



VEXAG Update

PSS

March 10, 2016

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VEXAG Events since October PSS meeting:

- 13th VEXAG meeting October 27 – 29, 2015 (NASA HQ, Washington, DC)
- Final Reports Completed
 - Venus Exploration Targets Workshop (May 19-21, 2014, Houston, TX)
 - Venus Science Priorities Workshop for Laboratory Measurements and Instrument Definition (April 7-8, 2015, Hampton, VA)
- Akatsuki entered Venus orbit December 7.
- Venera-D Science Definition Team has convened; meeting this week in Moscow.



Akatsuki Update

- Orbit insertion on Dec 7, 2015 (5 years to the day since 2010 attempt) using only the attitude control thrusters!
- 9-day orbit is near equatorial with apoapsis $\sim 350,000$ km
- Except for far fewer radio occultations, all science goals achievable, or enhanced due to more continuous coverage
 - NASA Participating Scientist program has 2 Scientists in Residence (Limaye & McGouldrick) and 6 Participating Scientists (Acton, Bullock, Lorenz, Jessup-Lea, Schubert, Young)
 - First Science Team meeting was held on Jan 26-27, 2016 at ISAS.
 - All instruments in good working condition
 - Routine operations begin in April 2016.





Venera-D Update

- Venera-D Joint Science Definition Team met in Moscow in October 2015 and has had bi-weekly telecons and sub-group video conferences.
- Next meeting is 9-11 March 2016 (Moscow) and will review the Venera-D science goals-VEXAG GOI connections and also Decadal Survey match to define mission strawman
- Interim report to NASA and IKI/Roscosmos in summer 2016, and final report anticipated by late 2016.



VEXAG Thoughts on New Frontiers

- VEXAG has had no official deliberation, but will be keeping an eye on how this progresses
- The VEXAG Executive Committee hopes that PSS will deliberate potential impacts of NASA's notional addition of "Ocean Worlds" to the New Frontiers-4 mission set:
 - Titan and Enceladus missions are not prescribed for NF-4 by the Decadal Survey.
 - 2011 Decadal did not (re)endorse broad latitude advocated by 2006 mid-term assessment (NOSSE)
 - Ongoing OPAG Roadmap for Ocean Worlds (ROW) may suggest science objectives, but timing of mid-term assessment may be too late to impact NF-4 competition.
 - Congressional language for Ocean Worlds is not consistent with either competed or directed missions.
 - Concern that if OW selected in NF-4, community will think the fix was in. If not selected, Congressional wishes may not be fulfilled.
 - Separate, directed OW flight program will keep competition viable but may have other impacts.



Deliberations of the 13th VEXAG

- In order for NASA to receive maximum scientific value from the community's investment in New Frontiers mission proposals, VEXAG encourages the Planetary Science Division to provide adequate, additional time for New Frontiers proposers to complete their proposals after the 2016 Discovery selection(s) are announced. This will best position the proposed New Frontiers missions to address Decadal Survey science objectives in the context of the newly selected Discovery missions(s).

Addressed by
Community Announcement



Deliberations of the 13th VEXAG

- VEXAG reaffirms the importance of a balanced program of Discovery, New Frontiers and Flagship missions to further the exploration of Venus. The Planetary Science Division is conducting further studies in FY16 and FY17 of the Ice Giants and Enceladus Flagship missions that were identified and prioritized by the 2011 Planetary Science Decadal Survey (PSDS). VEXAG finds that reassessment of the Venus Climate Mission (VCM), which was also identified by the PSDS as a Flagship priority, is also needed. Conducting further studies of the Venus Flagship mission immediately following the completion of the Enceladus study should allow sufficient time for an in depth study in time to be evaluated by the next PSDS.



Deliberations of the 13th VEXAG

- VEXAG appreciates recent support from the Planetary Science Division, and strongly encourages continued support, of international opportunities for science participation and investigation. The VEXAG community is enthusiastic about the imminent return of Akatsuki to Venus, and looks forward to the science results from the mission and NASA's Participating Scientists. VEXAG is excited about re-activation of the Venera-D Joint Science Definition Team and additional possible international cooperative possibilities of the upcoming European Space Agency's M-5 opportunity. VEXAG continues to encourage NASA participation in future international partnerships including mission collaboration and participating scientist programs. NASA support of the International Venus Exploration Working Group (COSPAR), and collaborating communities in IKI and ISRO will facilitate the needed dialogue towards the exploration programs. The Venus science community is energized by the Phase A Discovery selections of DAVINCI and VERITAS and hopeful about the prospect of one, or even two imminent, high value NASA/US missions to Venus.



Deliberations of the 13th VEXAG

- VEXAG encourages PSD support for upcoming opportunities and initiatives:
 - Continued efforts to initiate the Extreme Environments Challenge,
 - A workshop focused on science results based on laboratory, theoretical modeling, and simulation studies of a broad range of Venus topics,
 - 14th VEXAG meeting, November 2016, Location TBD,
 - Comparative Climatology of the Terrestrial Planets – 3 (CCTP-3), in FY2017.



Deliberations of the 13th VEXAG

- VEXAG has been greatly served by having Dr. Adriana Ocampo as our NASA HQ Point of Contact (POC). Through her, the Venus community has been informed of relevant NASA activities and directions and she has helped our community navigate the NASA policies and procedures. We have also benefited from her representation of Venus interests in the day-to-day NASA HQ interactions and decisions. In short, her support to the Venus community has been invaluable and her absence in recent months has been felt. We sincerely desire her quick and full recovery and look forward to her continued support of the VEXAG when she returns to a full-time schedule. In the meantime, the VEXAG needs an interim person at NASA HQ who can actively serve as our backup POC. Therefore, VEXAG encourages the PSD to identify a HQ POC who is available to engage in our activities and represent our needs as a backup until Dr. Ocampo resumes her role on a full-time basis.

