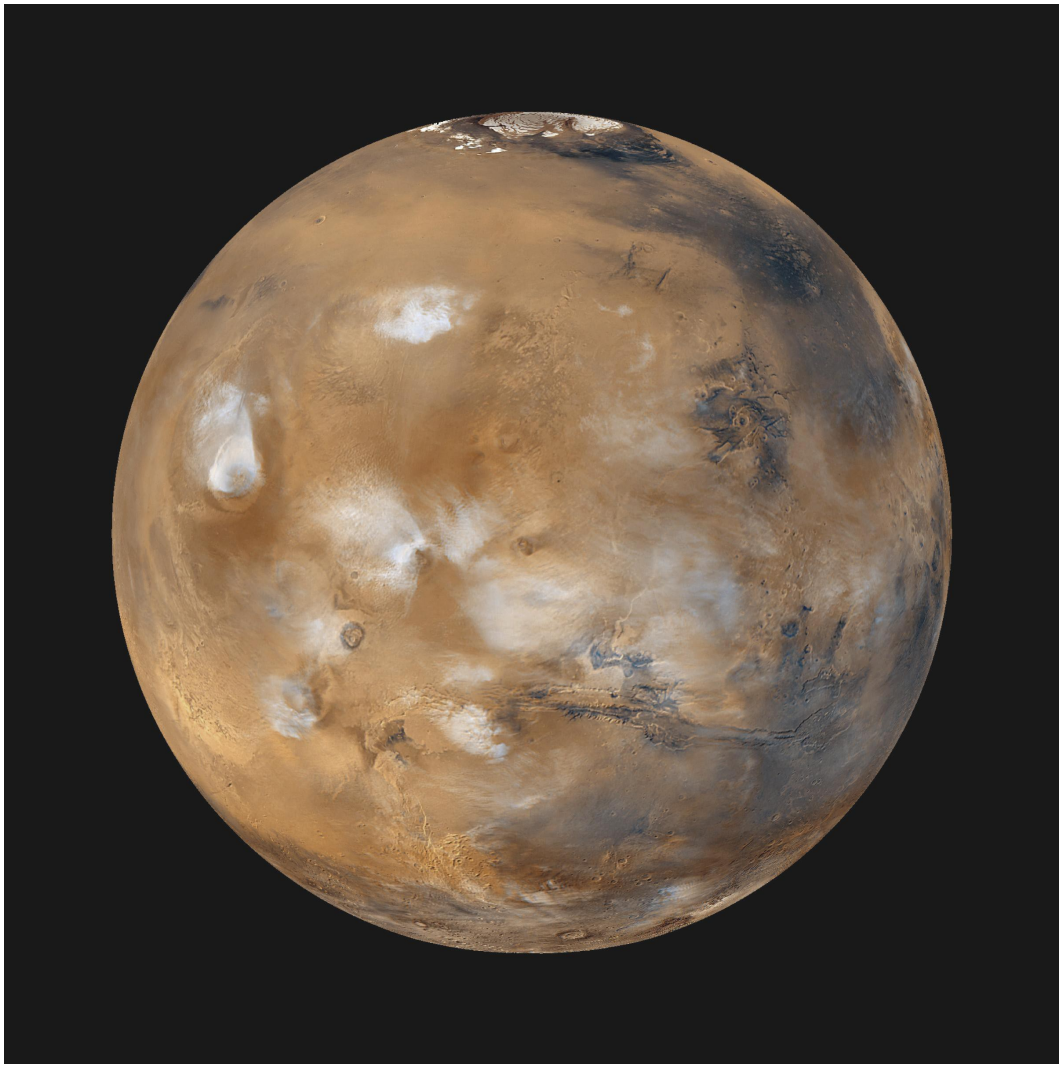
Mars Methane Explorer



Mission plan for International