

# Venera-D lander Imaging system

- Three major tasks:
  - Synoptic views, descent imaging system (resolution: a few meters/px up to tens of centimeters/px);
  - 360° panorama;
  - Close-up views.
- Contents:
  - Descent cameras (2 pcs)
  - Panoramic cameras (resolution: centimeters/px),
  - Microscopic cameras (resolution: millimeter/px),
  - Common mass memory and data compression unit.

# Scientific and practical goals

**Navigation usage of the cameras.** This is the primary goal because precise determination of the landing point has very high priority.

**Surface morphology at meter scale.** This is the secondary goal because only restricted area could be observed.

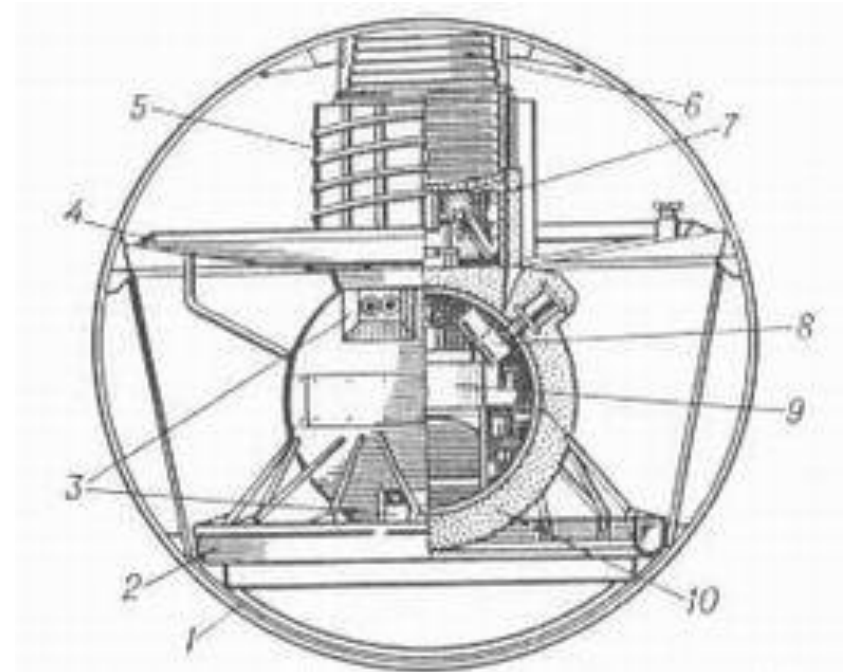
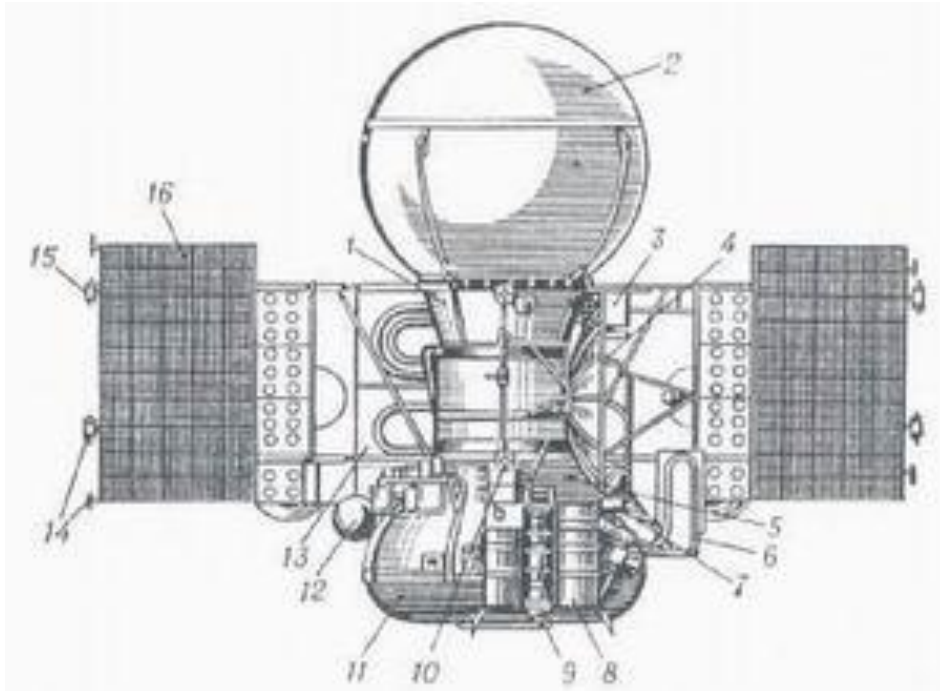
**Panoramic cameras:** observation at centimeter scale. Assessment of the surface texture, rocks and loose materials (observation in the area surrounding the lander, from the lander to the horizon).

