VEPI ORBITER
(and Fly-by-Platform) Scientific Payload

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and
VEPI steering committee

(MTA-ELTE Research Group for Geoinformatics and Space Sciences,
and the Space Research Group of the Eötvös University, Budapest, Hungary)

The scientific goals of the payload of the orbiter

No.	Main field	Scientific goal	Priority	Points
1	**Origin and evolution**	Escape of suprathermal neutrals	medium	1
2	**Origin and evolution**	Vertical profiles of H, O, Ar, Ne above 100 km	medium	1
3	**Dynamics and radiative balance**	Winds in the mesosphere	high/medium	1
4	**Plasma and wave processes**	E.m. waves in the ionosphere	high	2
5	**Plasma and wave processes**	E.m. activity in the atmosphere; lightning	high	1
6	**Surface and interiors**	Subsurface and interiors	low	1.5

The scientific goals of the payload of the orbiter

Added scientific value possibilities of the instrumentation proposed to reach the original goals No. 1~6 inside the scientific goal map of the whole VEPI mission.

No.	Main field	Scientific goal	Priority	Points
7	**Clouds**	Composition of the cloud particles	high	1
8	**Dynamics, structure and radiation balance**	Radiative balance	medium	1
9	**Surface and interiors**	Composition (and mineralogy) of the surface	high	1
10	**Surface and interiors** *(connection with 4)*	Surface-atmosphere interaction (surface-ionosphere interaction)	high	1

The scientific goals of the payload of the orbiter

Remarks:

- **No scientific goal was accepted for the orbiter on the main fields: „composition and chemistry” and „clouds”.**

However, adding the MIMA it is possible to investigate the ***cloud composition****, too.*

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However, adding the MIMA it is possible to investigate the ***cloud composition****, too.*

- For the goal **No.6 („subsurface and interiors")** the 'e.m. event detection & tbs' was proposed in the case of an orbiter, however, *we have* ***more*** *instruments* answering the 'tbs' and produce data in **„composition of the surface"** and in **„surface-ionosphere interactions"**.

The general role of the orbiter

- The **carrier** role.

  1 HB with 20 MPs,

  1 LB (Japan), - **?**

  4 DPs (3 daylight and 1 nightside DPs),

  1 VISP (Sweden), - **?**

  data collection and relay system,

  scientific payload.

The general role of the orbiter

- The **carrier** role.
- Data collection and **relay** station,

  with mission priorities before the orbiter's scientific goals.

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- Data collection and **relay** station.
- The **time-base** function for the whole mission.

It is very important!

The general role of the orbiter

- The **carrier** role.
- Data collection and **relay** station.
- The **time-base** function for the whole mission.
- The **EMC**.

Proposed instruments for the orbiter

Proposed instruments	*Scientific goal(s)*
CENTAUR	Not in priority list (atm. radioact.).
SAS2-VNS	No.4, No.5 and No.6.
EUV-FUV spectrometer	No.2.
FAVOURED	No.3. ? (very preliminary + VEX)
HNA mass-spectrometer	No.1, No.2.
MIMA	No.3, No.6 and No.7, No.8, No. 9.
SPOSH	No.5.
SWI	No.2, No.3.
SurVenTIS	Not in priority list (thermal imaging).
TPIV	No.3 and No.4, No.5
Accelerometer μSTAR	No.3. (aerobraking)
VISRS	No.4, No.6 and No.10.
VRS	No.6. (see the VISRS)
VIPI	No.2. (see the EUV-FUV sp.)
X-band transponder	No.6.
VISP plasma subsatellite	No.5 (and No.4).

The *basic* proposal for the scientific payload of the orbiter

Payload mass : ≈34 kg
(minimum 23 kg)

Consumption : ≤ 145 W
(minimum 34 W)

Data rate : ≤ 106 kbps
(minimum 87 kbps)

To be refined and optimized!

