units	Airborne near IR imaging along a transect ~8 km in length, at < 5 m spatial resolution	Near infrared (~1.1 micron) imager (FOV TBD, and SNR > 100)	Near-surface aerial mobility; >45° solar incidence, contiguous images of the surface during aerial traverse; 5 hour near surface operational lifetime

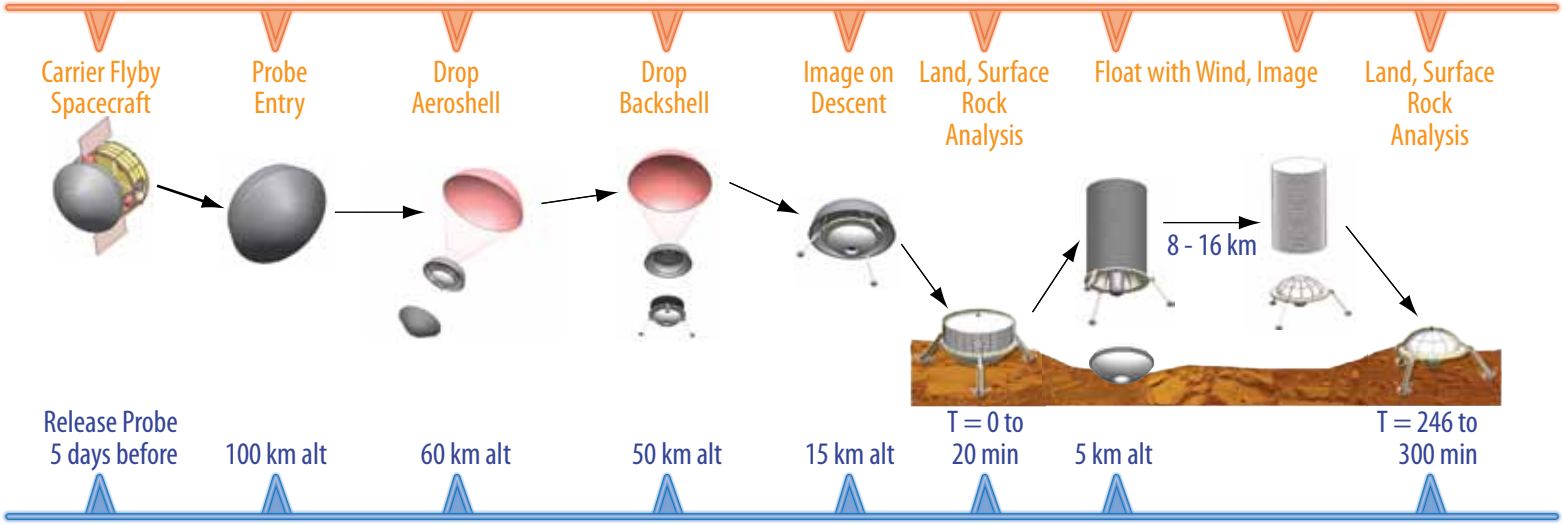
Lander Aeroshell (Cruise Configuration)

The innovative compact design of the science payload into a central cylinder surrounded by a toroidal pressurant tank and capped by the metallic bellows, allows the VME to be accommodated in an accepted aeroshell geometry.

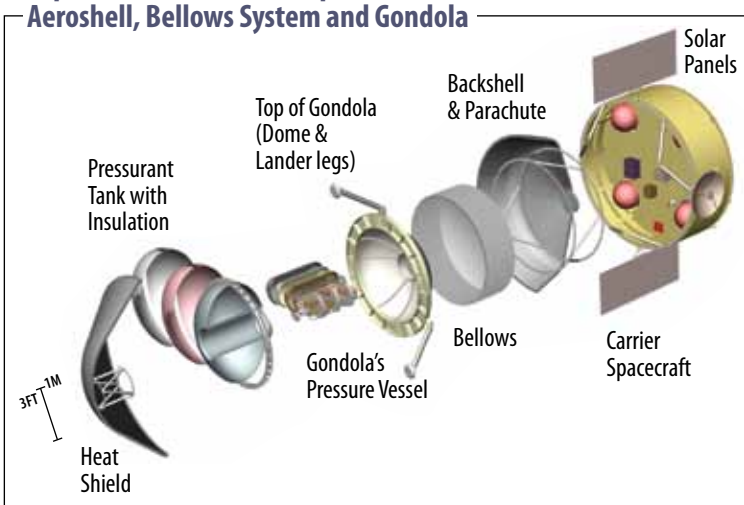
Gondola in Landed Configuration (Transparent View)



