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Venus Atmospheric Maneuverable Platform (VAMP) – A Low Cost Pathfinder Mission Concept

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The Northrop Grumman Aerospace Systems and L-Garde team has been developing an innovative mission concept: a long-lived, maneuverable platform to explore the Venus upper atmosphere. This capability is an implementation of our Lifting Entry Atmospheric Flight (LEAF) system concept, and the Venus implementation is called the Venus Atmospheric Maneuverable Platform (VAMP). The VAMP concept utilizes an ultra-low ballistic coefficient (< 50 Pa), semi-buoyant aircraft that deploys prior to entering the Venus atmosphere, enters without an aeroshell, and provides a long-lived (months to a year) maneuverable vehicle capable of carrying science instruments to explore the Venus upper atmosphere.

In this presentation we provide an update on the air vehicle design and a low cost pathfinder mission concept that can be implemented in the near-term. The presentation also provides an overview of our plans for future trade studies, analyses, and prototyping to advance and refine the concept. We will discuss the air vehicle's entry concepts of operations (CONOPs) and atmospheric science operations. We will present a strawman concept of a VAMP pathfinder, including ballistic coefficient, planform area, percent buoyancy, wing span, vehicle mass, power supply, propulsion, materials considerations, structural elements, and instruments accommodation. In this context, we will discuss the following key factors impacting the design and performance of VAMP:

1. Entry into the Venus atmosphere, including descent profile, heating rate, total heat load, stagnation, and acreage temperatures
2. Impact of maximum altitude on air vehicle design and entry heating
3. Candidate thermal protection system (TPS) requirements

We will discuss the inter-dependencies of the above factors and the manner in which the VAMP pathfinder concept's characteristics affect the CONOPs and the science objectives.

We will show how the these factors provide constraints as well as enable opportunities for novel long duration scientific studies of the Venus upper atmosphere that support Venus science goals. We will also discuss how the VAMP platform itself can facilitate some of these science measurements.