

**In this issue...**

[11th VEXAG Meeting – 1](#)

[Comp. Climatology Symposium – 2](#)

[Focus/Topical Group Updates – 3](#)

[ISSI International Venus Teams – 4](#)

[Meeting Notes – 4](#)

[Future Meetings – 6](#)

[Venus Missions – 7](#)

VeSPR – 8

Venus Express – 8

Akatsuki– 6

[Venus in the News – 9](#)

[Recent Venus publications – 9](#)

[Letter -VEXAG Chair – 9](#)

Welcome to this update from VEXAG on topics dealing with Venus research and exploration. Your contributions, comments and suggestions welcome.

*Sanjay Limaye*

Summer 2013 has been a very busy with meetings, continued uncertainty over NASA’s current year and future budgets and mission planning efforts, and new results. VEXAG Focus Groups and Topical Analysis Groups have been active in updating or creating position papers. The Discovery and New Frontiers AOs are still expected in 2015 and 2016 and ESA’s call for the M-4 mission under Cosmic Vision is expected in 2014. The International Space Science Institute in Bern, Switzerland has selected all three Venus International Teams’ proposals – Sulfur Dioxide in the Venus Atmosphere, Clouds and Aerosols and the Thermal Structure of Venus. Find out more about these and other items below.

**11<sup>th</sup> VEXAG Meeting, Washington, DC, 19-21 November 2013**

Please plan to participate in the next VEXAG meeting where several VEXAG documents currently being revised will be discussed and adopted. Wide community support of these position papers is essential. The current draft of the Venus Goals Objectives and Investigations is available at the VEXAG URL. Please download and provide your feedback and indication of support to the VEXAG Chair and the Focus Group leads. Meeting will be held in the James Webb Auditorium, NASA HQ. Details are posted at the VEXAG URL.

**Ellen Stofan named NASA Chief Scientist**

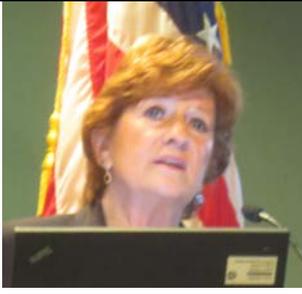
Congratulations to Ellen on taking over the responsibilities as the NASA Chief Scientist at the beginning of August! This is the second time VEXAG has “lost” Ellen, but each time for a good cause – first time for the Planetary Decadal Survey Inner Planets Panel Chair, and now she has all four SMD divisions in her focus. Doug Stetson has taken over as the Lead for the Venus Roadmap Topical Analysis Group.



Ellen Stofan moderating the SMD Divisions Panel at the Comparative Climatology Symposium – Mike Meyer (PSD), Jack Kaye (Earth Obs.), Lika Guhatakurta (Heliio) and Mario Perez (Astro)

## Comparative Climatology Symposium, NASA HQ, 10-11 May 2013

A Working Group sponsored by the International Space Science Institute in Bern, Switzerland published a Report entitled "Towards Understanding the Climate of Venus", in early 2013. This report arose through the efforts of Lennart Bengtsson and Roger Bonnet to demonstrate the generalities of circulation and climate models for planetary atmospheres which until now have been tested mainly for Earth. The development of such models has benefitted from the detailed comparisons of the model assumptions and output based on common initial conditions. A preliminary comparison performed for some of the current models of the Venus atmosphere by the Working Group pointed out how much work is still needed for achieving better consensus. This notion was also evident in the presentations and discussion at the first Comparative Climatology of the Terrestrial Planets Conference in June 2012 as well as the 2013 AGU Chapman Conference on Planetary Atmospheres. To consider future steps, a symposium involving the Astrophysics, Earth Science, Heliophysics, and the Planetary Science Divisions was held at NASA HQ to consider the symbiosis between understanding planetary climates and NASA exploration goals. Speakers included Roald Sagdeev (U. Maryland), Roger Bonnet (ISSI), Lennart Bengtsson (ISSI) as well as John Grunsfeld (NASA/SMD AA), Jim Green (NASA SMD/PSD), Mike Myers, Jack Dave Crisp (JPL) and David Grinspoon (Library of Congress) and others from NASA. A panel discussion at the end involving all four SMD divisions brought out commonalities between the respective exploration goals and strategies.

