Mission Science Goals

- Atmospheric structure and dynamics (VMC, MAG)
- Atmospheric composition and chemistry (VMC, ASPERA, MAG)
- Clouds and their radiative properties (VMC, ASPERA)
- Sources and sinks of atmospheric gases (VMC)
Venus Monitoring Camera (VMC) Overview

- Wide-angle camera (17°)
- Resolution of 200m at pericenter and 50km at apocenter
- 4 narrow band filters
VMC Goals

- **Atmosphere:**
  - Investigates cloud morphology and atmospheric dynamics
  - Search for water vapor in the lower atmosphere (night)
  - Atmospheric composition
    - Sulfur dioxide is found 0.20-0.32µm
    - Investigates 0.36, 0.51, 0.97, and 1.01µm
    - Water is found around 1µm

- **Surface:**
  - Thermal maps
VMC Results

- Clouds on Venus rotate slowest around noon and fastest morning/evening.
- Overall, cloud rotation rate is increasing.
- Clouds rotate fastest closest to the equator.
- Brightness variations in the southern polar regions.
Analyser of Space Plasmas and Energetic Atoms (ASPERA-4) Overview

- ASPERA-3 clone
- Contains 4 detectors:
  - 2 for energetic neutral atoms
  - Electron spectrometer
  - Ion mass analyser
ASPERA-4 Goals

- Determine how atmosphere interacts with solar wind
  - Mass addition/removal
- Postulate where the water went
  - Similar to Mars?
- Learn how plasmas interact with Venus
  - Similarities/differences between other terrestrial planets
ASPERA-4 Results\textsuperscript{5}

- H:O leaves Venus in a 2.2:1 ratio
  - Unlike Mars, the surface isn’t significantly oxidized
- The bow shock is closest to Venus at solar minimum
- The ionosphere on Venus and Mars have similar structure
- Greater than anticipated oxygen concentration in plasmas
Magnetometer (MAG)

- Repurposed Rosetta tool
- Detects magnetic fields in upper atmosphere
- Difference magnetic fields at two points to eliminate noise
- Benefits from highly elliptical orbit
  - Measures magnetosheath, ionosphere, and magnetotail
MAG Goals

- Solar wind interaction at solar minimum
- Map high time-res magnetic properties
- Measure magnetic fields
- Measure solar wind erosion
- Determine effects of plasma in exosphere
MAG Results

- At solar minimum, little solar wind enters the atmosphere
  - Occurs at bow shock minimum
Remaining Questions

- Was Venus too hot to have a magnetic field?
- Why does the solar cycle have an impact?
- Where does the excess oxygen go?
- Why do clouds behave the way that they do?
Successes/Failures

- **Successes:**
  - Lasted 9 years (nominally 500+500 days)
  - Mapped magnetosphere + atmosphere
  - Found a variety of atmospheric compounds (ozone, hydroxol)
  - Cloud structure/solar wind interactions
  - Confirmed Voyager data

- **Failures:**
  - Few
Future Missions

- Akatsuki (Orbiter)
- BepiColombo (Flyby)
- Venus Orbiter Mission* (Orbiter)
- Venera-D* (Everything)

* Proposed
References


Questions?