Space Apps Challange 2013

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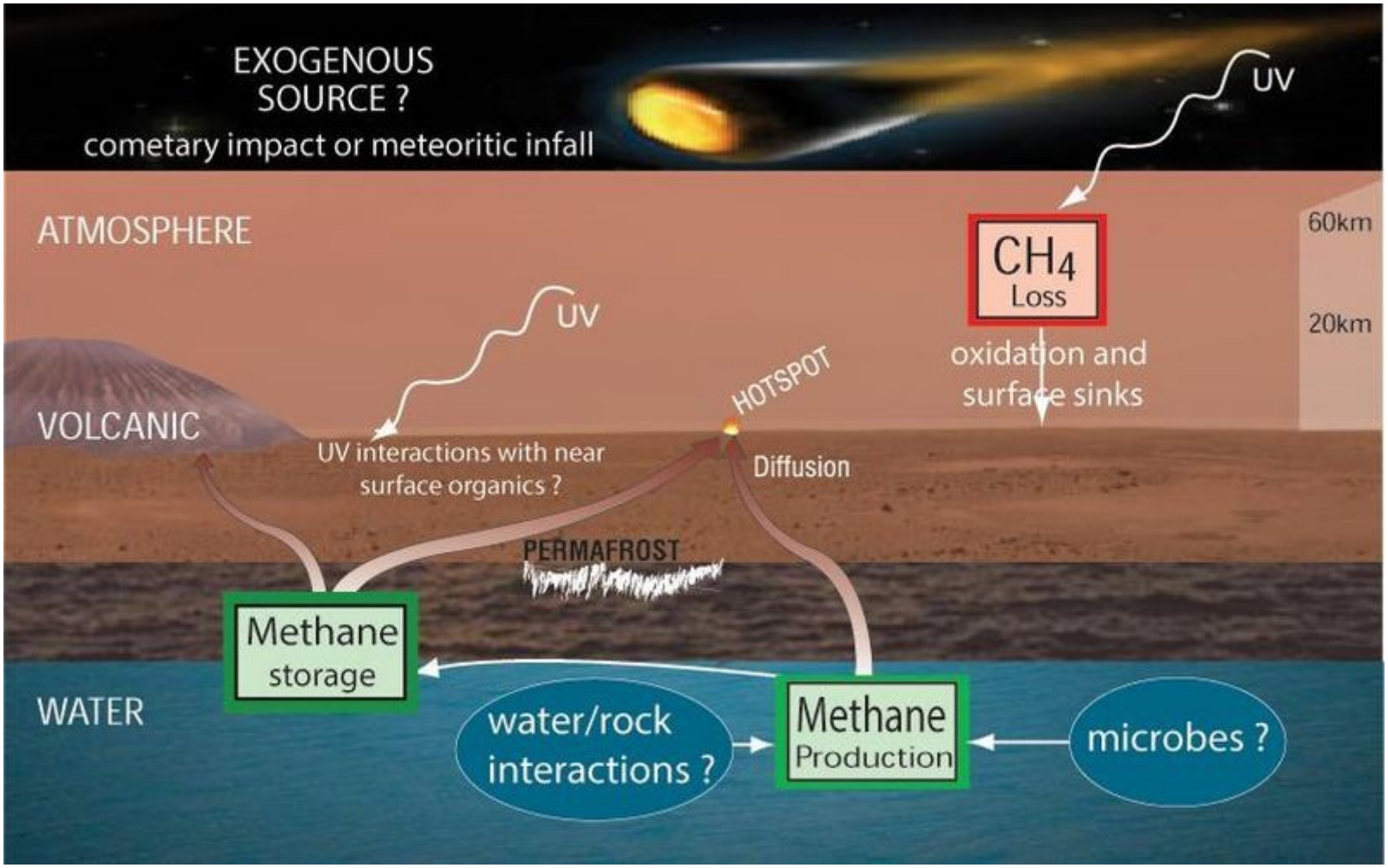
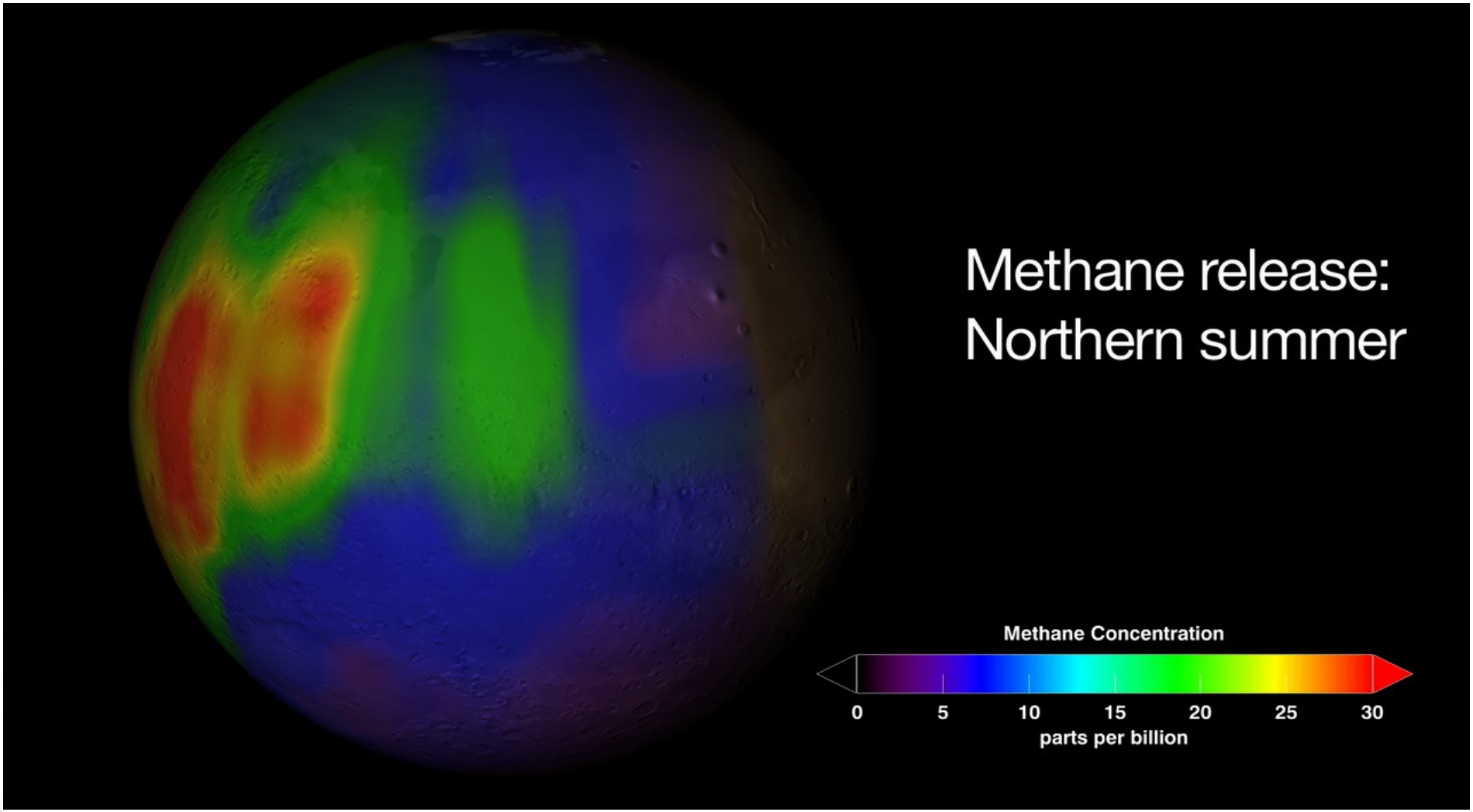
Methane on Mars?