			
SMD AA J. Grunsfeld (right) and PSD Director J. Green	R. Bonnet (ISSI Director)	R. Sagdeev (U. Md)	L. Bengtsson (ISSI)
			
Moderator	J. Green		A. Ocampo

Planning has already begun for the second Comparative Climatology of Terrestrial Planets conference to be held at NASA/Ames Research Center in June 2015 (contact, Jeff Hollingsworth).

Presentations made at the Symposium are posted at:

<http://www.lpi.usra.edu/vexag/meetings/ComparativeClimatology/presentations/>

### VEXAG Focus/Topical Group Updates

Focus Group on Goals, Objectives and Investigations. Following the discussion at the 10<sup>th</sup> VEXAG meeting, the GOI Focus group led by Robbie Herrick presented an initial revision of the Goals, Objectives and Investigation document during the Townhall meeting at the 2013 LPSC. A number of comments were received on the draft revision of the key objectives summarized in the GOI table. Over the summer the Focus Group worked hard to address the comments received and a revised table is now available for comments and adoption at the 11<sup>th</sup> VEXAG meeting in November. Please submit your comments on the web at:

[http://www.lpi.usra.edu/vexag/investigations\\_comments/](http://www.lpi.usra.edu/vexag/investigations_comments/). The Focus Group is also drafting a document to accompany the table which will be presented at the November meeting for comment.

Topical Group on Venus Roadmap. One of the outcomes of the 10<sup>th</sup> VEXAG meeting was the decision to develop a Venus Exploration Roadmap. A Topical Analysis Group led by Ellen Stofan was formed in early 2013. The group met on 11 March 2013 at NASA/GSFC and began developing the Roadmap consistent with the Venus Goals, Objectives and Investigations.

Following the discussion at LPSC the group has made considerable progress and a draft Roadmap was presented to the VEXAG Executive Committee in August 2013 and will be posted at the VEXAG URL prior to the November meeting.



Technology Development Group. A technology forum is planned for November 2013 in conjunction with the VEXAG meeting. Topics to be discussed will include Entry Descent & Landing developments, Aerial Platforms, Extreme Environments and the instrument technology status.

Competed Missions and ROSES Topical Group. The group has developed several draft responses for the NASA Request for Information regarding past Discovery, New Frontiers and JUICE AOs. These include items such as page limits, use of new technology, team participation (Participating Scientist Program vs. Co-Is), and better mechanisms for responding to reviewer comments. The group is also coordinating with other Analysis Groups (OPAG, SBAG and LEAG) prior to submitting responses (due October 15). Please contact G. Chin if you have any input or comments.

International Collaborations Topical Group. The Topical Group has carried on dialog via e-mail and a conference call was held in July 2013 to discuss the status of near and long term prospects for Venus exploration missions. The key development has been an overture to NASA from IKI and Roscosmos towards a dialog with NASA/SMD/PSD on potential collaboration on Russia's Venera-D mission currently planned to be launched in 2016. A follow up meeting is planned during the Fourth Moscow Solar System Symposium in October 2013. A white paper (posted at VEXAG URL) was also submitted on behalf of the COSPAR International Venus Exploration Working Group to ESA's Call for white papers for selecting the themes for Cosmic Vision L2 and L3 mission in 2030 and 2034. ESA organized a meeting during 3-4 September for selected presentations

representing 30 (out of 51 submitted) white papers, with Venus being one of them. Colin Wilson presented ideas for Venus missions on behalf of the three white papers submitted. "Venus: A Natural Planetary Laboratory" white paper is posted at: [venus.wisc.edu/endorsement](http://venus.wisc.edu/endorsement). [Links](#) to the papers by Wilson et al. and Marcq et al. can also be found at the same URL.