**Microscopic cameras:** observations at sub-millimeter scale (observation of rocks nearby the lander):

- fine-scale characterization of the sampling point at the sub-mm scale,
- identification of traces of weathering,
- fine-scale texture of rocks adjacent to the lander: massive, layered, phenocrysts, matrix?

# Venus surface imaging history

The only optical images available are panoramas acquired in Soviet Venera-9...14 landers mission (1975-1981)

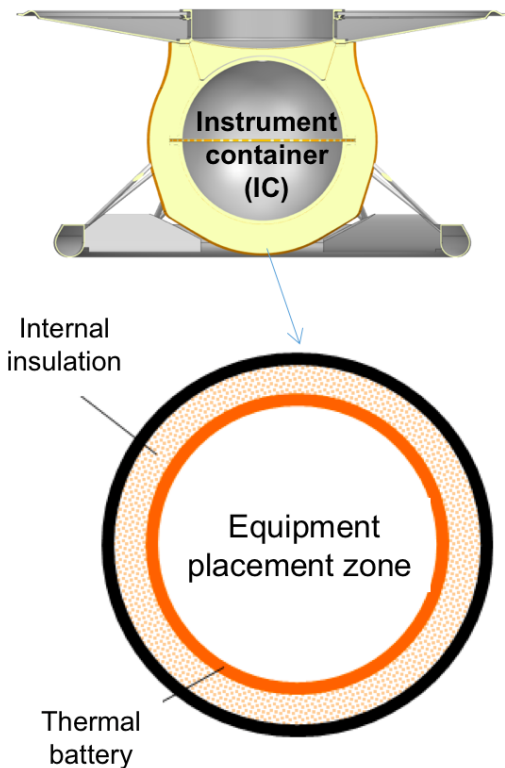


# Venera surface panoramas



Images were acquired by panoramic side view whisk broom camera

## Thermodynamic model



Earth-Venus flight trajectory:  
temperature from  $-50^{\circ}\text{C}$  up to  $+50^{\circ}\text{C}$   
inside instrument container (IC)

Before entrance:  
temperature inside IC  $-50^{\circ}\text{C}$

Temperature on the Venus  
surface:  $+30^{\circ}\text{C} \pm 10^{\circ}\text{C}$   
during lifetime ( $\sim 3$  hours)

on the Venus surface:

