

Small Group Discussion Session

Group 1: Opportunities and challenges associated with interplanetary nanosatellite missions

JORDAN VANNITSEN

National Cheng Kung University

Department of Aeronautics and Astronautics

Tainan, Taiwan

Takehiro Ohira

Tokyo Metropolitan University

Department of Aerospace Engineering

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



Asteroid (ESA)



Venus (ESA)

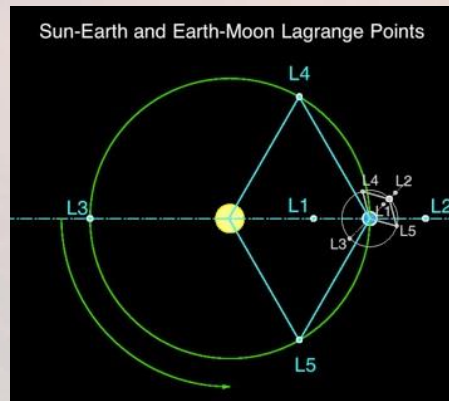


Moon (ESA)

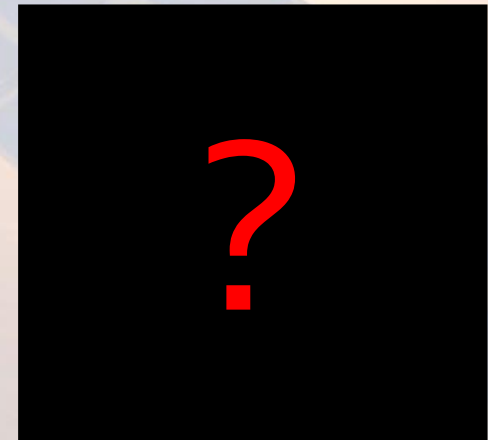
OPPORTUNITIES TO GO WHERE?



Mars (ESA)



Lagrange points (astrotecture.com)





Small body science

Asteroid (ESA)



Planetary science

Venus (ESA)



Planetary science

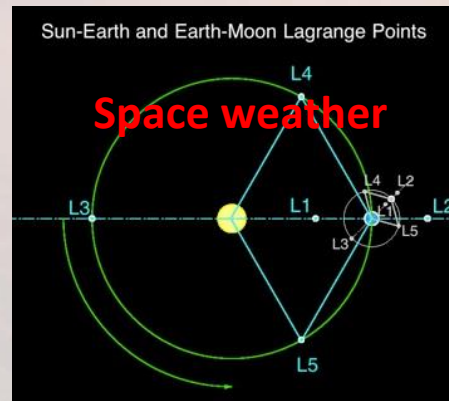
Moon (ESA)



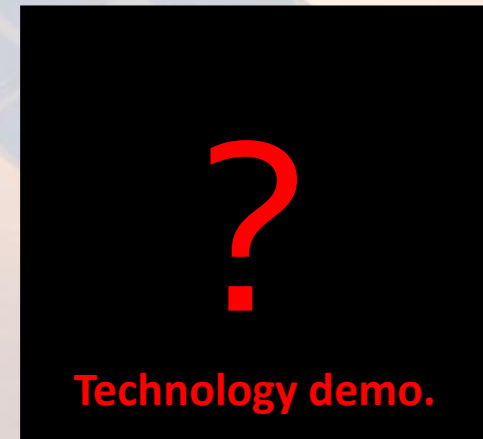
Planetary science


Mars (ESA)

OPPORTUNITIES TO DO WHAT?



Lagrange points (astrotecture.com)




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

MAIN INTERPLANETARY CHALLENGES

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

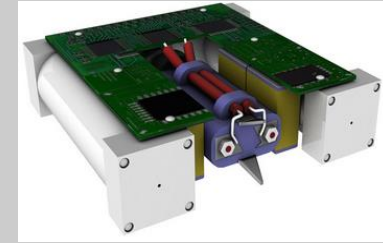
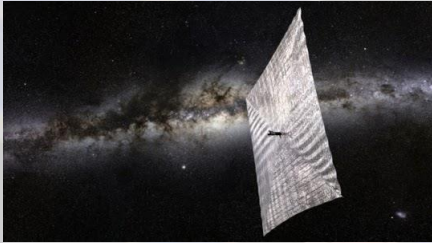
- MECHANICAL
- THERMAL
- POWER
- SCIENCE INSTRUMENTS

CHALLENGES MET BY LEO NANOSATELLITES

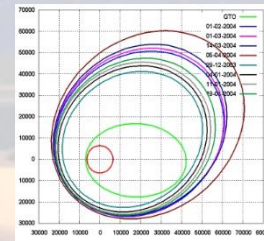
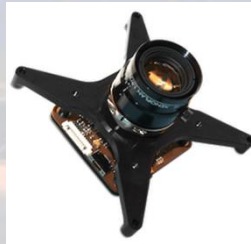
- 
- OPPORTUNITIES
 - CHALLENGES
 - **SOLUTIONS**
 - EVENTS
 - SMALL GROUP DISCUSSION SESSION

POTENTIAL SOLUTIONS

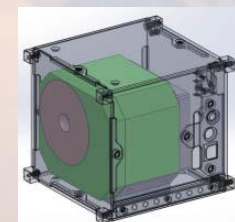
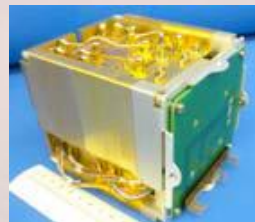
➤ **PROPULSION:** Solar sail, Solid, Hybrid, Electrical propulsion...



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




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



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




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

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.**



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



Technologies?

Sciences?

Collaboration?



Thank you for your attention!

Jordan Vannitsen
jordan.vannitsen@gmail.com

UNISEC-Global PoC (Taiwan)
Prof. Jyh-Ching Juang
juang@mail.ncku.edu.tw