



Current VEXAG
Priorities: Where does
the Upper Atmosphere
Stand?

Lori Glaze, VEXAG Chair

1/24/2013



- Purpose of this talk:
- Stimulate discussion regarding current stated priorities for Upper Atmosphere Science
- Are updates required
 - Are some things “done”?
 - Are there key investigations missing?
 - Is there enough emphasis on the “upper” atmosphere?
 - Should priorities be reconsidered?



- VEXAG maintains a list of Goals, Objectives, and Investigations (GOI) for Venus Exploration: <http://www.lpi.usra.edu/vexag/reports/GoalsObjectivesFactSheets.pdf>
- GOI last updated in 2009
- GOI currently undergoing revision based on November VEXAG meeting
 - Plan is to have new draft available for community review prior to LPSC



- Top Level VEXAG Goals are directly linked to the most recent Planetary Decadal Survey Themes:

Decadal Survey Theme	VEXAG Goal
Building New Worlds	Origin and Evolution
Workings of Solar Systems	Venus as a Terrestrial Planet
Planetary Habitats	Climate Change and the Future of Earth



- 3 top-level Goals are not prioritized
- Objectives are in priority order within each Goal
- Investigations are in priority order within each Objective.
- Investigations that include the Venus Upper Atmosphere are part of:
 - Objective #4 in Goal 2, and
 - Objective #1 in Goal 3



Goal 2 – Objective 4

Venus as a Terrestrial Planet	Characterize current processes in the atmosphere	Characterize the sulfur cycle through measurements of abundances within the Venus clouds of relevant gaseous and liquid/solid aerosol components such as SO ₂ , H ₂ O, OCS, CO, and sulfuric acid aerosols (H ₂ SO ₄).
		Determine the mechanisms behind atmospheric loss to space, the current rate, and its variability with solar activity.
		Characterize local vertical winds and turbulence associated with convection and cloud-formation processes in the middle cloud region, at multiple locations.
		Characterize superrotation through measurements of global-horizontal winds over several Venus days at multiple-vertical levels (day and night) from surface to thermosphere.
		Investigate the chemical mechanisms for stability of the atmosphere against photochemical destruction of CO ₂ .
		Characterize local and planetary-scale waves, especially gravity waves generated by underlying topography.
		Measure the frequencies and strengths of lightning and determine role of lightning in generating chemically-active species (e.g., NO _x).
		Search for and characterize biogenic elements, especially in the clouds.



Goal 3 – Objective 1

Climate Change and the Future of Earth	Characterize the Venus Greenhouse	Determine radiative balance as a function of altitude, latitude, and longitude.
		Measure deposition of solar energy in the atmosphere globally.
		Determine the size, distribution, shapes, composition, and UV, visible, and IR spectra, of aerosols through vertical profiles at several locations.
		Determine vertical-atmospheric temperature profiles and characterize variability.
	Determine if there was ever liquid water on the surface of Venus	Determine isotopic ratios of H/D, 15N/14N, 17O/16O, 18O/16O, 34S/32S 13C/12C in solid samples to place constraints on past habitable environments (including oceans).
		Identify and characterize any areas that reflect formation in a geological or climatological environment significantly different from present day.
	Characterize how the interior, surface, and atmosphere interact	Determine abundances and height profiles of reactive atmospheric species (OCS, H2S, SO2, SO3, H2SO4, Sn, HCl, HF, SO3, ClO2 and Cl2), greenhouse gases, H2O, and other condensibles, in order to characterize sources of chemical disequilibrium in the atmosphere.
		Determine rates of gas exchange between the interior, surface and atmosphere.



BACKUP SLIDES



- Goal 1: Origin and Evolution
 - Objective 1: Understand Atmospheric Evolution
 - Focused on noble gas isotopes, and isotopic ratios of H, N, O, S, and C (bulk atmosphere)
 - Objective 2: Seek evidence for past changes in interior dynamics
 - Objective 3: Determine if Venus was ever habitable
 - Focused on surface chemistry, mineralogy, and gases trapped in rocks



- Goal 2: Venus as a Terrestrial Planet
 - Objective 1: Chemistry and mineralogy of the crust
 - Objective 2: Structure and Dynamics of the interior
 - Objective 3: Rates of volcanism and tectonism
 - Objective 4: Characterize current processes in the atmosphere
 - Focused on chemical cycles (Sulfur and CO₂) and dynamics
 - Has been proposed to consider higher priority for this objective.
 - Thoughts?



- Goal 3: Climate Change and the Future of Earth
 - Characterize the Venus Greenhouse
 - Focused on radiative balance
 - Determine if liquid water were ever present
 - Characterize how the interior, surface and atmosphere interact