VICI (VENUS IN SITU CHAMBER INVESTIGATIONS): A SMALL VENUS SIMULATION CHAMBER.
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Introduction: Venus is an hot planet with high surface pressure (~740 K and ~95 bar, respectively) and an atmosphere comprised mostly of CO2 (~96.5%) and N2 (~3.5%) including trace amounts of CO and other reactive gases. To add to this image, it is covered with sulfuric acid clouds. Paradise, it is not. Although Venus is Earth’s nearest neighbor (excluding the Moon) and is very similar in size and mass with the Earth, it clearly followed a different evolutionary path. In order to solve this puzzle it is necessary to explore the planet directly. Unfortunately, the very thick cloud layer limits what can be done remotely and only the USSR’s Venera and Vega programs designed landers to specifically target and survive the surface of Venus. The challenge most often cited for this scarcity of surface probes is the workability/survivability of instruments and equipment in Venus’ harsh environment. As noted by the Venus Science and Technology Definition Team (VSTDT), “[The] key to enabling a Venus Flagship mission is the ability to conduct investigations and tests in Venus simulation chambers.” [1]. It was noted that “pressure and temperature mitigation technologies, whether high temperature electronics or efficient cooling mechanisms, must also be developed to a high level of readiness. Sensors and transducers that operate for long periods under ambient Venus conditions will also be required.”

As a partial solution for these types of investigations, a small pressure chamber (VICI: Venus In Situ Chamber Investigations) was acquired through the auspices of NASA Headquarters in 2009, put through its paces, and advertised for use in 2011. It is housed at Goddard Space Flight Center in Maryland and is available to the general community for short-term high temperature and pressure experiments. Since 2009, several experiments have been run within the chamber for a variety of different goals ranging from testing of small instrument components to actual Venus surface-related experiments (e.g. [2,3], SBIR testing, materials testing) Much has been learned from the early days and this experience has vastly improved operations.

Specifications: VICI is constructed of 316 stainless steel and is able to maintain a steady temperature of 740 K and pressure of 95.6 bar under a Venus simulated atmosphere (typically, 3.5% nitrogen, 150 ppm sulfur dioxide, balance carbon dioxide). The chamber’s interior working dimensions are five inches in diameter with twelve inches of depth. The actual physical volume is slightly less because of space taken up by monitoring sensors. Viewing ports and/or throughputs for data and power are proven options. Running at lower temperatures and pressures than those found at the Venus surface are possible. The software used with the chamber is LabView and records simultaneous temperature and pressure readings as well as a other additional readings as requested/installed by the enduser.

How to gain access. In order to obtain time for the pressure chamber, please contact Natasha Johnson at Goddard Space Flight Center (phone: 301-286-3919 or email: natasha.m.johnson@nasa.gov). We will hold discussions to make the most of the chamber functionality and the proposed project in both design and outcome. Funding is currently only available by proposing through the NASA ROSES opportunities as a targeted project or as part of larger program. VICI is a straightforward system with a relatively fast turn around time. Use is only limited by imagination and capability. Clearly, this chamber is for the use by the general community and if there is a project or experiment that could benefit, please contact us.


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