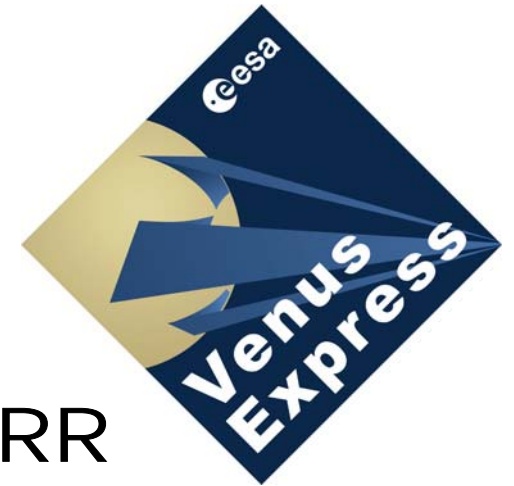


European Space Operations Centre

VENUS EXPRESS Ground Segment Summary Status at MERR



JPL, Pasadena: September 20, 2005

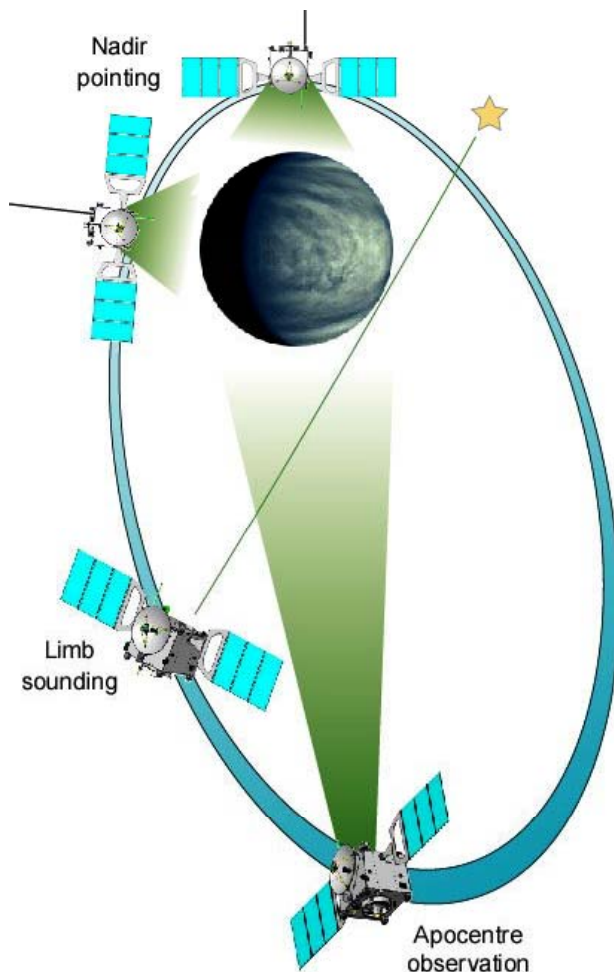
Manfred Warhaut
Venus Express Ground
Segment Manager
ESA/ESOC (OPS-OP)

History of Venus Express

- Mission conceived in call for re-use of Mars Express spacecraft in 2001
- Proposal won a competition against 9 others
- Mission of Opportunity: Several existing experiments and spacecraft rebuild
- Started development in mid-2002
- Launch on October 26th, 2005
- EXPRESS = extremely short development time



Venus Express Science Goals



Space environment:

- Ionised plasma environment
- Interaction with solar wind

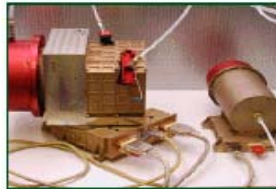
Atmosphere:

- Mechanisms of general atmospheric circulation
- Greenhouse effect
- Physics & chemistry of cloud layer
- Composition & chemistry of lower atmosphere
- Atmosphere-surface interaction

Solid planet:

- Surface IR topography
- Subsurface structure (few km)

