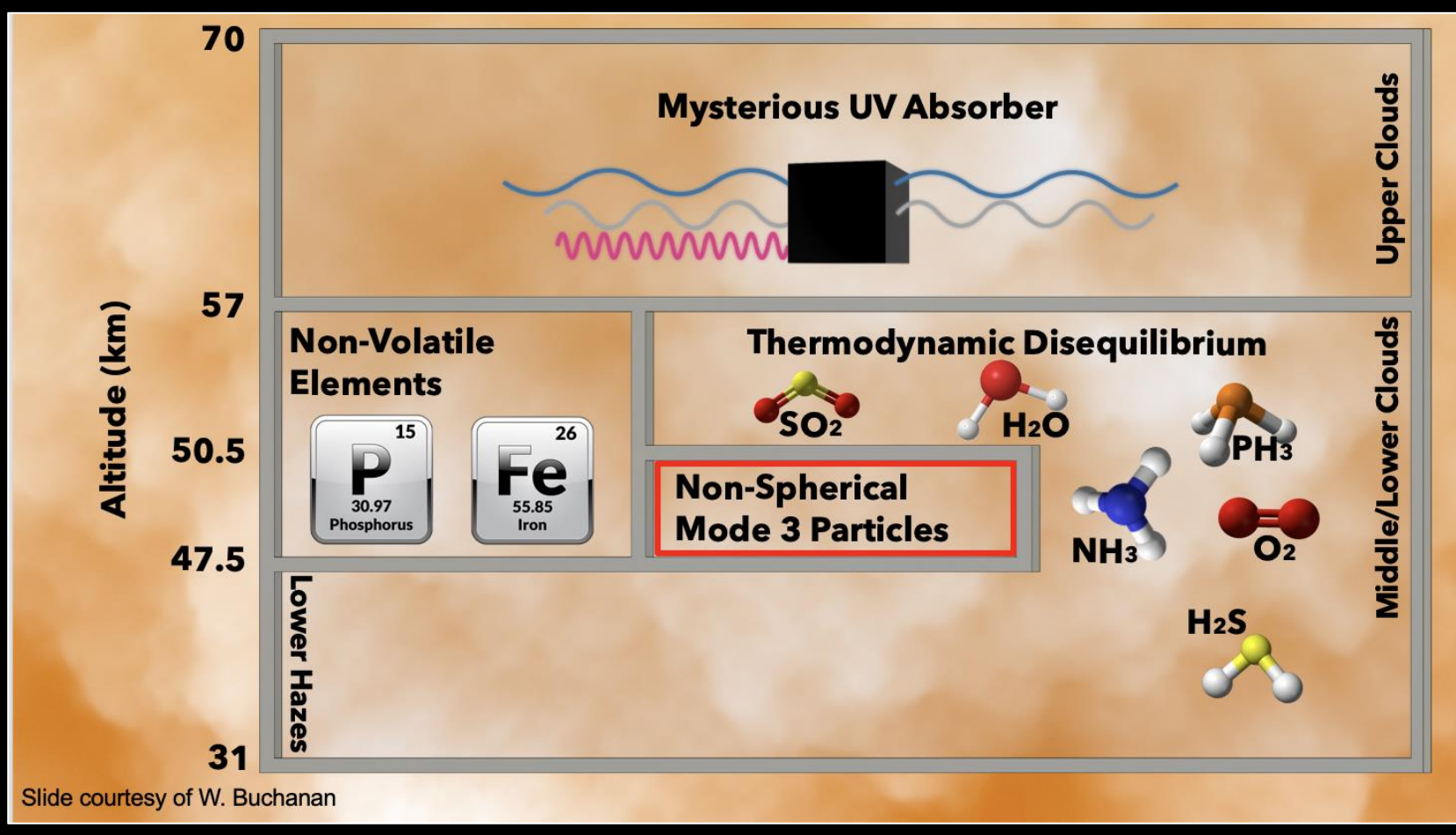


Venus Atmosphere and Cloud Particle Sample Return for Astrobiology

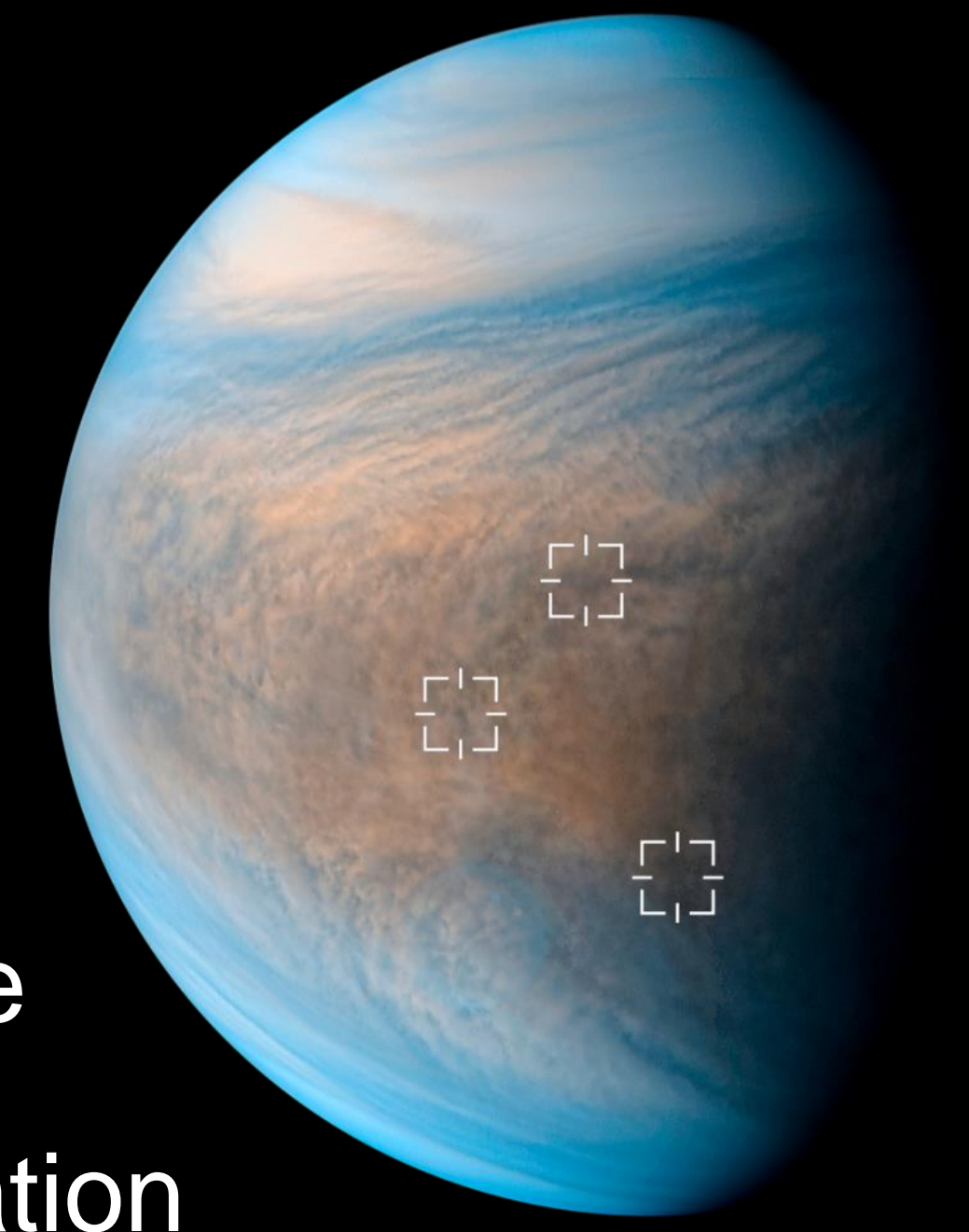
Lingering mysteries in the cloud layers



Venus might be inhabited by microbial lifeforms in the clouds

Why sample return?

