

LONG-LIVED IN-SITU SOLAR SYSTEM EXPLORER (LLISSE)



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LLISSE REFRESHER

- LLISSE is a small and “independent” probes for Venus surface applications
- LLISSE acquires and transmits simple but important science
- Three key elements leveraged
 - Recent developments in high temperature electronics
 - Focused, low data volume measurements
 - Novel operations scheme

LLISSE SCIENCE

- Science Objectives

- 1) Estimate momentum exchange between planet and atmosphere
- 2) Acquire temporal data to update global circulation models
- 3) Quantify near surface atmospheric chemistry variability
- 4) Technology demonstration for more capable future lander missions



- Operations Goals:

- Operate for a minimum of one Venus "daylight period" and day/night transition (~60 Earth days)
- Take / transmit measurements periodically – timed for science need and to maximize transfer to orbiter / data relay

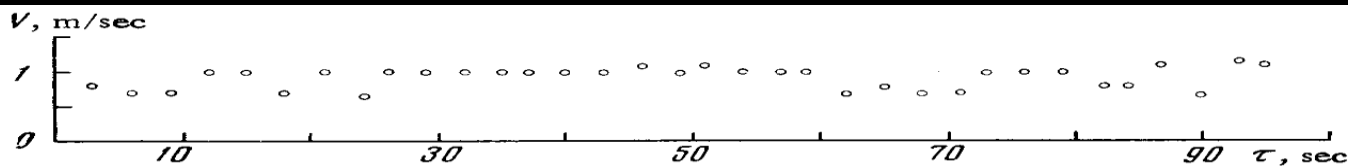


Fig. 5. Measured velocities at the landing site of automatic interplanetary station Venera 10.

Ref: V.S. Avduvskii et al, Measurement of Wind Velocity on the Surface of Venus During the Operations of Stations Venera-9 and Venera-10, Cosmic Research, 1977

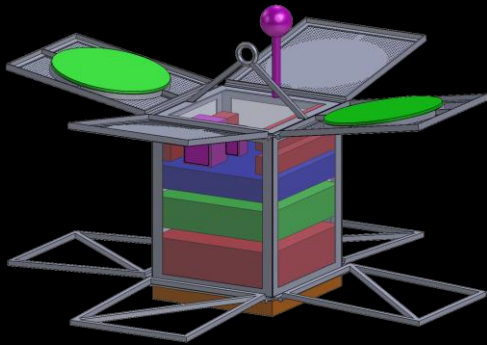
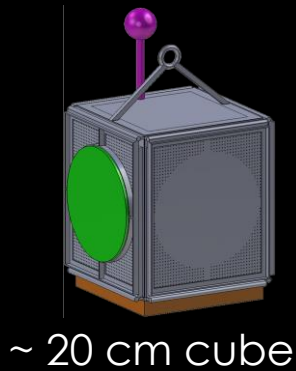
SCIENTIFIC MEASUREMENTS

Current status

- Surface wind speed
 - Orientation (for wind direction)
 - Surface temperature and pressure
 - Near-surface atmospheric chemical composition
 - Solar Radiance (new)
 - Operations Goal:
 - Operate for ~60 Earth days
- (1) Lab version just completed 60 day exposure test
 - Proof of concept in test at Earth ambient conditions
 - Same as (1)
 - Same as (1) - for (SO₂, OCS, HF, CO)
 - Developing requirements and notional design
 - Recent and future tests to be 60 days or longer

CURRENT FOCUS IS ON BATTERY VERSION

- Working parallel paths toward primary battery - down select in 2018
- LLISSE stays dormant during cruise and launch - automatically powers on and begins operations at surface
- Recently conducted assessment of requirements and project documents



Battery Version –
~ 10 kg

PROGRESS ON KEY ELEMENTS

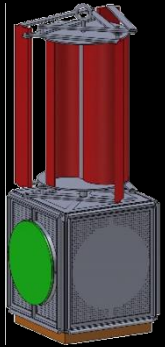
- Development on track

- Latest version of electronics successfully passed 60 day test. Latest IC's over 7x more complex than last test.