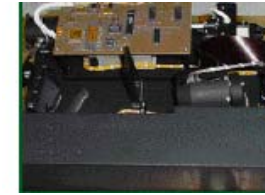
Venus Express Instruments



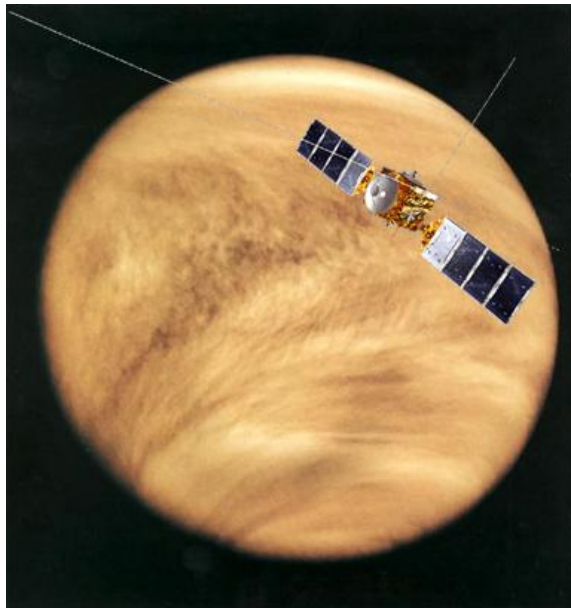
ASPERA – Analyser of Space Plasmas and Energetic Atoms
S. Barabash, IRF Kiruna (SE)



VIRTIS - Visible and Infrared Thermal Imaging Spectrometer
G.Piccioni, Obs. Meudon (FR)



SPICAV - Spectroscopy for the Investigation of Characteristics of the Atmosphere of Venus
J-L.Bertaux, CNRS Verrières (FR)



MAG - Fluxgate Magnetometer
T. Zhang, OAW Graz (AT)



VMC – Venus Monitoring Camera
W. Markiewicz, MP Ae Lindau (DE)

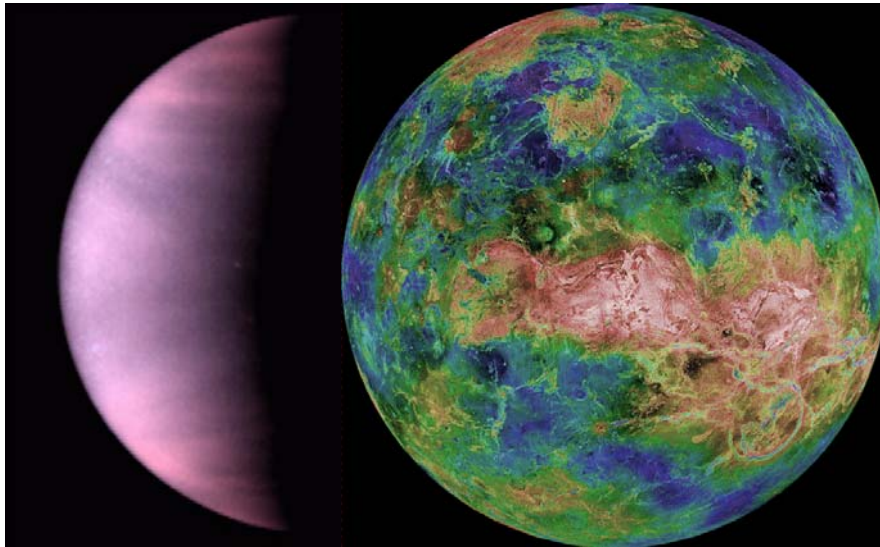


PFS - Planetary Fourier Spectrometer
V. Formisano, CNR Rome (IT)



VeRA – Venus Radio Science Experiment
B. Häusler, Univ. BW München (DE)

Venus Express "Firsts"



- Systematic long-term mapping (UV to thermal IR)
- Atmospheric temperature and dynamics at various levels (0 to 200 km altitude)
- Solar/stellar occultation techniques at Venus
- 3D ion mass analyser, Venus atmospheric escape
- Near-IR lower atmosphere and surface monitoring
- Subsurface radar sounding (few km)
- Reuse of spacecraft at another planet