Early Career Venus Scholars. This VEXAG Focus Group is formed to allow young scientists the opportunity to discuss research related to Venus and increase interest in furthering our understanding of our sister planet. Information about student travel grants for the 11<sup>th</sup> VEXAG meeting (19-21 November, Washington, DC), fellowships, post-docs and meetings where Young Scholars can network, is posted on the following URL: <http://www.lpi.usra.edu/vexag/scholars/>. The group is currently developing plans for a presentation competition at the upcoming Venus Exploration Targets Workshop, planned for May 19-21, 2014, in Houston. Please check the VEXAG website for more details.

\* \* \* \*

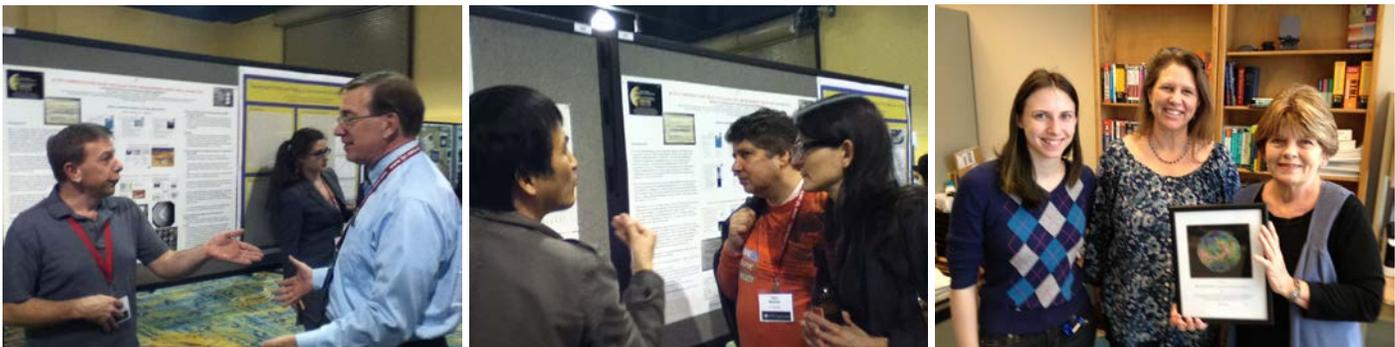
### ISSI International Venus Teams

In March three proposals for international teams were submitted in response to a call from the International Space Science Institute in Bern, Switzerland. The selections were announced in June 2013 and all three teams were successful. The three teams led by A. C. Vandaele and O. Korablev (BIRA – Sulfur Dioxide), C. Wilson and E. Marcq (Clouds and Aerosols) and S.S. Limaye (Thermal Structure) will hold their first meetings 4-8 November in Bern. The three teams proposed to review and synthesize the new information about Venus from Venus Express and other missions or projects. The teams' objectives are: (i) observations of Venus sulfur dioxide in the atmosphere, (ii) clouds and aerosols and (iii) the thermal structure of the Venus atmosphere. This should result in material for the updates to Venus International Reference Atmosphere adopted in 1985 from Pioneer Venus and Venera missions. The three teams will meet in a plenary session mid-week to keep informed of the relevant issues. Two additional meetings are planned in 2014 with the efforts culminating in at least one journal article submitted from each team. Interested persons willing to contribute to the teams' efforts are encouraged to contact the leads.

\* \* \* \*

### Meeting Notes:

#### 44<sup>th</sup> Lunar and planetary Science Conference, the Woodlands, Texas, 18-22 March 2013





A number of papers were presented in oral (Venus Tectonics, Volcanism and Surface Properties, Planetary Atmospheres) and a poster sessions (Venus Surface and Interior ) on Venus at this meeting. VEXAG also held a townhall meeting to discuss the revision of the Goals, Objectives and Investigations document, and the development of the Venus Roadmap. VEXAG presented a plaque to Ronna Hurd in appreciation of her services for the VEXAG web pages.

