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LONG-DURATION VENUS LANDER DEVELOPMENT

Abstract

Abstract: One of the most intriguing planets in our solar system for both solar system and extra-solar system science is Venus. Venus is the planet most similar to Earth in several key ways and many believe Venus-like planets are more common around other suns than are Earth-like planets. Therefore scientific understanding of our sister planet is a high priority. However, the hostile environmental conditions at the surface coupled with thick acid clouds and dense atmosphere have made understanding this planet very challenging. Remote sensing of surface features and near surface environments is very limited. The hostile environment has also limited the ability of landers to survive, in fact the longest living asset survived just over two hours. Even after over 50 years of attempts to explore Venus, many key measurements, especially near the surface, are still in the future.

NASA has begun to undertake steps to overcome the technical challenges and is developing the capability for sustained operations and science return from this important body. For example, recent technology advances in high temperature sensors, electronics, power, and other systems have been funded and this, combined with the new capabilities to replicate Venus conditions on Earth, are changing the outlook for Venus surface exploration.

Through the LLISSE (Long-Lived In-situ Solar System Explorer) project, NASA has begun development of a long-lived Venus surface lander. LLISSE uses high temperature electronics and systems to achieve a planned surface operations life of at least 60 days, over 2 orders of magnitude longer that achieved to date! This long-lived lander will begin tackling temporal science of the deep Venus region, something never before attempted. If successful and flown, LLISSE will provide insight into the atmospheric dynamic processes and perhaps the super rotation phenomena. The current state of LLISSE will be discussed as well as enhancements and future sensors and instruments to expand its science return. The progress to date has spurned detailed mission studies, such as SAEVe (Seismic and Atmospheric Exploration of Venus). Supporting the technology and mission studies is a unique world–class facility. The facility at NASA Glenn Research Center accurately replicates extreme atmospheres and conditions, including conditions found at the surface of Venus. This capability has been used in science experiments and for technology development efforts.