Venus Express Spacecraft

Thermal control
Mars Express Principles customized for Venus
 ✓ Controlled heaters
 ✓ Passive MLI & radiators

Structure
Mars Express primary structure
 ✓ Machine ALLVA ring from forging
 ✓ Al honeycomb panels
 ✓ Three shear panels
 ✓ Outer and shear walls equipment/payload mounting

Attitude control and measurement
Mars Express rebuilt
 ✓ Three axis stabilised using four 12 Nms reaction wheels
 ✓ Two wide Field of View Star Trackers with autonomous Star Pattern recognition and measurement capabilities
 ✓ Two inertial measurement units including three ring laser gyros and three accelerometers each
 ✓ Two coarse sun sensors

Power
Mars Express rebuilt with enhanced PCU
 ✓ Fully regulated 28V bus
 ✓ Maximum Power Point Tracking
 ✓ 900 watts peak power for Venus operations
 ✓ 3 Li ion batteries 24 Ah
 ✓ 2x42 State Power Controller for power distribution and protection
 ✓ 2x32 Solid State Power Controller for pyrolines

Data handling
Mars Express rebuilt
 ✓ ESA class 1 OBDH architecture
 ✓ Two Command & Data Management Units providing :
 ○ four 3.1750 processors for AOCs & DMS
 ○ reconfiguration modules with majority voting capability
 ○ transfer frame generation up to 228 kbps
 ✓ 12 Gbits Solid State Mass Memory
 ✓ IEEE 1355 links for high data rates transfers

GaAs cells solar array
 ✓ Three fold out two panel arrays
 ✓ 1450 W power at Venus
 ✓ One axis orientation
 ✓ GaAs triple junction

Telecommunications
Mars Express enhanced with a second X-band HGA
 ✓ 1.3 metre diameter fixed HGA (SIX band)
 ✓ 0.3 metre diameter fixed HGA2 (X band only)
 ✓ Two LGA for omnidirectional coverage
 ✓ SIX-band uplink
 ✓ SIX-band downlink
 ✓ X-band TWTA : 65 watts RF
 ✓ Dual SIX-band transponder 5 watts RF

Propulsion
Mars Express rebuilt
 ✓ Bi-propellant system
 ✓ Two 267 litre propellant tanks
 ✓ 595 kg propellant capacity (540 kg needed)
 ✓ One 35 litre pressurant tanks
 ✓ Pressure regulated and blow down operational modes
 ✓ Eight 10N attitude thrusters
 ✓ One 400N main engine

On-board software
Mars Express update
 ✓ PSS-05-0 standard, ADA based
 ✓ Separate AOCs and DMS functions
 ✓ Modular design
 ✓ Top level object oriented design