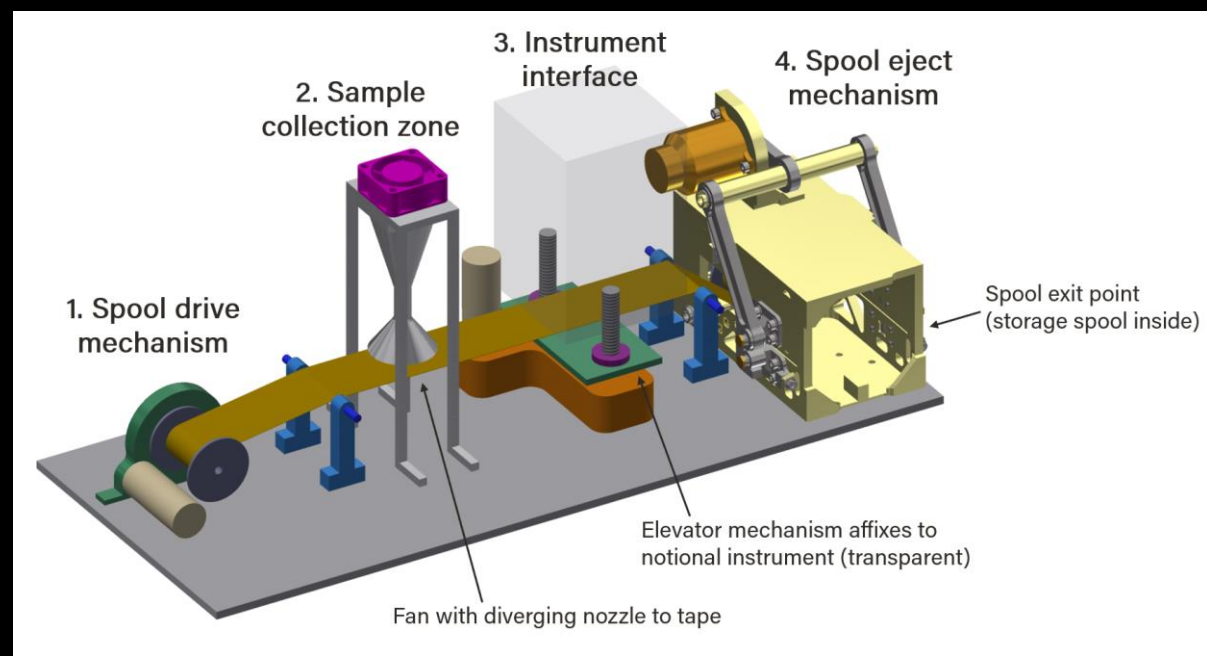
- Enabling unambiguous detection of life
- Sophisticated analysis on Earth
- Opportunity for high-risk, high-reward science
- Technology applications for planetary exploration



Phase I Goal: Determine feasibility and concept maturity of following four critical flight systems

Solid Particle Capture

- Capture down to 0.2 μm particles
- Inertially impacted particles collected and stored on a spooled “sticky” tape
- Gold coated tape considered
- Get rid of sulfuric acid liquid from sample

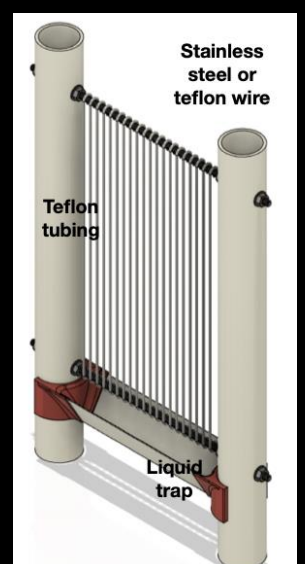


Gold witness plates

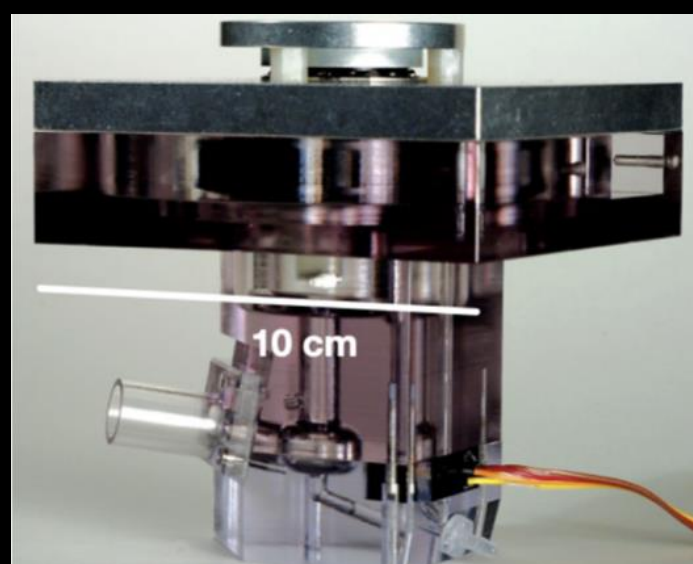
Spool tape sampler concept

Liquid Particle Capture

- Low-power active collector based on commercial products
- Passive “fog-harp” collector
- Work in a sulfuric acid environment