**International Venus Workshop, Catania, Sicily, 10-14 June 2013**

Following previous Venus conferences organized by the Venus Express team in 2007, 2008 and 2010, this fourth conference invited talks on all aspects of Venus science. About 120 scientists, students attended the meeting. The meeting was held near Mt. Etna to draw attention to Venus geology and a field trip to the volcano was organized. Abstracts are at: [www.iaps.inaf.it/Venus2013/Program/VenusAbstracts.pdf](http://www.iaps.inaf.it/Venus2013/Program/VenusAbstracts.pdf).

**International Planetary Probes Workshop, San Jose, California, 17 -21 June 2013**

Seven papers related to aerial platforms, instruments and atmospheric entry were presented at the 10<sup>th</sup> workshop which may be of interest to those proposing or developing future missions to Venus. The titles are given below.

<a href="#"><u>Recent Advances in Planetary Balloon Technology</u></a>	Kim Reh	Jeff Hall, Andre Vargas
<a href="#"><u>Science Questions and Needed Measurements in the Neighborhood of the Cloud Region of Venus</u></a>	S.S. Limaye	David Crisp, Tibor Kremic, Lori Glaze
<a href="#"><u>Comparison of Aerial Platform Options for investigating the Upper Atmosphere of Venus</u></a>	James A. Cutts	Patricia M. Beauchamp
<a href="#"><u>Venus Atmospheric Maneuverable Platform (VAMP)</u></a>	Kristen Griffin	Daniel Sokol, Dean Dailey, Gregory Lee, Ronald Polidan
<a href="#"><u>Aerodynamic Characteristics of a Venus Lander as Obtained from Static and Dynamic Wind Tunnel Tests</u></a>	Anita Sengupta	Juan R. Cruz
<a href="#"><u>Ballistic Entries at Venus</u></a>	Dinesh Prabhu	Gary Allen, Thomas Spilker, Gelsomina Cappuccio, Helen Hwang, Robert Moses
<a href="#"><u>Arcjet Testing of Woven Carbon Cloth for Use On Adaptive Deployable Entry Placement Technology</u></a>		



## Future Meetings of Interest:

### *Fourth Moscow Solar System Symposium, Moscow, Russia, 14-18 October* (<http://ms2013.cosmos.ru/>)

A Splinter Meeting on Venera-D will be held on October 17, 10:00 – 12:00 pm, Room 200, IKI (L. Zasova and S.S. Limaye). A session on Venus will be held on 18 October (10:00 – 16:00). Highlights include presentations on Russian Solar System exploration program (Zelenyi and Popovkin), ESA's Space Science Program (A. Jiminez), and NASA's Planetary Science Missions (J. Green), 50 Years of Russian and American Lunar Exploration (J. Head), and Study of Venus by space missions (L. Zasova) among others.

### *VEXAG Technology Forum, Tuesday, November 19, 2013, 8 am - 6 pm, NASA Headquarters, James Webb Auditorium (Ground Floor, West Entrance), 300 E St. SW, Washington DC 20546*

The goal of the Forum is to present a coherent picture of where specific technologies useful to potential Venus Missions currently stand and to provide where they could be in 5 - 10 years. Presenters will provide information that will allow the VEXAG community to make decisions on what is possible now and in the future. These technology evaluations and subsequent discussions will allow the community to be better educated when discussing the Goals, Objectives and Investigations and Roadmap documents the following day at the VEXAG meeting. A draft of the VEXAG Technology plan will be presented and the following questions will be discussed:

- What science opportunities for both near-term (< 10 years) missions and longer-term (> 10 years) missions are enabled by existing technologies? How are these science opportunities limited by existing technology?
- What science goals are or should be driving technology development? What technology synergies and cross-cutting technologies have the potential for changing the way Venus science is done? How should we prioritize technology development?
- Identify gaps (if any) in the technology developments due to lack of communication between scientists and technologists, hampering the achievement of science goals.
- Identify gaps in funding for Venus-related instruments and technology

### *11<sup>th</sup> VEXAG Meeting, Washington, DC, 20-21 November 2013*

Information about the meeting is posted at the VEXAG url. Deadline for student travel support has passed.

