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

Sanjay Limaye, VEXAG Chair

Proposed NASA budget for FY 2013 decreases Planetary Science Spending in FY2013 and beyond

The budget presented to congress by the President in early February reduces the Planetary Exploration budget by 300 M$ and the reductions continue in the notional budgets for the following four years. This budget singles out Planetary Science Division (PSD) for sharp reductions while the other divisions appear to receive current level of support. Hearings in Congress on the proposed budget have begun and the congressional action will of course determine the budget allocated for PSD in FY2013 when the NASA budget is voted upon.

In the proposed budget it is difficult to know how the PSD can achieve even a portion of the program for planetary exploration recommended by the National Academies Decadal Survey of Planetary Science. PSD projects no flagship missions in this decade under the proposed budget, the next Discovery Announcement of Opportunity in FY 2015 followed by the competition for the fourth New Frontiers Mission in FY2016.

The exploration of Mars continues to attract a significant amount of attention in the future with a new partnership between the Human Exploration effort and Planetary Science Division with the involvement of the Office of the Chief Technologist. It is critical therefore that the Venus community ensures its concerns and views are heard in the year that marks the beginning of planetary exploration with the successful fly-by of Venus by Mariner 2 in December 1962.

How a flagship mission to Venus can be planned with international partners will be considered by the VEXAG International Venus Exploration Focus Group. A meeting is planned during EGU conference in April.
A high altitude observatory flying in Earth’s stratosphere may be able to help answer important Venus science questions

A brief report on the Workshop on Planetary Observations from Balloon Platforms, Cleveland, Ohio 25-26 January 2012
Tibor Kremic, NASA/GRC

A workshop to explore the potential planetary science that could be accomplished from a high-altitude balloon-based observatory was held at NASA Glenn in late January. The workshop brought together 75 scientists and engineers from a number of disciplines. The attendees were briefed on current capabilities of balloon platforms. Principle investigators and experts from recent balloon missions, flown for other NASA SMD divisions, presented their experiences and were available for questions and comments. Participants then split into working groups by target bodies to explore the potential science achievable if this platform existed for planetary scientists today.

The Venus break-out was led by Sanjay Limaye and identified four distinct science concepts that this platform would enable/enhance. These include temporal day and night cloud circulation, thermal surface emissivity, and lightning detection.

These and the other 36 science concepts are being made available to the broad planetary science community for comment. The community will also be invited to offer other science concepts not currently in identified. Balloon-based observations have the potential to achieve some high level science which can then be used to build a stronger case for future orbiters, probes, or landers to Venus.

The participants were entertained by Jim Green (NASA/PSD) with a fascinating talk on the use of balloons during the civil war. Be looking for news through PEN and other sources on how you can comment and add your ideas/input to this effort!

Figure 1. Participants on day 2 of the workshop at the Ohio Aerospace Center.
A Survey of Environmental Test Chambers suitable for testing instruments for Venus
Rodger Dyson (NASA/GRC) and Natasha Johnson (NASA/GSFC)

The following matrix only includes in-situ test facilities that support a Venus atmosphere.

<table>
<thead>
<tr>
<th>Location</th>
<th>Volume (ft³)</th>
<th>Dimensions (ft by ft)</th>
<th>Pressure (bar)</th>
<th>Temperature (°C)</th>
<th>Species</th>
<th>Notes</th>
<th>Public/ROSES Availability</th>
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</thead>
<tbody>
<tr>
<td>NASA JPL</td>
<td>0.0009</td>
<td>.049 by .49</td>
<td>1 to 1000</td>
<td>20 to 1000</td>
<td>CO₂, N₂, SO₂</td>
<td>Accelerated Weathering</td>
<td>Yes</td>
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<tr>
<td>MIT</td>
<td>0.001</td>
<td>0.04 by 1</td>
<td>1 to 200</td>
<td>20 to 700</td>
<td>CO₂</td>
<td>Pressure or temperature</td>
<td>No</td>
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<td>0.04 by 1</td>
<td>1 to 10,000</td>
<td>20 to 150</td>
<td>CO₂</td>
<td>LIBS/Raman</td>
<td>No</td>
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<tr>
<td>Univ. of Wisconsin</td>
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<td>0.05 by 1</td>
<td>1 to 270</td>
<td>20 to 650</td>
<td>CO₂</td>
<td>DOE Reactor Corrosion</td>
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</tr>
<tr>
<td>MIT</td>
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<td>0.08 by 4</td>
<td>1 to 200</td>
<td>20 to 700</td>
<td>CO₂</td>
<td>Pressure or temperature</td>
<td>No</td>
</tr>
<tr>
<td>NASA GSFC</td>
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<td>0.41 by 1</td>
<td>1 to 95.6</td>
<td>20 to 500</td>
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<td>Materials</td>
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<tr>
<td>NASA JPL</td>
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<td>0.33 by 5.25</td>
<td>1 to 103</td>
<td>20 to 500</td>
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<td>RVLT, Optical Access</td>
<td>Yes</td>
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<tr>
<td>Georgia Inst of Technology</td>
<td>1.05</td>
<td>1.16 by 1</td>
<td>1 to 100</td>
<td>20 to 343</td>
<td>CO₂, N₂</td>
<td>Higher altitude only</td>
<td>No</td>
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<tr>
<td>NASA Glenn</td>
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<td>1.5 by 3</td>
<td>1 to 100</td>
<td>20 to 500</td>
<td>CO₂, N₂, SO₂</td>
<td>Any altitude, Under Construction</td>
<td>Yes (Fall 2012)</td>
</tr>
<tr>
<td>NASA Glenn</td>
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<td>3 by 4</td>
<td>10² to 10³</td>
<td>20 to 537</td>
<td>CO₂, N₂, SO₂, Ar, H₂O, CO, He, Ne, OCS, HCl, HF</td>
<td>Any altitude, Optical Access, Under Construction</td>
<td>Yes (Fall 2012)</td>
</tr>
</tbody>
</table>