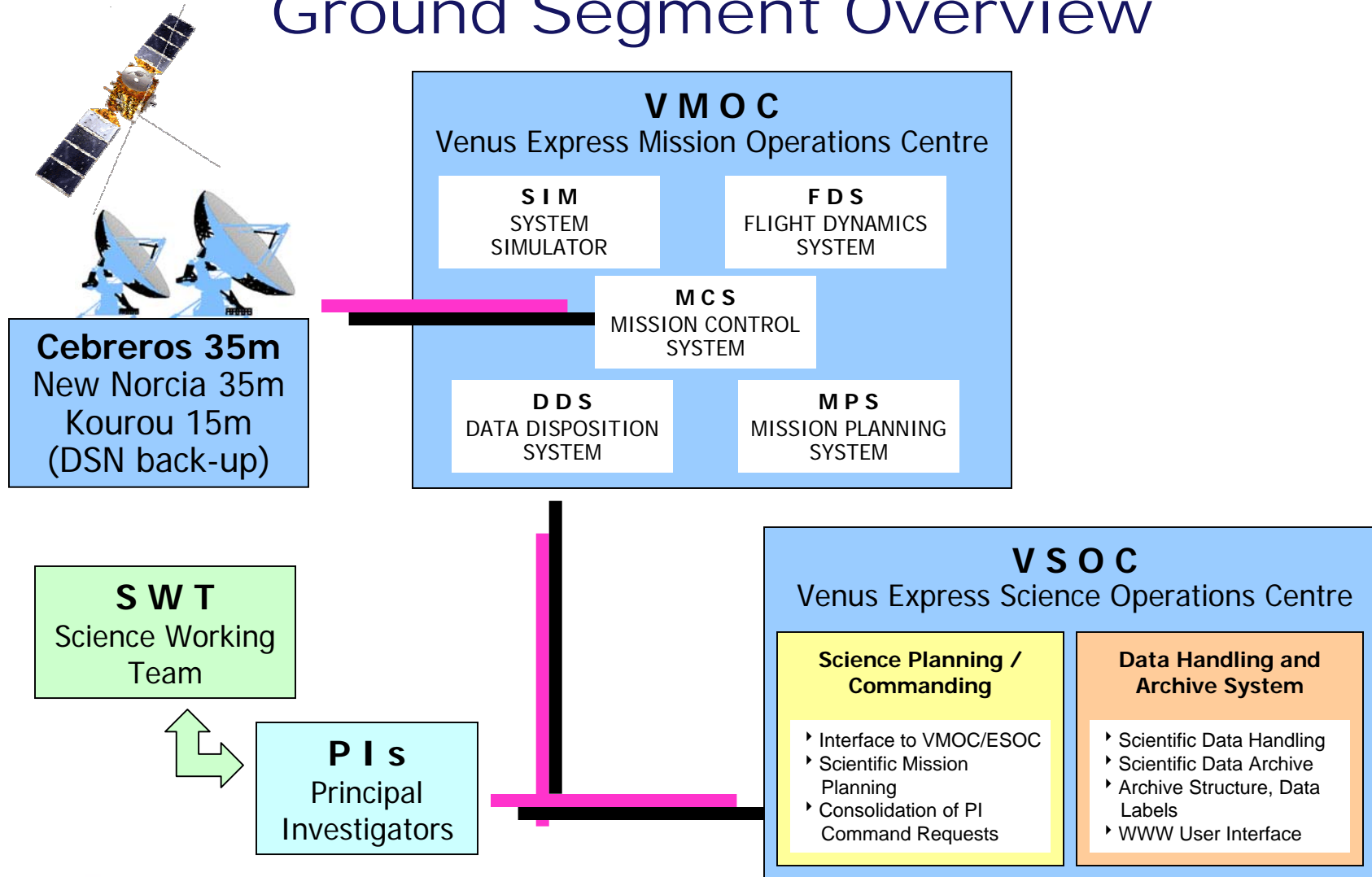


Venus Express Launch Service

- Launch from Baikonur, Kazakhstan (1270 kg)
- Soyuz rocket to ballistic trajectory
- Upper stage (FREGAT) burn to circularise then 2nd burn to Venus injection
- Separation about 90 minutes after lift-off
- LEOP for 3 days



