VEXAG FINDINGS 2021

1. VEXAG is pleased that there are new Venus missions, and we are positioning ourselves to welcome and advocate for a much larger international Venus community. Nonetheless, we recognize that there are still many outstanding Venus questions that cannot be addressed by the current suite of missions, so future Venus flagship, New Frontiers, and ride-along mission(s) and a Venus program remain high priorities. **VEXAG asks NASA to: 1) establish a formal Venus Program within SMD as part of this effort; 2) retain Venus as a target for future New Frontiers opportunities.**
2. NASA has been developing a compact, long-duration Venus surface lander (on track to reach TRL 6 by early 2025 assuming continued funding): Long-Lived In-situ Solar System Explorer (LLISSE). As an integrated system of multiple technologies, LLISSE requires continued investment that would be very difficult to accommodate under focused R&D programs. Continued development support would allow LLISSE to provide timely infusion of long-duration capabilities into current and future mission architectures, which is highly relevant to requests for new capabilities and technologies applicable to the next New Frontiers Announcement of Opportunity. **Thus, VEXAG requests NASA to continue to support LLISSE maturation and to offer this platform as a capability in the New Frontiers 5 Announcement of Opportunity.**
3. Methods to provide long-term power to Venus surface assets have been studied extensively, including the Venus Surface Platform Study. However, other than radioisotopic nuclear power, there exists no clear long-term solution for providing power for mobility and/or temperature control for weeks, months, or even longer. This long-term capability is critical for answering key science questions (cf. the VEXAG GOI, but this is a multi-AG issue). Given that the development of such capability is expected to take a decade at a minimum, **VEXAG asks the PAC to request NASA STMD to restart the assessment and development of long-duration power systems generally, including those that can directly be applied to Venus exploration.**
4. Because of the small size of the active, NASA-funded Venus community, there is a risk that not enough R&A review panelists have sufficient relevant expertise to fairly evaluate Venus-related proposals. To address key science questions related not just to Venus, but to the evolution of terrestrial planets and exoplanets, it is critical that fundamental and underlying Venus science be supported to enable mission development at a level commensurate with community engagement. **VEXAG requests detailed statistics on proposal submission and selection rates in all ROSES programs that include, but are not limited to: 1) the number of Venus proposals submitted to each program; 2) the percentage of those proposals selected; and 3) success rates for non-Venus proposals in those same programs, for all years since the Planetary R&A reorganization.**
5. **We request the establishment of a new program for Fundamental Research that can support Venus-related scientific questions.** There are significant data deficiencies that are unlikely to be addressed by the Solar System Workings (SSW) program element alone, including support for fundamental research including laboratory measurements. A program is needed that can *"amongst other target bodies"* address Venus science in support of current and planned missions, as well as assist the growing body of Venus-

related science, such as planetary evolution models and the characterization of exoplanets.

6. **We request that NASA augment the Solar System Observations (SSO) program to support dedicated Venus observations, and expand technology advancement programs to include proposals to develop new capabilities for suborbital and ground-based observatories.** Fundamental questions about the interior, surface and atmosphere of Venus can be effectively addressed by ground-based and suborbital observing campaigns, which require additional support. This need has become critical after the loss of the Arecibo Observatory. In another example, obtaining time on the Deep Space Network is exceptionally difficult without NASA advocacy because Venus is not viewed as a DSN priority.
7. Venus is a compelling cross-disciplinary research target, essential for answering fundamental astrobiological and climate evolution questions, and for its ability to help us understand habitability on terrestrial planets and the exoplanets that we continue to discover. **VEXAG anticipates that Venus-related and comparative planetology proposals will remain on the list of solicited research on calls for the Habitable Worlds and Exobiology Programs in R&A, with specific language on Venus-related science questions that are solicited.**
8. Aerial platforms uniquely enable a wide range of important planetary science investigations from atmospheric chemistry and dynamics, to geophysics and astrobiology. However, at present there is little NASA support for funding development of technologies to a high TRL status before mission proposals, which is crucial to perform Venus or other atmosphere-borne in-situ science, e. g., balloon envelope, attitude determination, power, communications systems, thermal control, and corrosion resistance approaches. **We strongly suggest that NASA funds a broad solicitation for aerial platform technologies targeting solar system bodies with atmospheres**, e.g., a "CLOUDTECH" program similar to the HOTTECH and COLDTECH programs already established.
9. In the next 10 years, NASA needs to actively assess, take steps, and mitigate risk of atrophy for Venus-relevant Thermal Protection Systems (TPS), such as 3-D Woven TPS and PICA TPS (PICA-D and Conformal PICA). Otherwise, future missions to Venus *and other bodie*s with an entry and descent phase will be negatively impacted. **VEXAG recommends continuation of NASA support for advanced EDL and TPS technologies be maintained as part of NASA's EDL technology portfolio.**
10. The Astronomy & Astrophysics 2020 Decadal report was an outstanding win for the Venus community! The Astronomy & Astrophysics community called to attention the importance of further investigations of Venus and the need for collaboration between them and the Venus community as emphasized by the following quote: "Our reduced insight into some solar system planets (particularly Venus, Uranus, and Neptune) in turn limits our understanding of the dynamics, composition, and evolution of atmospheres, indicating need for further study of these worlds". **We request that NASA create joint Astrophysics and Planetary calls of opportunity that specifically address the cross-disciplinary recommendations of the Astronomy & Astrophysics 2020 Decadal report**.

Response from HQ: in response to this finding, we have changed text in the XRP ROSES-22 solicitation (to-be released on Feb. 14, 2022) to explicitly state that proposals that use comparisons to Solar System bodies are allowed, so long as the proposal demonstrates that the investigation focuses on the advancement of exoplanet science. XRP is the most appropriate existing call since it is cross-disciplinary and jointly managed by PSD, APD, HPD, and ESD—though mostly PSD and APD. Creating an entirely new program isn't budgetary feasible at this time, and XRP fills this role already anyway.

11. There are concerns about the safety of LPSC attendees, there is a desire to make LPSC accessible to a broader geographic range of people, and there is no longer a historical association between LPSC and JSC that constrains the conference's location. Between 30 and 40% of LPSC attendees are students for whom location is critically important. **VEXAG finds that the location of the LPSC conference should be rotated away from Texas beginning in 2023.**