For more information about facilities in Europe and other information, please visit the VEXAG URL where the information is posted.

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VEXAG Focus Groups continue to tackle the issues related to Venus exploration. They provide an effective means for considering the discussing relevant issues and provide the VEXAG Committee to provide feedback to NASA through the VEXAG Chair and the Planetary Science Subcommittee of the NASA Advisory Council (NAC). Membership of the focus groups and leads is posted on the VEXAG URL. Please provide your input through available discussion boards or directly to the leads. Current Focus Groups are:

- Competed Missions and ROSES Focus Group
- Technology Development and Laboratory Measurements Focus
- Venus Goals and Objectives (Document) and Venus Exploration Sites Focus Group
- International Venus Exploration Focus Group
- Young Scholars Focus Group
Transit of Venus – 5/6 June 2012

Two hundred and fifty years after the discovery of the atmosphere around Venus, the first planetary discovery about any planet, the 2012 transit will be the first one which has the potential to inform us more about the atmosphere of Venus as a transiting exoplanet in its habitable zone. The 1639, 1761/1769, 1874/1882 transits focused more on the measurement of the astronomical unit, but the attempts were foiled by the "black-drop" effect, which prevented the accurate timing of the ingress and exit of Venus onto the observed solar disk. The 2004 transit of Venus was the first one to be observed from spacecraft. During the 2004 transit of Venus, two amateur astronomers used a home-built coronagraph to observe Venus and captured unexpected good views of the aureole around Venus created by the refraction of incident sunlight.

Thomas Widemann (Paris Observatory) and Paolo Tanga (Nice Observatory) are leading an effort to assemble a few such "Cytherographs" to deploy at several locations around the world to capture the Venus aureole at different times and at various continuum wavelengths from different perspectives. The analysis and subsequent modeling of the aureole data obtained in 2004 has yielded some information about the atmospheric thermal structure and its variation with latitude (P. Tanga, T. Widemann, B. Sicardy, J.M. Pasachoff, J. Arnaud, L. Comolli, A. Rondi, S. Rondi, P. Sütterlin, Sunlight refraction in the mesosphere of Venus during the transit on June 8th, 2004, Icarus, Volume 218, Issue 1, March 2012, Pages 207-219, ISSN 0019-1035, 10.1016/j.icarus.2011.12.004, Preprint at: http://arxiv.org/pdf/1112.3136v1.pdf). The authors have demonstrated that in the absence of opaque haze and cloud layers, in a transiting exoplanet, otherwise similar to Venus in size and atmospheric composition, there could be a significant amplification of spectral signature of atmospheric species due to refraction. This is a crucial advance that may be useful for studies of extra-solar terrestrial planets in their habitable zone.

NASA SMD is planning coverage of the global events covering the transit of Venus via the web and NASA TV. A new web site has been created for the transit (venustransit.nasa.gov) which also has a map based tool for users to enter local events. Live coverage is planned using images of the Sun from Mauna Kea, Hawaii.

Figure 2. Drawing by M. Frassati (Unione Astrofili Italiani) representing the aureole during the 2004 transit egress, using 20 cm Schmidt Cassegrain telescope.