No longer relevant



Deliberations of the VEXAG Technology Focus Group

- Continues to encourage PSD to support technology incentives, such as HEEET, for Discovery and New Frontiers.



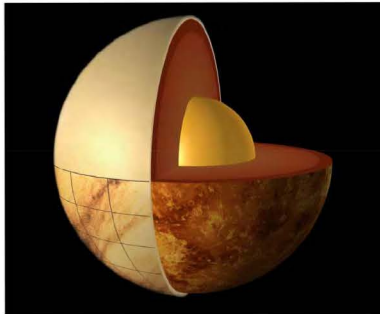
Upcoming Highlights:

- VEXAG Town Hall at LPSC (Thursday, 3/24 @ noon)
 - Both Venus Discovery concepts will provide presentations
- International Venus Conference, April 4 - 8, 2016 (Oxford, England)
- Short course covering Venus science, technology and mission architecture to be offered at the 13th International Planetary Probe Workshop (June 13-17, APL)
- Venus III Book in preparation
- Very excited about the new Comparative Climate ROSES element



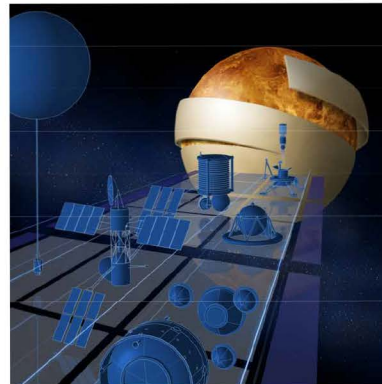
*Goals, Objectives, and Investigations for
Venus Exploration*

May 2014



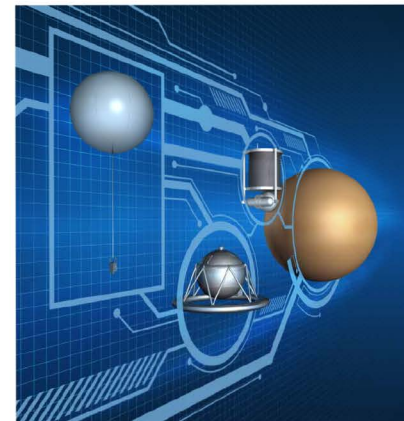
Roadmap for Venus Exploration

May 2014



Venus Technology Plan

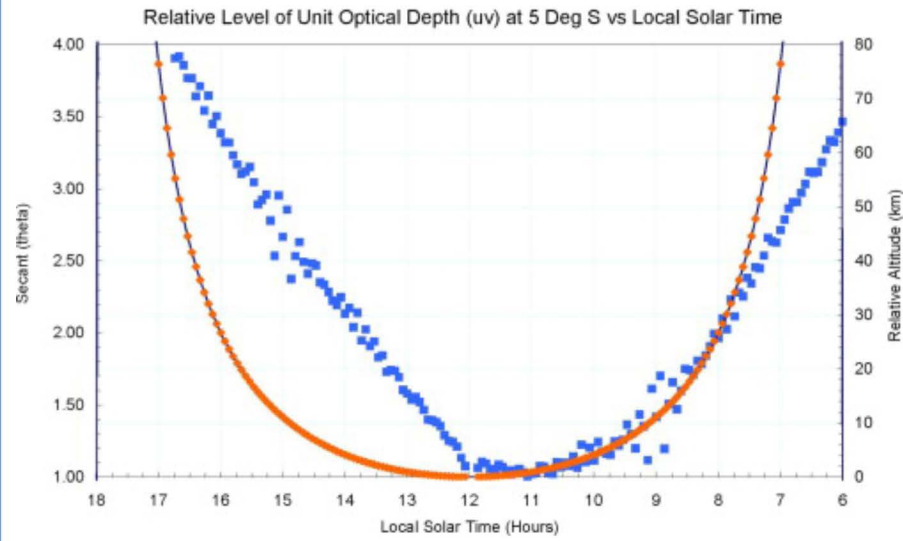
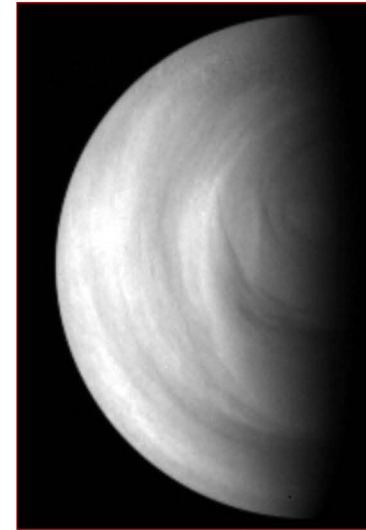
May 2014



SCIENCE NUGGETS

Venus Clouds Different from Morning to Evening

The Venus Monitoring Camera (VMC) on Venus Express is shedding more light on Venus clouds. Previous Earth based and spacecraft observations inform us that Venus is covered globally with a mixture of clouds and hazes with a mixture of small particles of predominantly two particle sizes composed of dilute sulfuric acid and some other substances whose identity still remains unknown.



By precision determination of the level of the unity slant optical depth from VMC images, we now know that the distribution of cloud and haze particles is not symmetric about local noon. The orange line in the figure above shows how the relative altitude of the slant unit optical depth should change with local time for a clear atmosphere while the blue dots show the actual (at 1013 nm) variation – the difference being due to presence of hazes and clouds, showing the morning-afternoon asymmetry. This asymmetry is seen at all four VMC wavelengths (right). The haze reaches much higher in the late afternoon and decreases from sunrise until noon, but the build up is much faster than the dissipation in the morning.