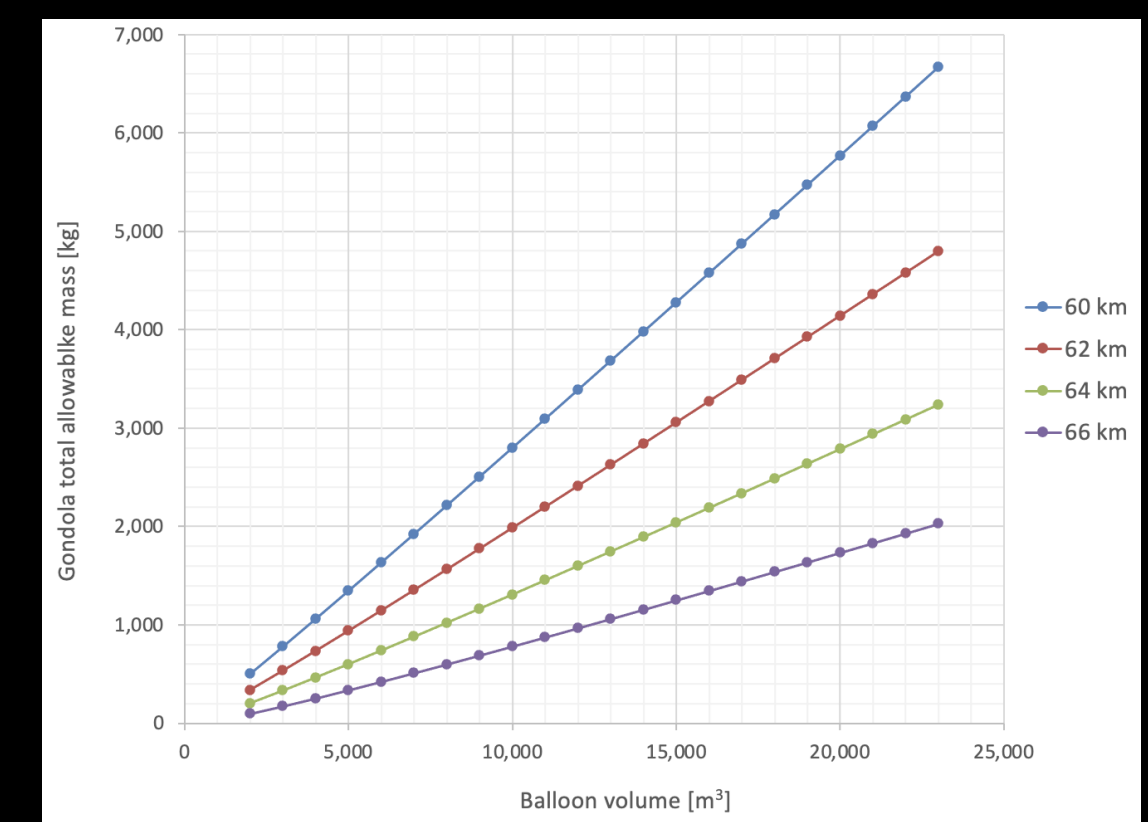
Fog harp concept



Cyclone sampler (representative model, Research International SASS 2400)