Overall: Methane on Mars is controversial issue, need more observations!

Credit: NASA

Methane concentrations

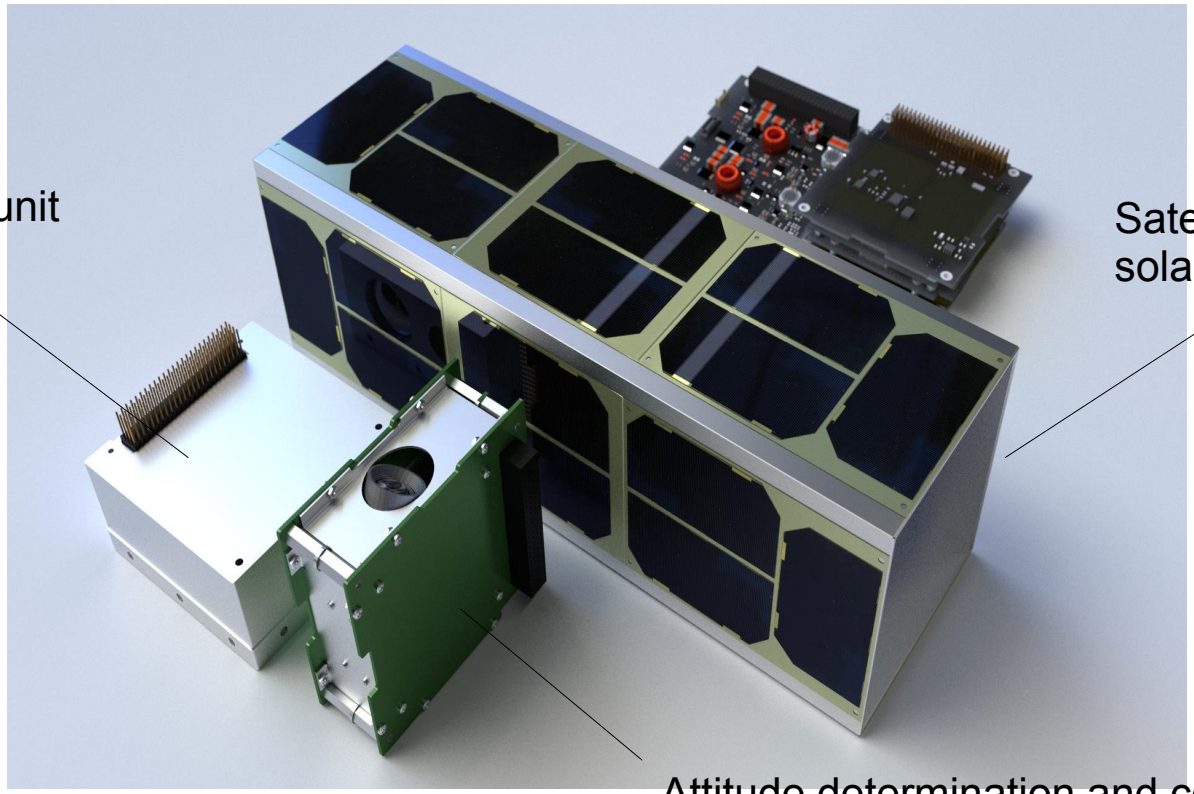


Based on previous observations, MSL did NOT find methane!

Credit: NASA

Mars Methane Explorer (MME)

- Model for MME is Aalto-1, a 3U CubeSat student satellite project at Aalto University, Finland



Credit: Aalto University

Scientific Objective

- MME's main objective is to track methane on Mars with passive Hyperspectral Imaging Spectrometer
- Aalto-1 project's main payload is a smallest spectral imager available, developed and manufactured by VTT, Technical Research Center of Finland
- Similar spectral imager could also be used for possible Martian methane tracking.