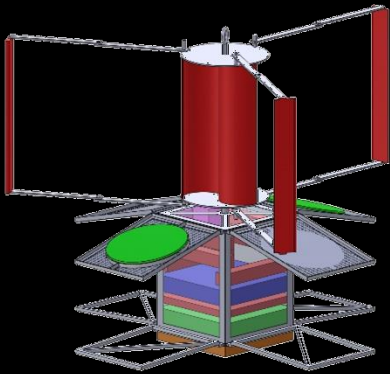
- Nearly all first generation version of high temp sensors successfully passed exposure test

- Primary battery in work – looking to award contract with an industry partner

- Working communication system design and some component testing



Wind Version –
stowed ~ 10 kg



Wind Version –
~ 10 kg

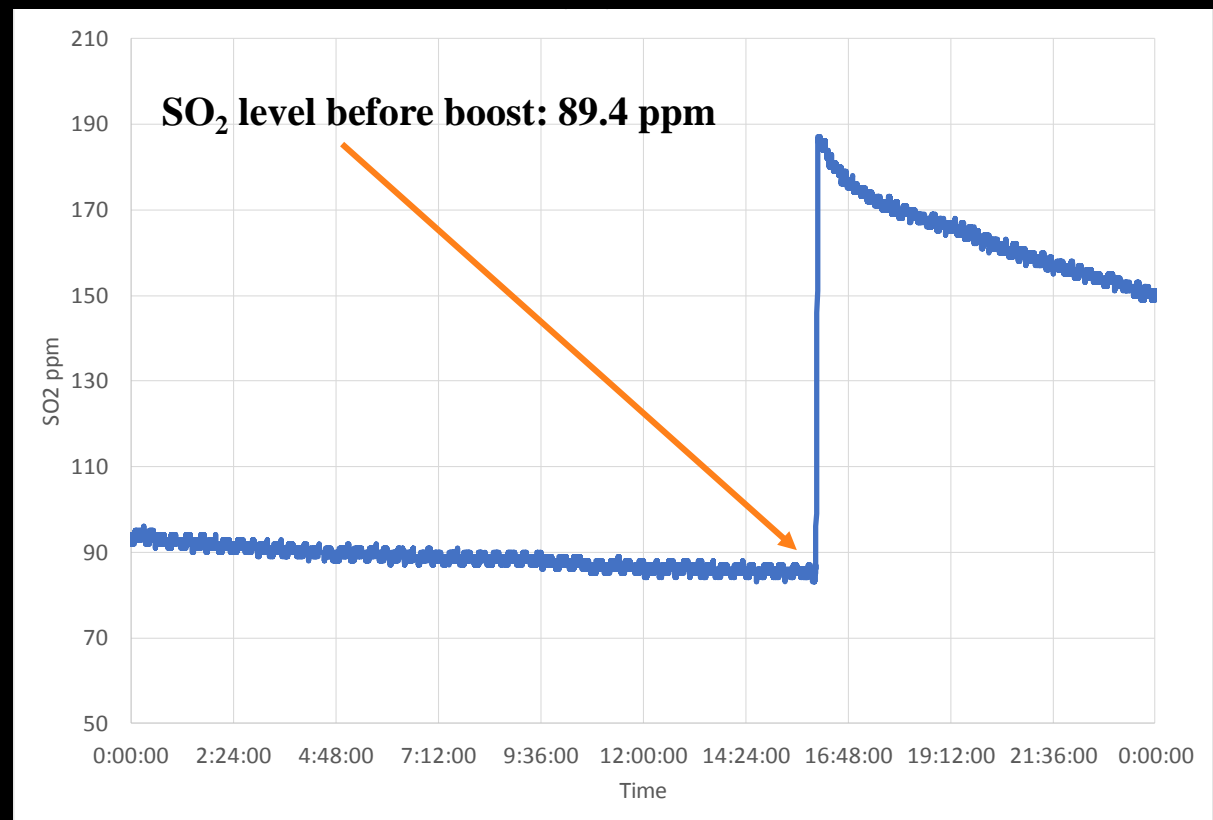
EARLY RESULTS FROM RECENT TEST IN GEER

- **Chemical sensors operational for 60 days in GEER chamber**
- **Planned SO₂ boost into GEER Chamber observed by SO₂ sensor**



Courtesy of D. Makel, Makel Engineering, Inc.

Sensor Array for GEER chamber testing



SUMMARY SCHEDULE