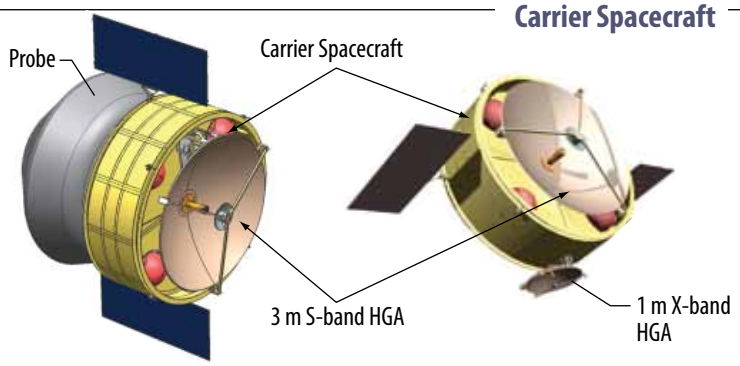
Probe timeline illustrates configuration changes throughout science mission duration, Wind drives the neutrally buoyant aerial traverse.



Exploded view of Carrier Spacecraft, Aeroshell, Bellows System and Gondola



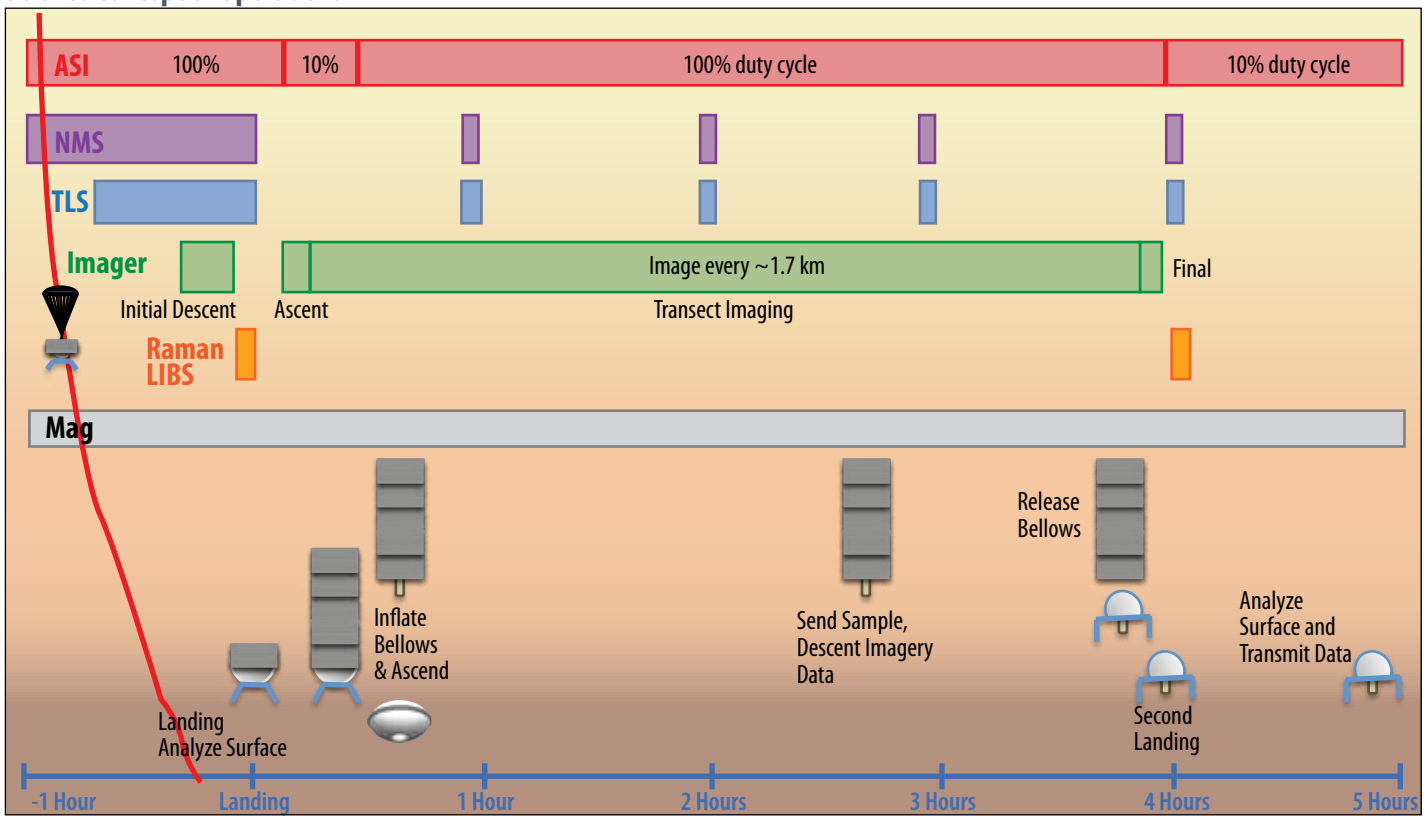
Carrier Spacecraft



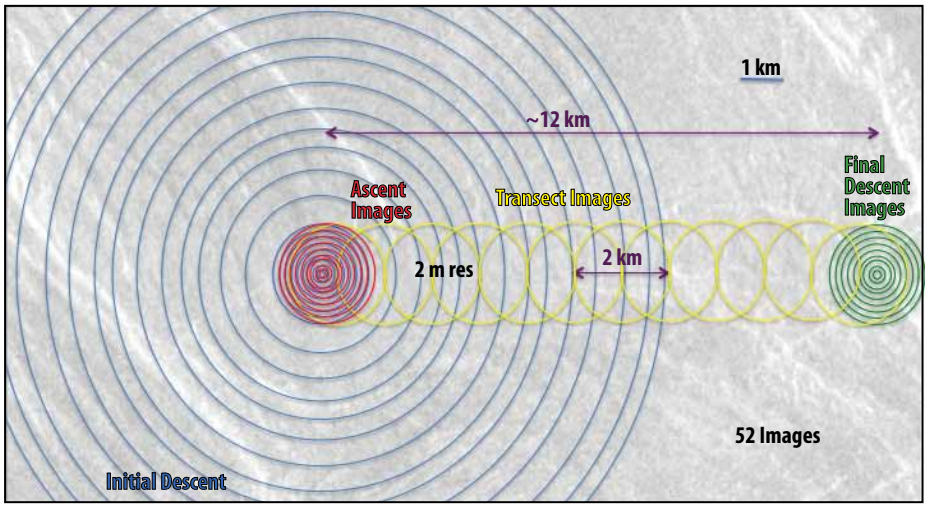
Carrier Telecom

Antenna	Wavelength	Purpose
3 m HGA mesh	S-band	Probe to Carrier uplink
2 omni-directional	X-band	Carrier to Earth contingency
1 m HGA solid	X-band	Carrier to Earth Science

Science Concept of Operations



ASI = Atmospheric Structure Investigation; Mag = Magnetometer



Nominal example of imaging sequence assuming ~12 km aerial traverse. IR Images are taken on initial descent from 15 km to the surface (blue), on ascent (red), as the gondola floats with the wind under the bellows (yellow) and on final descent (green), collecting 52 images.

Mass Breakdown

Component	CBE [kg]	Allow [%]	Max Mass [kg]
Lander	1390	30%	1782
Lander Science Payload	31	30%	41
Lander Subsystems	469	30%	609
Mechanical/Structure	270	30%	351
Mechanisms	51	30%	66
Thermal	113	30%	147
Other	34	30%	44
Bellows	890	30%	1132
Aeroshell	876	30%	1139
Spacecraft	846	30%	1100
Satellite *(S/C + Probe)* Dry Mass	3112	30%	4021