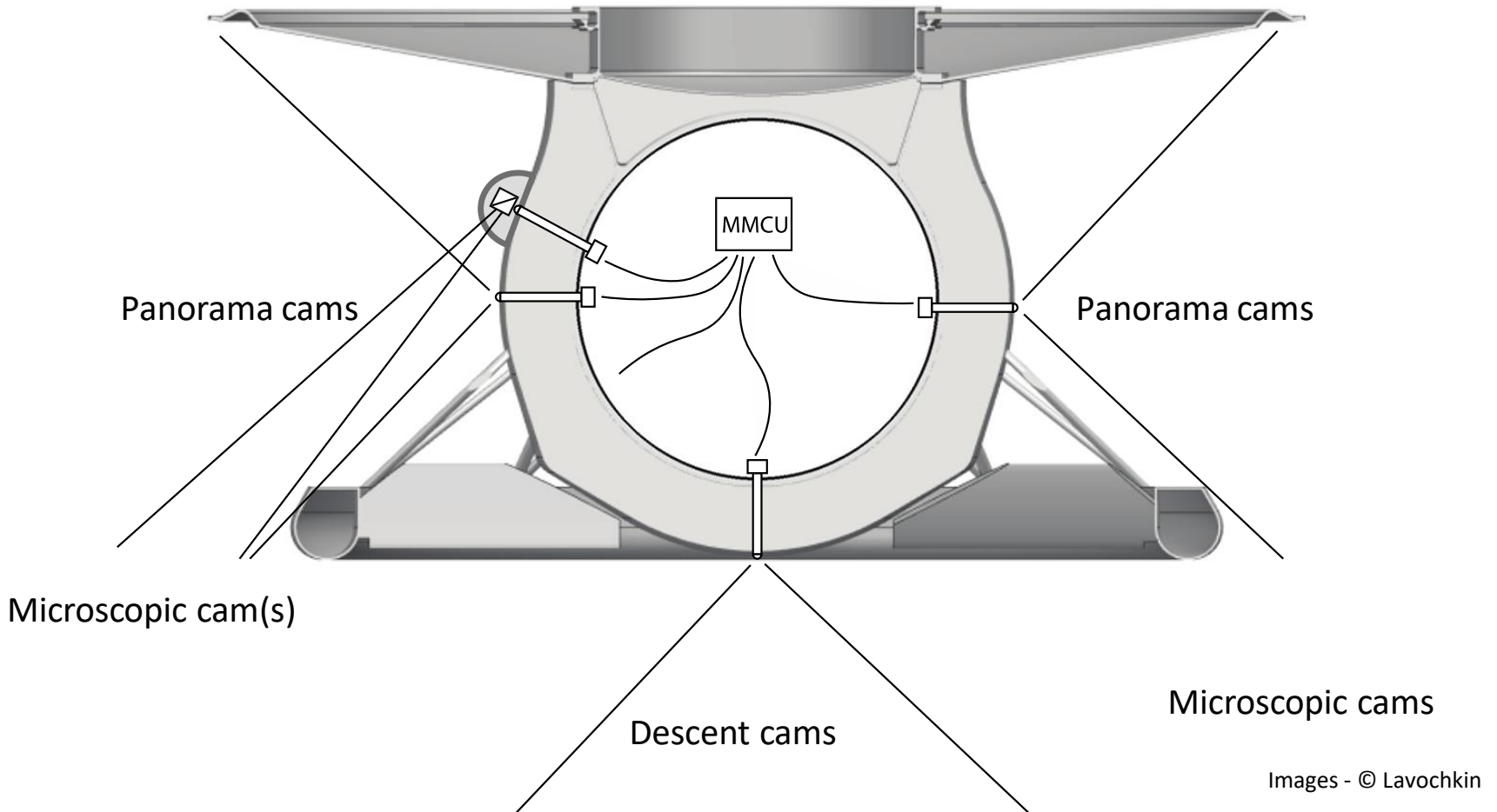
Exhaustion of  
the heat sink's  
capacity

Temperature  
inside the IC  
increases

The end of LM functioning -  
thermal “death” of radio  
transmitting equipment  
( $90 - 120^{\circ}\text{C}$  inside).

# Venera-D Imaging concept principle

Multicamera approach – a number of tiny similar cameras with different lens and common Mass Memory and Control Unit