Aerial Platform

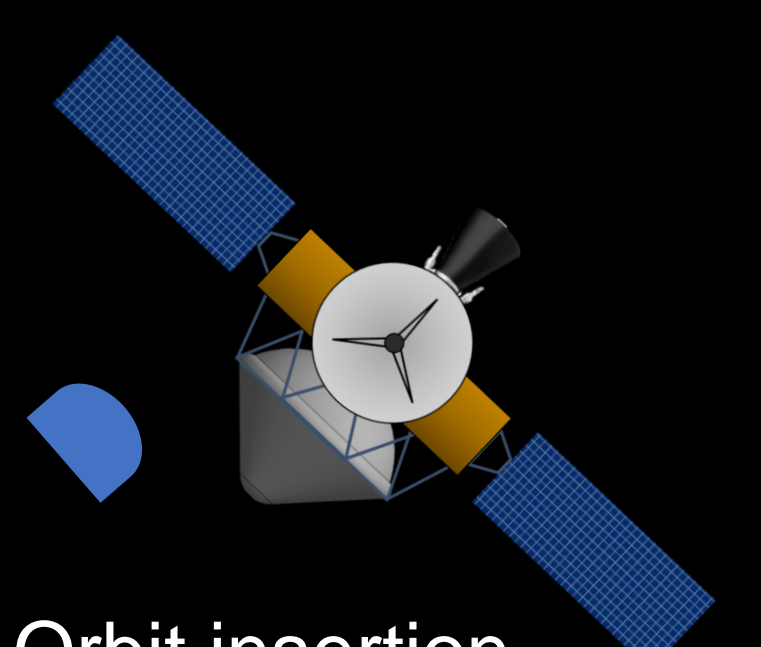
- Controlled ascent from ~48 to ~64 km
- Deployment and inflation during descent
- 35-meter diameter fully extended balloon
- Super-pressure balloon
- Lift up to 2-ton gondola
- Compact stowage



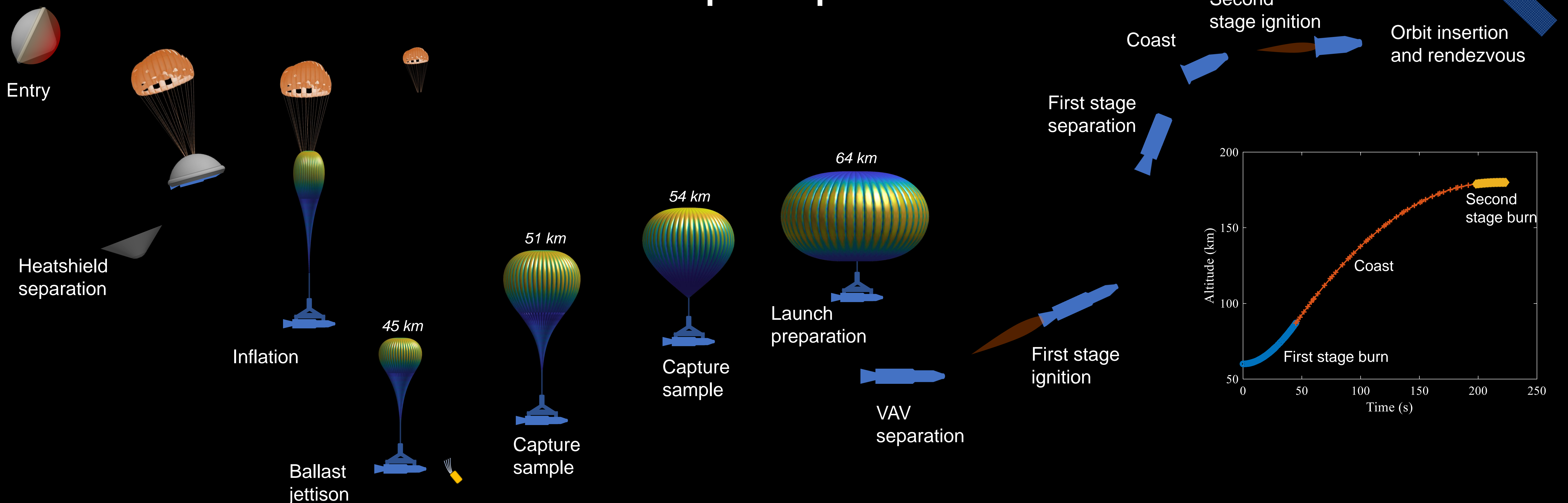
Mass highly dependent on launch altitude

Venus Ascent Vehicle (VAV)

- Transfer sample canister to 300 km orbit
- Two-stage solid propellant leading candidate
- Launch from balloon moving at ~60 m/s
- Potentially turbulent environment with wind gusts and gravity waves
- Attitude determination and navigation are challenging in Venus clouds



Concept of Operations



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