Future Meetings of Interest

**Venus Volcanism Session at the Lunar and Planetary Science Conference and VEXAG Townhall Meeting**

A “special” session on Venus volcanism will be held on Tuesday, 20 March 2012. A VEXAG townhall meeting will be held in the Waterways 4 Room on Wednesday from 12:00 – 1:15 pm. Dr. J. Green, Director, PSD has been invited. He will be giving an update on the NASA budget on Monday at 5:30 pm. Venus scientists are
invited to attend the budget briefing so that they can be prepared for a dialog with Dr. Green about the future of Venus exploration. Interested persons not attending LPSC can call in via telephone. Phone Numbers are: 818-354-3434. Toll Free Number 1-866-328-8761 – Meeting ID:9916

Venus Session at the European Geophysical Union Meeting, Vienna and - International Venus Exploration Focus Group Townhall Meeting, 24 -25 April 2012, 7 pm, Room 7, Austria Center, Vienna, Austria

The Third International Planetary Dunes Workshop: Remote Sensing and Data Analysis of Planetar y Dunes will be held June 12–15, 2012, at the Lowell Observatory, 1400 West Mars Hill Road, Flagstaff AZ 86001. The workshop will also include a one-day field trip on Wednesday, June 13, to aeolian sandstones near Page, Arizona, via motor coach with two stops along the way, and an optional field trip on Saturday, June 16, to an active dune field near Grand Falls, Arizona. Contact Dr. Tim Titus (ttitus@usgs.gov) for more information.

Deadline for Abstract Submission: Tuesday, April 3, 2012 5:00 PM CDT (GMT -5)

9th International Planetary Probes Workshop, Toulouse, France, 18-22 June 2012
There will be a dedicated Venus session, to which you are particularly invited to submit papers, Colin Wilson (Oxford U.) and Anita Sengupta (JPL) are convenors. Abstract deadline is 16 March 2012.

The goal of this conference is to look at climate in the broadest sense possible — by comparing the processes at work on the four terrestrial bodies, Earth, Venus, Mars, and Titan, and on terrestrial planets around other stars. These processes include the interactions of shortwave and thermal radiation with the atmosphere, condensation and vaporization of volatiles, atmospheric dynamics and chemistry, and the role of the surface, interior, sun and other external factors in the long-term evolution of climate. Conference talks will compare the scientific questions, methods, numerical models, and spacecraft remote sensing experiments for Earth, and the other planets, with the goal of identifying objectives for future research and missions.

COSPAR 2012, 14-22 July 2012, Mysore, India

Scientific Commission Panel B, Event B .08 Exploration of Venus
After arriving at Venus in April 2006, Venus Express has now collected data on the atmosphere, clouds, surface and solar wind interaction for more than five years. The Japanese Venus Climate Orbiter, Akatsuki, after its first unfortunate attempt for orbit insertion in 2010, is now retargeted to arrive at Venus in 2015. At the same time there are several missions in the planning and/or proposal stage in Russia, the USA and Europe. In addition Chinese and Indian scientists have expressed interest in missions of their respective nations. It is obvious that activities related to Venus research are more intense now than for many years. This session is therefore very timely and will provide a platform for all scientists active or interested in Venus research. We welcome contributions in all fields related to Venus including, among others, space or ground based observations and results, modeling, theory, comparative planetology of the terrestrial planets, and plans and ideas for new missions.
Scientific Commission Panel C

Scientific results and proposed input for updating models will be presented at the following sessions:
Event C 3.1 Planetary Atmospheres
Event C 3.2 Planetary Upper Atmospheres, Ionospheres and Magnetospheres
Event C 3.3 Modeling of Planetary Atmospheres

Abstract deadline is past. If you are planning to attend, please let the VEXAG Chair know.

Venus in the News

The print issue of the Icarus Special Issue on Advances in Venus Science was published in February 2012. It contains 41 papers dealing with Venus interior, surface and atmosphere.

Hot Flow Anomalies Observed on Venus

When discontinuities in the solar wind remain in contact with a planet’s bow shock, they can collect a pool of hot particles that becomes a hot flow anomaly (HFA). An HFA on Venus most likely acts like a vacuum, pulling up parts of the planet’s atmosphere. HFAs have been seen before near Earth, Saturn and possibly Mars. But the new observation is the first unambiguous confirmation of the phenomenon on Venus according to a paper published in JPG-Planets. Collins et al. present a multi-instrument study of observations from the Venus Express spacecraft in the Venusian foreshock, on the 22nd of March 2008, incorporating both Venus Express Magnetometer and ASPERA plasma observations. Centered on an interplanetary magnetic field discontinuity with inward convective motional electric fields on both sides, with a decreased core field strength, ion observations consistent with a flow deflection, and bounded by compressive heated edges, the properties of this event are consistent with those of HFAs observed at other planets within the Solar System.

Current Venus Missions

Venus Express

All currently operating instruments on Venus Express continue to operate normally. VIRTIS continues to collect data in the visible channels. Venus Express is coming up for a review in June 2012 for continued funding through 2014 and operations beyond 2014. Venus Express data is accessible via NASA/PDS from ESA’s Planetary Science Archive.

Akatsuki

After successful trajectory manoeuvres in September and November last year, JAXA’s Akatsuki mission is waiting until 2015 for a close fly-by of Venus. The Operations team will evaluate the options for orbit insertion closer to the fly-by date.