Miniature Hyperspectral Imaging Spectrometer - parameters

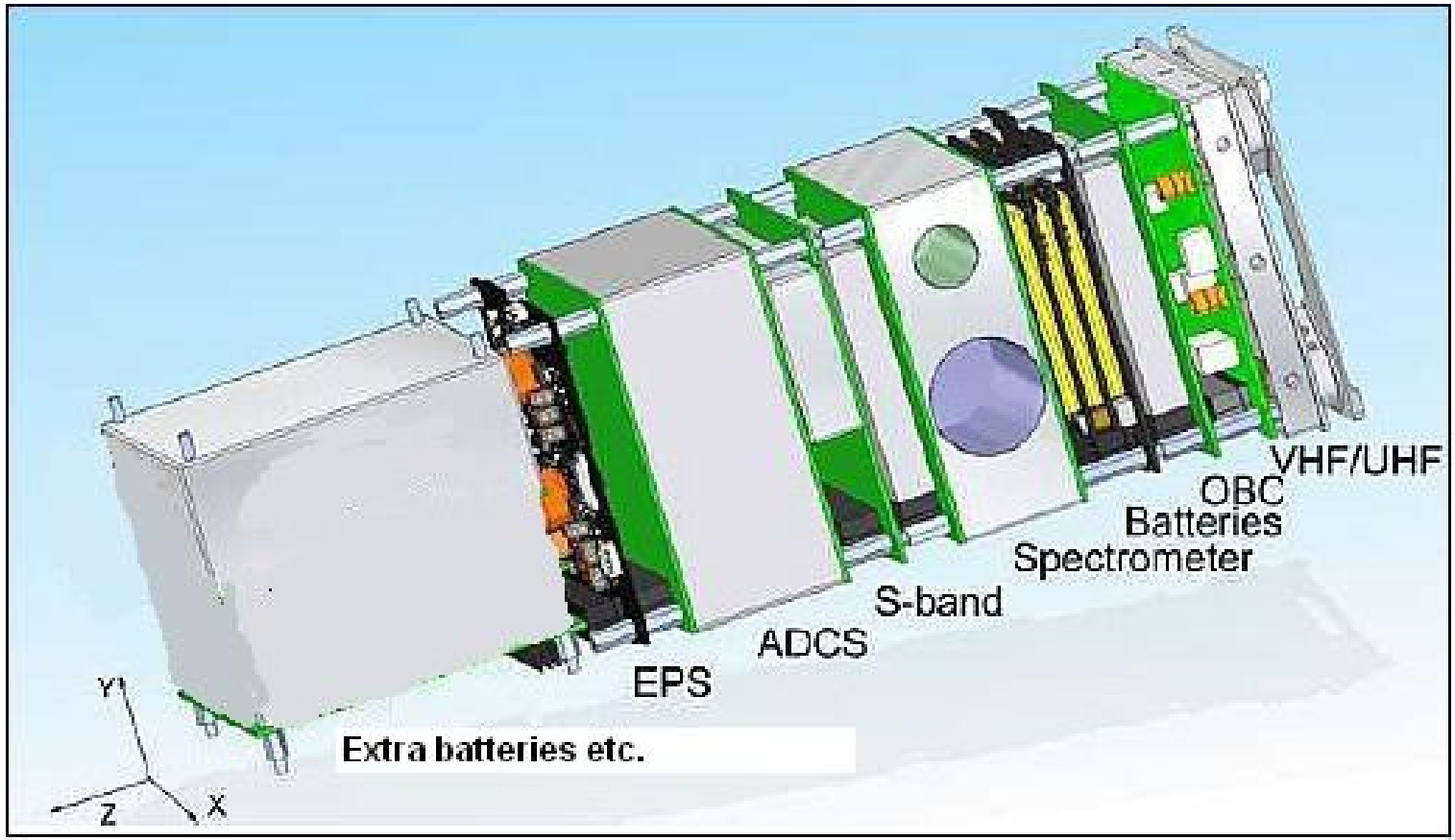
Parameter	Value	Comment
Spectral resolution	10-30 nm	@FWHM, spectral step 1 nm
Ground pixel size	~250 m x 250 m	@ 700 km Earth orbital altitude
Spectral channels	6 to 20	60+ channels possible
FOV (Field of View)	10º	At least 150 km swath @ 700 km
Spectral range	500 to 900 nm	
Power usage	< 4 W	Peak power
Instrument mass	~500 g	
Detector	4.2 Mpixel (2048 x 2048 pixels) RGB CMOS sensor	CMOSIS CMV4000, binned to 512 x 512 resolution

Credit: VTT

CubeSat structure

- Similar 3U stucture as in Aalto-1 project
  - Fast development with proven concept
- Power management with solar panels and battery
  - Need to be rescaled for Mars distance
- Attitude control, 3 axis stabilized & more
- Data handling subsystem
- Teleommunications, data transmission to Earth through 'mother' orbiter or lander

MME structure



Possible configuration, based on Aalto-1 concept.

Mission profile

- Hitch a ride to Mars
- Release after retro-burn for desired orbit (P-POD)
- Sun-synchronous orbit around Mars, e.g. Altitude 200 km, incl. 96.09 deg.
- Observations from the daylight side of the planet
- Lifetime ~years

Open issues

- Spectrometer precision
  - Can Miniature Hyperspectral Imaging Spectrometer detect very small concentrations of methane (ppm)?
- Solar panel size for Mars distance
  - Is 3U CubeSat surface area enough?
- Orbital mechanics, is mission profile feasibe?
  - Need calculations