Instrument	Goal in science	Mass (kg)	Power (W)	Data rate (kbps)
VISRS	No.4,6,10	< 9	11	≥ 80
X-band tr.	No.6	no spec.	no spec.	housekeeping
EUV-FUV sp.	No.2	4.5	4	3
HNA mass sp.	No.1,2	2	4	~ 0.5
SWI	No.2,3	9.2	49.5	~ 9.2
SAS2-VNS *	No.4,5,6	0.7	~ 4	4
SPOSH	No.5	2.5	10	~ 0.5
TPIV * ⇓	No.3,4,5	0.96	1.8	1.5
SLP * ⇑	No.5	~ 1	~ 1	0.5
SGVM mag. *	No.5	≤ 1.2	1.2	1.5
MIMA	No.3,6,7-9	1	3 ≤ 5	4.4
Acc. µSTAR	No.3	1	1	0.2 (<0.03)
Total	**All** sci. goals	~ 34 kg	≤ 93W	105.3 kbps ***daily average***

Summary of the instruments main parameters and the budget

Instrument	Volume (cm^3)	Mass (kg)	Power (W)	Data rate (kbps)	Data rate min. - (kbps)	TRL
VISRS	38x26x26	< 9	11	≥ 80	80	8
X-band tr.	+ USO only	+ ≤ 1.	+ < 1	-	-	9
EUV-FUV sp.	35x35x15	4.5	4	3	1	3 / 4
HNA mass sp.	18x27x3	2	4	~ 0.5	~ 0.5	6
SWI	70x50x40	9.2	49.5	~ 9.2	~ 9.2	8 / 9
SAS2-VNS *	10x11x15 + 1b	0.7	4 – 4.5	4	2	6 / 4
SPOSH	10x10x15	2.5	10	~ 0.5	~0.5	6
TPIV * ⇓	15x25x2 + 1b	0.96	1.8	1.5	≤ 1	9
SLP * ⇑	10x10x5 + 1b	~ 1	~ 1	0.5	0.5	9
SGVM mag. *	10x10x5 + 1b	≤ 1.2	1.2	1.5	0.5	9
MIMA	12x13x10	1	3 ≤ 5	4.4	1.1	3 / 5
Acc. µSTAR	~ 9x12x10	1	1	0.2 (<0.03)	0.2 (<0.03)	3 / 8
Total	**~ 0.2 m^3** min. 0.05 m^3	~ 34 kg min. 23 kg	≤ 93W min. 34 W	105.3 kbps min. 95.6	96.3 kbps min. 86.6	-

The Fly-by-Platform / ASR scenario

The task of the FbP:

- Carrier of the 1 HB, 1 LB and 4 DPs (and 1 VISP ?).
- ASR.
- Data collection and relay from DPs (and balloons).

Possible option with real scientific benefit:

- **Very small scientific payload for FbP.**

Summary of the instrument parameters of FbP payload

Instrument	Goals in science	Volume (cm^3)	Mass (kg)	Power (W)	Data rate (kbps)	Data rate min. - (kbps)
HNA mass sp.	No.1, 2.	18x27x3	2	4	~ 0.5	~ 0.5
SAS2-VNS	No.4, 5, 6.	10x11x15 + 1b	0.7	4 – 4.5	4	2
TPIV ⇓	No.3, 4, 5.	15x25x2 + 1b	0.96	1.8	1.5	≤ 1
SLP ⇑	No.5.	10x10x5 + 1b	~ 1	~ 1	0.5	0.5
SGVM mag.	No.5.	10x10x5 + 1b	≤ 1.2	1.2	1.5	0.5
Acc. μSTAR	No.3.	~ 9x12x10	1	1	0.2 (<0.03)	0.2 (<0.03)
Total	**All** sci. goals have high priority	**~ 0.006 m^3**	~ 7<9 kg	~ 13W	8.2 kbps ***daily average***	4.7 kbps ***daily average***

51 MByte/24h < 100 MByte/24h

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TPIV ⇓	No.3, 4, 5.	15x25x2 + 1b	0.96	1.8	1.5	≤ 1
SLP ⇑	No.5.	10x10x5 + 1b	~ 1	~ 1	0.5	0.5
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- The TPIV + SLP + SAS2-VNS + SGVM will be active *during the whole mission*, however, the HNA and μSTAR only *at the Venus*.