Ground Segment Overview

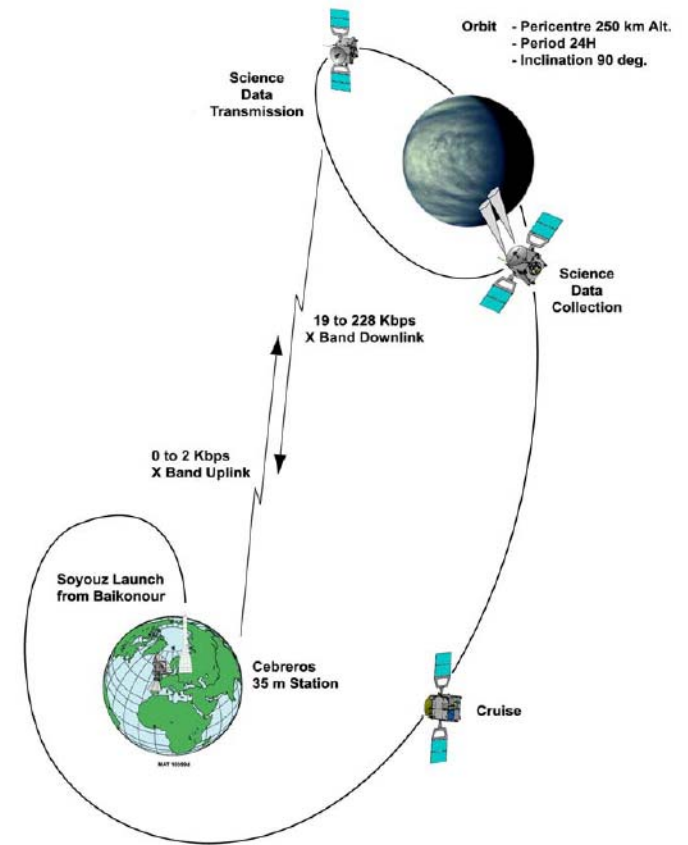


Cebreros
(Avila Spain)
June 2005

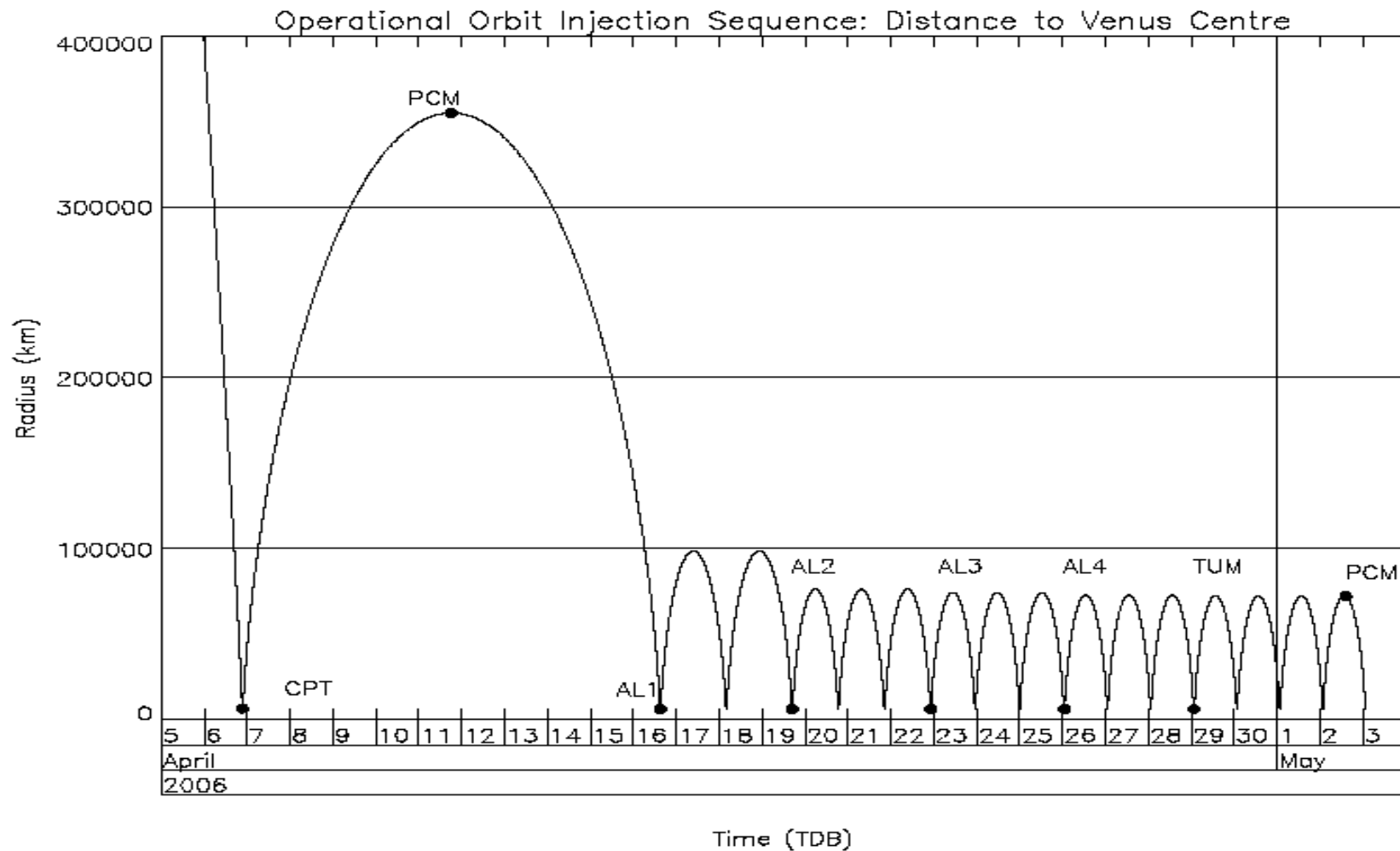


Venus Express Mission Overview

- Launch and Early Orbit Phase (LEOP) for 3 days
- Near Earth Verification for 4 weeks
- Interplanetary Cruise for 5 months
- Injection into operational orbit of 24 hours (April 2006)
- Operations for 2 Venus Days (486 earth days) using a Look-Record-then playback operations scenario



Venus Orbit Insertion (VOI)

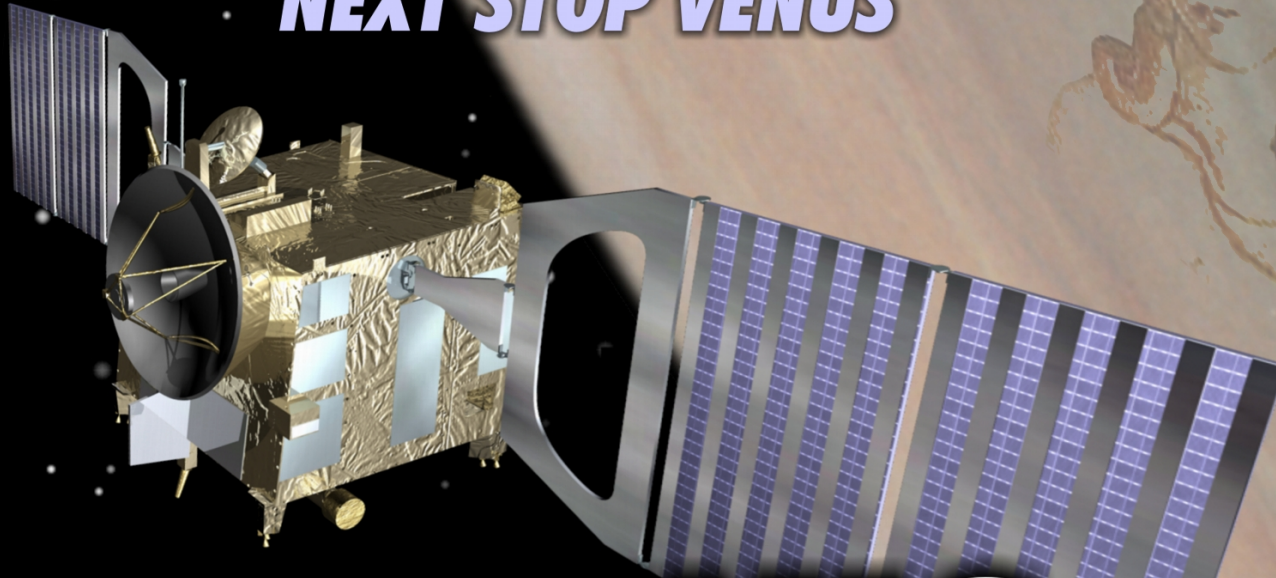


NASA/DSN Interface Status

- Use of the NASA/DSN agreed for
 - Venus Orbit Insertion (VOI) support, in particular delta-DOR and 70m coverage during Venus capture
 - LEOP support (3 days)
 - Back-up support during cruise
- Pertaining implementation documentation has been signed by ESA and JPL (November 2004) and actual implementation testing is well advanced
- Letter of Agreement (LOA) now signed (17-Jun-05)
- No provisions made to date for DSN VeRA support during routine mission. This is agreed with parties concerned



NEXT STOP VENUS



***VENUS
EXPRESS***