

# Small Group Discussion Session

## Group 1: Opportunities and challenges associated with interplanetary nanosatellite missions

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- 
- **OPPORTUNITIES**
  - **CHALLENGES**
  - **SOLUTIONS**
  - **EVENTS**
  - **SMALL GROUP DISCUSSION SESSION**





Asteroid (ESA)



Venus (ESA)

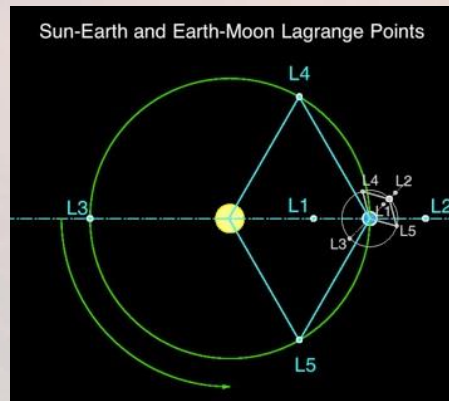


Moon (ESA)

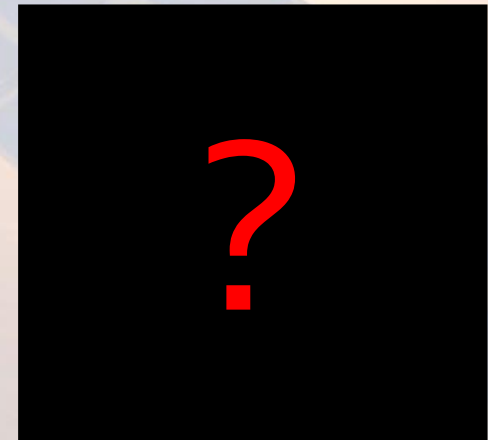
## OPPORTUNITIES TO GO WHERE?



Mars (ESA)



Lagrange points (astrostructure.com)





Small body science

Asteroid (ESA)



Planetary science

Venus (ESA)



Planetary science

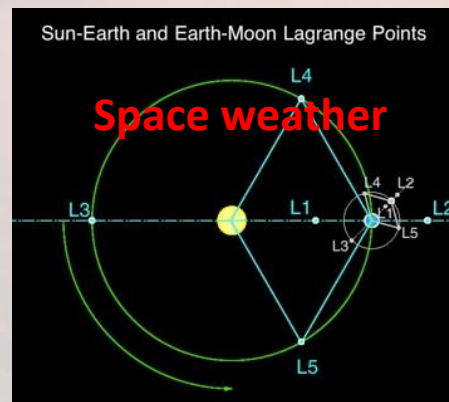
Moon (ESA)



Planetary science

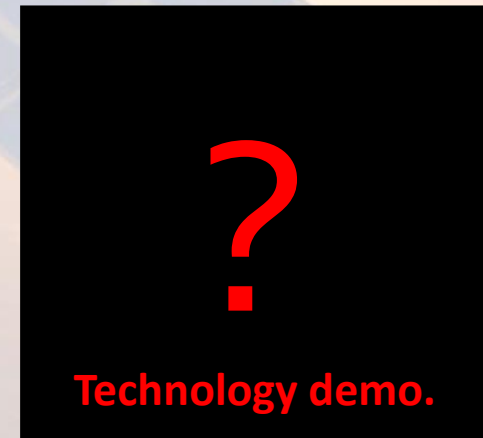
Mars (ESA)

## OPPORTUNITIES TO DO WHAT?




Space weather

Lagrange points (astrostructure.com)



Technology demo.

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## MAIN INTERPLANETARY CHALLENGES

- PROPULSION: **Isp, thrust, mass...**
  - (AUTONOMOUS) NAVIGATION: **Accuracy...**
  - COMMUNICATIONS: **Datalink...**
  - LIFETIME/RADIATIONS: **Single Event Upset...**
- 

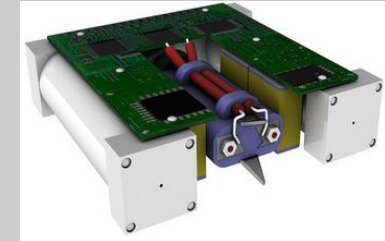
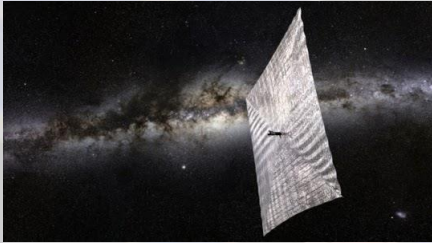
- MECHANICAL
- THERMAL
- POWER
- SCIENCE INSTRUMENTS

CHALLENGES MET BY LEO NANOSATELLITES

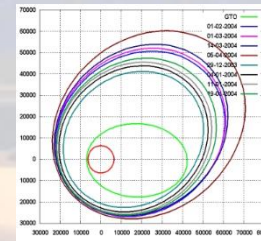
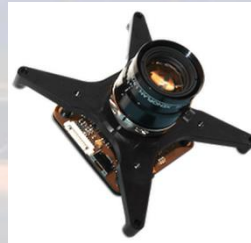
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## POTENTIAL SOLUTIONS

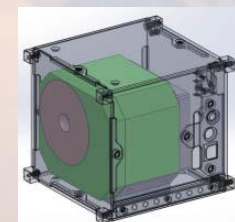
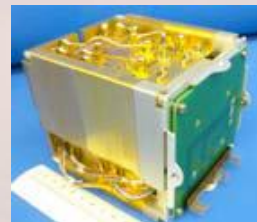
➤ **PROPULSION:** Solar sail, Solid, Hybrid, Electrical propulsion...



➤ **(AUTONOMOUS) NAVIGATION:** Star, Planet tracker, pre-loaded trajectory...




➤ **COMMUNICATIONS:** Host, orbiters, X/Ka/UHF Radio, Optical com...



➤ **ENVIRONMENT/LIFETIME/RADIATIONS:** Rad-hard technologies...






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## EVENTS

- **iCubeSat - Interplanetary CubeSat Workshop: since 2012.**  
*14 US presentations, 5 Europeans, 3 Asians*
- **Interplanetary Small Satellite Conference: since 2013.**
- **NASA Mars CubeSat/NanoSat workshop: 20/21 Nov 2014.**  
*(46 US presentations, 1 French, 1 Franco-Taiwanese) → US has strongest interest!*
- **NASA Interplanetary CubeSat Challenge: 2014.**



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Technologies?

Sciences?

Collaboration?



**Thank you for your attention!**

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