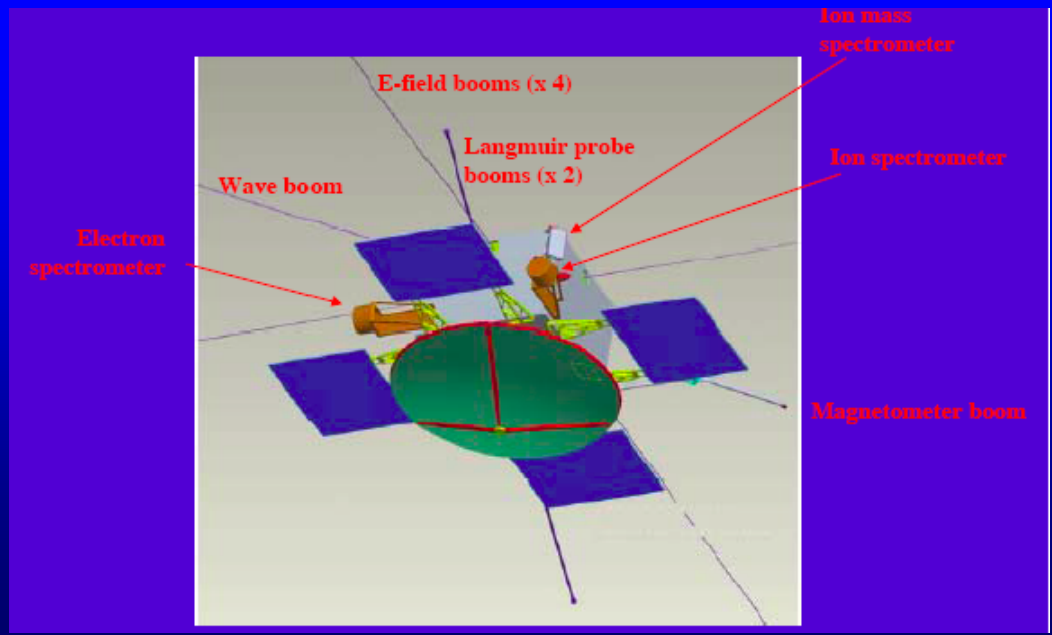
The VISP plasma orbiter (Sweden)

Benefit: *Simultaneous measurements with the VPO.*

Problem: *Increased mass and complexity.*

Parameters:

- Venus Ionospheric Science Probe (***VISP***)
- Royal Institute of Technology (Stockholm, Sweden)
- Sub-satellite (spinning platform)
- Low periapsis, high apoapsis
- Science payload ≈ 9 kg :
  DC **E**, **B**, waves,
  thermal plasma,
  electron spectrometer,
  ion spectrometer,
  ENA spectrometer.
- **Total mass : 50-60 kg.**



The VISP

Instrumentation:

Sensor	Configuration	Mass, kg	Comments
DC electric field	4 wire booms, 10 m each	3.0	BC design
Magnetic field	Flux gate on one still 1 m radial boom	1.0	
Waves	One wire boom	0.5	
Thermal plasma	2 Lagmuir probes on 50 cm booms on solar panels	0.2	
Electron spectrometer	Top-Hat ESA	0.5	MEX 0.3 kg
Ion spectrometer	Same as electron spectrometer	0.5	
Ion mass spectrometer	2 identical sensors, 0.5 kg each	1.0	BC design
Central DPU		1.0	
ENA imager	2 identical sensors	2.0	Optional
Total		9.7	

Option: ***To integrate a SAS-type function into the VISP is possible.***

Next step

- To decide about ***the final configuration of the VPO*** scientific payload.

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- To decide about ***the application of a small scientific payload on board of the FbP***.

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- To decide about ***the final configuration of the VPO*** scientific payload.
- To decide about ***the application of a small scientific payload on board of the FbP***.
- To decide about ***the application of the VISP*** in the mission scenarios.

Thank you for your attention !