

Findings of the 12th VEXAG Meeting  
9 April 2015  
National Institute for Aerospace, Hampton, VA

1. VEXAG is enthusiastic about the science observations of the dynamic environment of Venus that can be made during the more than two dozen gravity-assist fly-bys that will occur through 2024 from ESA and NASA missions - Solar Orbiter, BepiColombo and Solar Probe Plus. These would be particularly valuable to maintain continuity of Venus observations until the next mission(s) to Venus. VEXAG appreciates the role that PSD played in identifying these opportunities and in supporting the assessment of possible science observations. VEXAG encourages PSD to identify future opportunities to include Venus science with missions that have other primary applications/targets. Many mission trajectories include one or more Venus flybys and these opportunities may enable new low cost mission data. VEXAG also encourages PSD to consider secondary payloads for Venus observations that can take advantage of missions that may have excess launch mass capacity.
2. VEXAG encourages PSD to create a sustained mechanism for the development/maturation of specialized spacecraft systems that will enable PSD to explore all the solar system, including the challenging yet scientifically significant atmosphere and surface of Venus. Future Venus missions can be enhanced or enabled by advanced technology. Some of these technologies are of a specialized nature with limited applications outside of planetary science and therefore unlikely to be developed or matured by others. Examples of technologies that are critical for future Venus exploration include high temperature electronics, high temperature power generation and storage systems, and high temperature mechanisms. Currently there is no mechanism for these technologies to get proposed or funded within PSD or elsewhere.
3. VEXAG encourages PSD to explore the feasibility of STMD supporting technologies applicable to Venus missions. Some technologies could benefit from space demonstrations and could be prime candidates for consideration in the Technology Demonstration Mission program.
4. VEXAG encourages PSD to support the further development of a new stratospheric observing asset that would be made available to the science community. The recent assessments and demonstrations of stratospheric balloon borne telescopes offer promise and could benefit the Venus community by providing science data such as day and night time winds, cloud properties, emissivity mapping, and more. A facility balloon asset would provide frequent and much needed opportunities to engage in missions and science measurements. Competing the science and observing time through ROSES is encouraged to maximize community access and engagement, as well as the science returned.
5. VEXAG continues to encourage NASA participation in future international partnerships including mission collaboration and participating scientist programs (e.g., Akatsuki and Venus Express). NASA support of the International Venus Exploration Working Group (COSPAR) will facilitate the needed dialog towards the exploration programs.
6. VEXAG encourages PSD support for several upcoming opportunities and initiatives:
  - a. Comparative Climatology of the Terrestrial Planets -2 (CCTP2), 8-11 September 2015, Ames Research Center, Moffett Field, CA.
    - i. VEXAG is encouraged by the broad support for this meeting from all four NASA science divisions
    - ii. Participation from students and early-career scientists whose research spans all four NASA HQ science divisions is expected. VEXAG anticipates travel support for these early career scientists to present the results of their research at this meeting.
  - b. 13th VEXAG Meeting, October 27 – 29, 2015, Washington, DC area

- c. Continued efforts to initiate the Extreme Environments Centennial Challenge
- d. A workshop focused on science results based on laboratory, theoretical modeling, and simulation studies of a broad range of Venus topics
- e. A future workshop to cross-fertilize technologies of interest to Venus exploration as well as other applications

Resolutions of the 12th VEXAG Meeting (these are not directed toward PSD)

1. VEXAG resolves to identify all data sets, including calibration and standardization data, from the Russian missions to Venus. This list will identify which data are contained in the PDS, which data are held by NSSDC but not in the PDS (e.g., microfiche on file), and which data may only be held by the original investigators in Russia. Many analog data sets from past Venus missions (such as Venera) may be disappearing as individuals who have the data retire. As a result, some unique measurements (e.g., surface geochemistry) may be lost forever. It is very important to make sure that all existing Venus data are preserved, and permanently archived in the PDS. Once all data are identified, VEXAG will encourage PSD to officially request missing data from the Russian space agency and to support the permanent archival of all Venera data in the PDS.
2. VEXAG appreciates the support PSD provided for the “Venus Science Priorities for Instruments and Laboratory Measurements” workshop held at the National Institute for Aerospace near NASA LaRC on April 7-8, 2015. VEXAG also sincerely thanks all the participants and organizers of this workshop. The community engagement and the discussions support Venus exploration objectives and, based on the quick results, the workshop achieved its objectives and helped raise community awareness and understanding of the status and needs for Venus focused laboratory experiments and instruments. VEXAG resolves to increase awareness of needed work identified by the workshop. Needed work includes laboratory experiments in fundamental sciences, such as physical properties of supercritical elements and emissivity of materials as well as better understanding of the temperature and pressure effects on instruments and interpretation of the data. Better measurements of atmospheric species and aerosols including the upper atmosphere, and modeling are also needed. VEXAG is looking forward to the detailed meeting report and other documents that will be developed and will plan for a presentation of final results at a future VEXAG meeting.
3. VEXAG resolves to consider the utility of updating the Venus International Reference Atmosphere (VIRA) model based on new data from Venus Express, including new data on atmospheric density from the aerobraking campaign. VIRA is the standard used by mission designers to plan Venus atmospheric entry scenarios. However, the information contained in the VIRA is based on data from the handful Pioneer Venus and Vega entries.
4. VEXAG resolves to continue encouragement for the use of existing ground and suborbital (balloon, airplane, and sounding rocket) observing assets to acquire new and unique Venus science data. These assets should continue to be made available to Venus scientists through the appropriate Planetary Science ROSES elements.
5. VEXAG endorses the Comparative Tectonics and Geodynamics of Venus, Earth, and Rocky Exoplanets meeting planned for May 4 – 6, 2015, in Pasadena, California.