CALYPSO VENUS SCOUT. Horzempa, Philip, LeMoyne College (Syracuse, New York; horzempa45@gmail.com).

Introduction: The Calypso Venus Scout is a mobile, low-altitude survey and mapping mission. A unique design allows the science payload to view a significant amount of the surface of Venus from an altitude of 10-25 km. The harsh environment of the planet makes a surface rover or a low-altitude balloon untenable. Venus presents 4X the continental surface area of the Earth. This is a vast territory which would take centuries to explore by landers.

Venus is not an easy place to explore. The key to the viability of this design is the separation of hardware elements. They operate in environments that do not require leaps in technology. The anchor balloon stays at high altitude, obviating the need for metallic bellows that can survive at a temperature of 350C (700F). The whole purpose of Calypso is to allow cameras to venture below the clouds and haze layers of Venus, and get a clear view of the surface.

Mission Overview: The Descent Module ("Bathysphere") will descend on a tether, "skimming" over the terrain below. The deployment gondola is suspended a few meters below the balloon, and reels out the tether to a length of 20-40 kilometers. Solar panels are located along the upper rim of the gondola. At the flotation altitude of 50-55 km, sunshine will provide ample power.

The anchor balloon will be traveling with the winds of Venus. The science module will also be carried along at that velocity, allowing it to conduct a transect of the ground below. The temperature at an altitude of 10 kilometers is 380 C (720F).

The Bathysphere will be well insulated, but the duration of its "dive" is limited by the time required for its interior to reach 150C, the limit of state-of-the-art electronics. Calypso aims to limit technology development and will use available avionics. Allowance needs to be made to guard against the effects of droplets of sulfuric acid. This, however, is a well understood technology challenge.

After being reeled in to the anchor balloon, the science module will cool to 50 C, followed by another deep dive.

Calypso will demonstrate control of the module during deployment, aerodynamic stability at various altitudes, and the ability to collect meaningful science data.

Payload: Calypso will carry a High-Resolution Imager and a wide-angle Context Camera. Both are crucial to conducting aerial Field Trips. Below the haze layers, the atmosphere is clear. However, Rayleigh scattering will be a factor. As the Bathysphere reaches greater depths, the visible-light cameras will get a clearer view of the terrain below. The Context Camera will provide an overview of a location, with 1-meter resolution. The narrow-angle Hi-Res camera will produce images with a resolution of 1-10 cm.

Further insight will be provided by the near-IR imager. It will allow first-order estimates to be made of the mineralogy, and by inference, lithology. The power of Calypso is that these measurements will not be confined to one or two landing sites. Rather, a large number of targets will be surveyed, allowing access to most of Venus' major geological provinces.

The Gondola will include an engineering camera to monitor the operation of the tether winch. This camera will provide, as a bonus, views of flight within the haze layer. The Gondola could also carry instruments to sample, and analyze, the atmosphere. That bonus science will depend on the funding level.

Future Missions: Block II Calypso vehicles will be able to actively steer, or hover, above a site of interest. Block III vehicles will have the ability to set the Descent Module on the surface for several minutes. This "touch-and-go" operation will allow the collection of samples that can be analyzed at high altitude. During this brief visit, rapid analyses of rocks at the site can be conducted with a Laser-Induced Breakdown Spectrometer (LIBS). Tests have demonstrated that a Venus-specific LIBS instrument will function on the surface. This design also provides a pathway for a plausible Venus Sample Return mission. Soil and rocks can be taken to a waiting Earth-return rocket attached to the high-altitude balloon. There is no need to launch the vehicle from the surface.