VEXAG Update
NASA PSS Meeting
12 March 2014

Lori S. Glaze, NASA GSFC
VEXAG Chair
• Recent Activities
  - November: VEXAG General Meeting
  - December: VEXAG Town Hall meeting at AGU
  - December: Special Session at AGU on Venus Exploration; opportunity for feedback on new community documents
  - January: Near-final version of new community documents posted on-line for endorsement (63 so far)
  - February: Venera-D SDT members announced; 5 US members (Limaye, Senske, Jessup, Economou, Kremic)
  - March: VEXAG Town Hall meeting at LPSC; early career scholars mixer
• In preparation for Discovery AO....
• Completed top priority for 2013: Update Goals, Objectives and Investigations for Venus Exploration – Led by Robbie Herrick
• Completed 2nd priority for 2013: Develop a Roadmap for Venus Exploration – Led by Doug Stetson and Martha Gilmore
• Completed draft Technology Plan; companion to Goals and Roadmap documents - Led by Pat Beauchamp and Jim Cutts
• All three final documents will be rolled out at the VEXAG Town Hall during LPSC next week
### Upcoming Executive Committee Changes:

<table>
<thead>
<tr>
<th>Name</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lori Glaze (GSFC)</td>
<td>Chair</td>
</tr>
<tr>
<td>Pat Beauchamp (JPL) Tibor Kremic (GRC)</td>
<td>Lead Technology FG</td>
</tr>
<tr>
<td>Gordon Chin (GSFC)</td>
<td>Lead Competed Missions TAG</td>
</tr>
<tr>
<td>David Crisp (JPL)</td>
<td>Member at Large</td>
</tr>
<tr>
<td>Robert Grimm (SwRI)</td>
<td>Member at Large</td>
</tr>
<tr>
<td>Robert Herrick (U Alaska)</td>
<td>Lead Goals FG</td>
</tr>
<tr>
<td>Stephanie Johnston (U Maryland) Lynnae Quick (GSFC)</td>
<td>Lead Early Career Scholars FG</td>
</tr>
<tr>
<td>Sanjay Limaye (U Wisconsin)</td>
<td>Lead International TAG, Past Chair</td>
</tr>
<tr>
<td>Sue Smrekar (JPL)</td>
<td>Past Chair</td>
</tr>
<tr>
<td>Ellen Stefan (Proxemy) Martha Gilmore (Wesleyan)</td>
<td>Lead Roadmap TAG</td>
</tr>
</tbody>
</table>
• Findings from November 2013 meeting encourage PSD support of:
  1) New entry technologies; in particular to maintain support until they are ready for infusion
  2) High efficiency power/cooling capabilities for long term survival at or near the Venus surface (e.g., radioisotope power systems)
  3) US-Russian bilateral participation in the Venera-D Science Definition Team
  4) Decadal Survey recommended cadence for Discovery and New Frontiers
  5) Including the AG Goals documents in the AO and Program Libraries to ensure availability during Discovery and New Frontiers evaluation processes
Findings (continued) from November 2013 meeting encourage PSD support of:

6) Several upcoming opportunities and initiatives:
   a. Exploration Targets Workshop (May 19-21, 2014)
   b. Comparative Climates of Terrestrial Planets – 2 (July 7-10, 2015)
   c. Venus Instrumentation Workshop (FY14)
   d. Venus Express Science Team Meeting in the US (2014 or 2015)
   e. Extreme Environments Centennial Challenge
• Venus mission status
  – Venus Express:
    • Spacecraft in excellent condition after > 7 years in orbit
    • Over 5000 Gbit of science data transmitted to Earth
    • Extended mission approved through 2014;
    • Preliminary approval through 2015, but fuel likely to run out in 2014.
    • Aerobraking simulations campaign scheduled for March – May, readiness review in late April
    • End of routine science mission scheduled for 17 May
    • Aerobraking campaign to begin in May and June
  – Akatsuki continues on a schedule that includes a Venus Fly by in November 2015 and possible Venus Orbit Insertion in 2016 (6 day orbit in equatorial plane)
  – Bi-lateral discussions between Russia and US have begun on a possible Venus mission. A joint IKI-NASA Venera-D Science Definition Team was established in February.
• Upcoming Activities
  – May 19-21: Venus Exploration Targets Workshop to be held at the Lunar and Planetary Institute; Focus on specifying measurement type, quality and precision required to answer top science Goals.
  – May 22: Venera-D SDT meeting at LPI in conjunction with VET
  – August (dates TBD): International Venus Exploration Laboratory Measurements and Instrument Technologies Workshop (joint with Venera-D SDT)
  – April (?) 2015: Venera-D SDT final report
  – April 2015: 12th VEXAG meeting at NASA HQ; after Discovery submissions and FY16 Budget release
  – Spring 2015: Possible workshop on Venus interior dynamics and geophysics
  – July 7-10, 2015: Comparative Climate of the Terrestrial Planets II
SCIENCE NUGGETS
Many air travelers have seen this phenomenon – a ring around the shadow of the airplane on a cloud or a fog bank when the sun is directly behind. If the cloud particles are nearly uniform in size, rings in rainbow colors can be seen. The glory on Venus was predicted (Hansen and Hovenier, 1974) and observed first from Pioneer Venus Orbiter Cloud Photopolarimeter data from the increased polarization amount (Kawabata et al., 1980). Now the Venus Monitoring Camera has captured the full glory at 365 nm. Because the radius of the glory is ~ thousand km, even the 20° FoV of VMC cameras could not capture the entire ring at 965 and 1010 nm.

In a paper published on-line in Icarus, today, Markiewicz et al. discuss the implications of the glory observations. The main result is that the cloud particles require a high index of refraction contamination to the sulfuric acid composition, and FeCl₃ is one possible candidate. S. S. Limaye (U. Wisconsin) is a NASA funded Participating Scientist for Venus Express and VMC Co-Investigator. http://www.sciencedirect.com/science/article/pii/S001910351400061X
Bimodal distribution of sulfuric acid aerosols in the upper haze of Venus
Peter Gao a,†, Xi Zhang a,b, David Crisp c, Charles G. Bardeen d, Yuk L. Yung

Peter Gao, a graduate student in the Geological and Planetary Science Division at Caltech, recently lead an effort to analyze observed variations in the haze above the main cloud deck, in the Venus mesosphere (60 – 100 km).

A 1-dimensional version of the Community Aerosol and Radiation Model for Atmospheres (CARMA) model was used to simulate the evolution of the haze microphysics.

They found that the observed bi-modal particle size distribution could result as small droplets nucleated locally on meteoric dust mixed with larger particles transported upward from the main cloud deck.

Interestingly, within the main cloud deck, they found that fallout of nucleation-sized particles, combined with upwelling of sulfuric acid vapor from below the cloud led to oscillatory particle growth, which could result in sulfuric acid rain.

These results have been published in the March issue of ICARUS (v231, 83-98, 2014)

Time evolution of the nominal particle size distribution at 84, 74, 64, and 54 km over $10^8$ seconds. Note strong, periodic particle growth in the middle cloud (54 km).
Determining the Size of Planetary Cores

Chris Russell

• During the Apollo program the size of the Moon’s iron core was determined by the distortion of the magnetic field in the Earth’s magnetotail by the presence of the Moon. Repeated soundings showed that the core was close to 400 km in radius, a value recently confirmed seismically.

• Today Venus Express is adding magnetic measurements to those obtained by Pioneer Venus that define the distortion of the magnetic field wrapped around the planet by the solar wind. We hope to be able to determine the magnetic distortion from orbit but a better determination could be made from the atmosphere in balloons that would circle the globe every four days.

• A similar measurement could be made from the surface of Mars by InSight or Mars2020 if so instrumented using the rotation of the planet to define the induced field.