# Venera-D Imaging concept principle

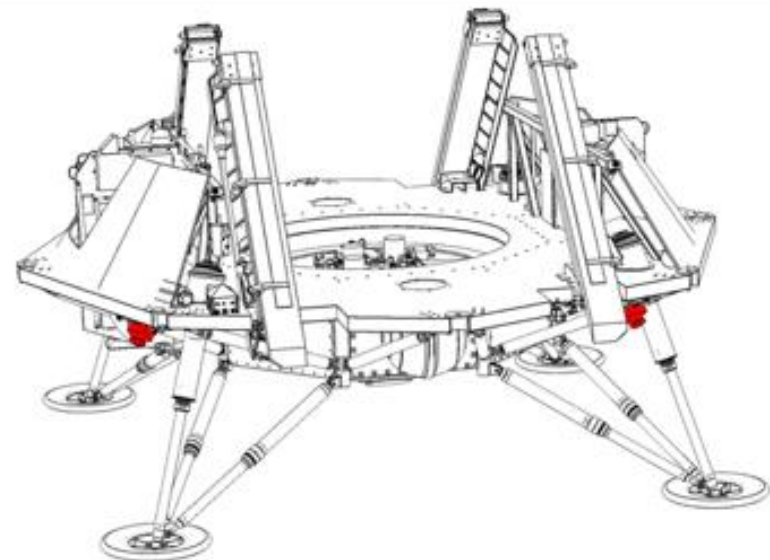
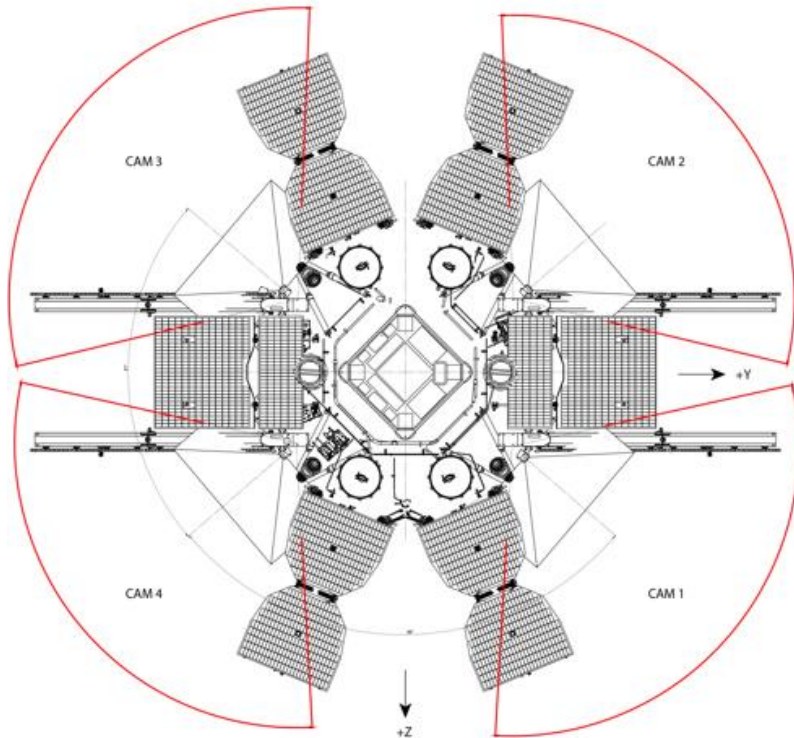




# Prototypes

- Imaging system for ExoMars-2020 Surface platform

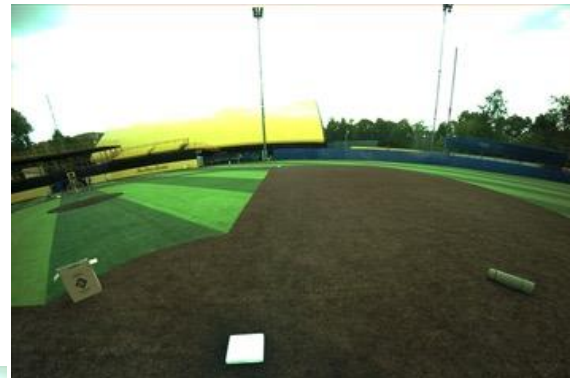
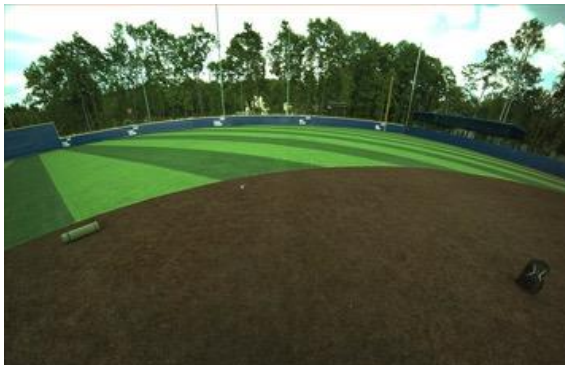
TSPP cameras FOV :  $4 \times 105,6^\circ$  in skyline plane (YOZ)





# Prototypes

- Imaging system for ExoMars-2020 Surface platform



Field tests  
4 images



# Prototypes

- Imaging system for ExoMars-2020 Surface platform

Field tests

Stitched 360° panorama image