### *AGU Fall Meeting, San Francisco, California, 8-13 December 2013*

Session P014 High Priority Investigations for Venus Exploration Special Session (oral session 11 Dec, 4:00-6:00; poster session 12 Dec, 8:00-12:20)

*VEXAG Town Hall*, 10 Dec., lunchtime. Check AGU posting for the room.

### *[IAA Space Exploration Conference, Washington, DC, January 09, 2014](#)*

A pre-Summit Conference of the HEADS OF SPACE AGENCIES SUMMIT ON EXPLORATION will be held with focus on *Planetary Robotic and Human Spaceflight Exploration*. Abstract deadline is November 15.



[45<sup>th</sup> LPSC Meeting, the Woodlands, Texas, March 17 – 21, 2013 \(tentative, pending approval\)](#)

[EGU General Assembly 2014, Vienna, Austria, 27 April – 2 May, 2014](#)

The EGU General Assembly 2014 will bring together geoscientists from all over the world into one meeting covering all disciplines of the Earth, planetary and space sciences. Especially for young scientists, it is the aim of the EGU to provide a forum where they can present their work and discuss their ideas with experts in all fields of geosciences.

*Venus Exploration Sites Workshop, Houston, Texas, 19-21 May 2014*

LPI/URSA would be hosting this VEXAG sponsored workshop, which is currently scheduled for May 19-21, 2014 at LPI. A small Registration Fee may be charged.

[40<sup>th</sup> COSPAR Scientific Assembly, Moscow, 2-8 August 2014](#)

For a look at the preliminary scientific program please visit <https://www.cospar-assembly.org/>. Abstract deadline: 14 February 2014.

\* \* \* \*

## Venus Missions

Venus Spectral Rocket Project (VeSPR): *NASA Sounding Rocket Launch in Mid November*

VeSPR aims to learn about the loss of water from Venus by measuring the D/H ratio using ultraviolet spectra. It is coincident that MAVEN, the Discovery mission to learn about loss of atmosphere of Mars to space is also about to be launched in November, as the science questions are similar. The loss mechanism suggests a vertical gradient in this ratio, and Venus Express finding of a higher D/H ratio than the lower atmosphere value supports this notion, and VeSPR will attempt to determine the vertical profile. VeSPR is led by John Clarke (Boston U.) and will be launched from White Sands Missile Range in mid-November (barring any delays due to the govt. shutdown).

VeSPR is a telescope that will be mounted inside a sounding rocket. This is a suborbital rocket that will take the telescope to a height of 300 km in less than 5 minutes-well to an altitude of ~ 110 km. About half as high as the Hubble Space Telescope, VeSPR will fall back to earth on a ballistic trajectory less than 10 minutes after launch, and will be recovered to be used again.

During the almost seven minutes of flight time to reach the highest altitude, VeSPR will collect UV spectral observations of Venus during three and a half minutes on the way up, and three and a half on the way back down. The goal is to collect at least 250 seconds (4 minutes, 10 seconds) of observations. The most challenging task for the telescope is to find and “lock” on to Venus in only about two and a half. The same observation would take HST approximately four hours.

More information about VeSPPr can be found at: <http://www.bu.edu/csp/PASS/science/venusfaq.html>.

### Venus Express Orbiter

The mission has been extended into 2015. However, the recent estimates of remaining useable fuel are lower than earlier estimates and it is possible that the controlled operations may end earlier than expected, perhaps by July 2014. It is the sentiment of the Instrument PIs to continue science observations as long as possible. Some aerobreaking tests may be conducted. The next Venus Express Science Working Team in Kiruna, in December will consider the science operations possible in the next year.

The VIRTIS/VMC Data access and use workshop planned to be held during October 21-24 in Madrid has been postponed until spring 2014. Scientists interested in getting familiar with the data and software available should contact the Venus Express scientist or the instrument PIs.

### Akatsuki Venus Orbiter

Akatsuki is still on track to enter orbit in November 2015 or in 2016. Using only the attitude control system thrusters to achieve orbit insertion, the spacecraft will likely be placed in 2016, forgoing the 2015 opportunity due to the different orbit inclinations achievable. The 2015 option can only achieve a polar orbit while the 2016 opportunity can place the orbiter in a long (seven to eight day period) equatorial orbit, with apoapse at ~ 300,000 km instead of the planned 80,000 km. The final decision on which opportunity to exploit will be made in 2014 according to the Project Manager, M. Nakamura. The orbiter and the instruments it is carrying has so far survived several perihelion passes exposing it to much stronger Sun than planned, and a few more passes will occur before Venus orbit insertion.

\* \* \* \* \*

### Venus in the News

#### *Another Reason to Return to Venus!*

**Did Earth get its moon from Venus?** Dave Stevenson suggested this idea last week during the "Origins of the Moon" conference organized by the Royal Society, London. "We cannot understand the terrestrial planets unless we understand Venus, and at the moment, we don't know anything about Venus in terms of the isotopes" it has, he says. "And I also think that as a test of our understanding of the [origin of the moon](#), we need to understand whether Venus ever had a moon." As reported in the story published on the web on [space.com](http://space.com)





## Recent Venus Publications

Kouyama et al., Long-term variation in the cloud-tracked zonal velocities at the cloud top of Venus deduced from Venus Express VMC images, *J. Geophys. Res.* 118, 37-46, 2013.

[I.V. Khatuntsev](#), [M.V. Patsaeva](#), [D.V. Titov](#), [N.I. Ignatiev](#), [A.V. Turin](#), [S.S. Limaye](#), [W.J. Markiewicz](#), [M. Almeida](#), [Th. Roatsch](#), [R. Moissl](#), Cloud level winds from the Venus Express Monitoring Camera imaging, *Khatuntsev et al.*, Cloud level winds from the Venus Express Monitoring Camera imaging, *Icarus* (2013); doi: 10.1016/j.icarus.2013.05.

Garate-Lopez et al., A chaotic long-lived vortex at the southern pole of Venus, *Nature Geoscience*, 6, 254–257, 2013. doi:10.1038/ngeo1764

Chamberlain, S., Bailey, J., Crisp, D., & Meadows, V. (2013). Ground-based near-infrared observations of water vapour in the Venus troposphere *Icarus*, 222 (1), 364-378 DOI: [10.1016/j.icarus.2012.11.014](https://doi.org/10.1016/j.icarus.2012.11.014)

## Letter from VEXAG Chair

Hello Friends of Venus!

As you'll see from this newsletter, there's a lot going on within VEXAG and in the broader Venus community. Most importantly, I want to draw your attention to several upcoming opportunities to participate in Venus science and exploration activities. For those of you attending AGU, I would like to encourage you to attend the Venus science sessions and Town Hall that are planned (please see calendar on page 6 of this newsletter). The science sessions include a two-hour oral session with 8 presentations and a poster session with 19 contributions. The Town Hall is open to all and will include time for questions and discussion.

I'm also really excited about an upcoming workshop planned for May 19-21, 2014. This workshop will be focused on identifying and characterizing exploration targets (which can be on the surface or in the atmosphere) that can be accessed via landers, probes, balloons, or orbiters. The primary objective of this workshop is to specify key measurement and access requirements for addressing high priority Venus science questions. Mark your calendars!

Most importantly, plans are underway for the upcoming 11<sup>th</sup> VEXAG meeting planned for November 19-21, 2013, at NASA Headquarters. One of the primary goals of this meeting is to discuss the newly restructured and revised Goals Objectives and Investigations table. This revised table is a direct result of comments and discussion at the VEXAG #10 as well as at the LPSC Town Hall meeting. The draft table is now available for comment on the VEXAG web site and I encourage you to look at it prior to the meeting. Logistical information, a draft agenda and other VEXAG issues for discussion will also be posted on the web site in advance of the meeting, so check back often. I'm looking forward to seeing everyone in November!

Lori S. Glaze, VEXAG Chair