Introduction to Nano/Micro Satellite Mission Idea Contest

Presentation adapted from Shinichi Nakasuka and Herman Steyn.

Nate Taylor Rei Kawashima

UNIVERSITY SPACE ENGINEERING CONSORTIUM

21
Local Chapters

Local projects

Global impact

UNISEC-Global envisions a world where space science and technology are used by individuals and institutions in every country, rich or poor, and offers opportunities across the whole structure of society–whether academic, industrial or educational– for peaceful purposes and for the benefit of humankind.

MISSION IDEA CONTEST HISTORY

- Launched in 2010 to encourage innovative exploitation of micro/nano-satellites to provide useful capabilities and services.
- Mission idea and satellite design for 50kg class micro-satellites or smaller satellites and their constellation were proposed and evaluated.
- Four books and one proceedings were published as **IAA book series.**

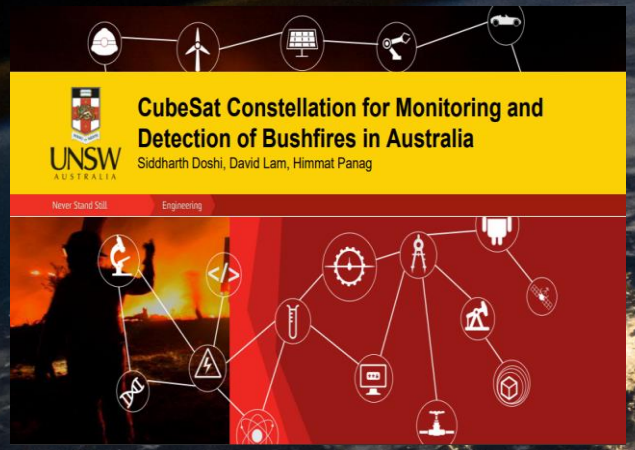
MIC3 finalists and reviewers, Nov 19, 2014, Kitakyushu, Japan

MIC4 finalists and reviewers, Oct. 21, 2016, Verna, Bulgaria

IAA book series (MIC1-4)

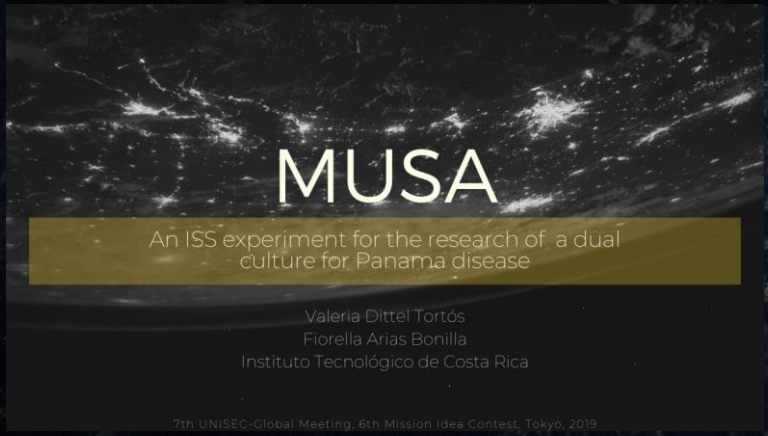
MIC WINNING MISSION IDEAS

MIC5



MIC4

MIC6



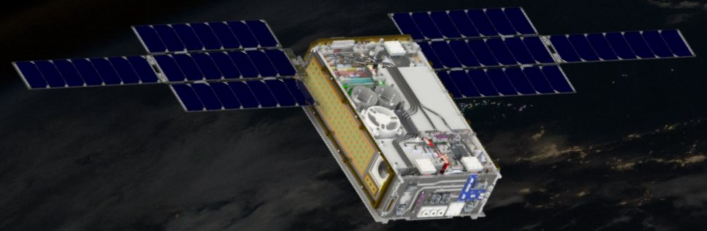
	Proposed idea	Country
MIC 1 (2011) (constellation)	Integrated Meteorological / Precise Positioning Mission Utilizing Nano-Satellite Constellation	Japan (professional)
MIC 2 (2012) (Satellite Design)	SOLARA/SARA:Solar Observing Low-frequency Array for Radio Astronomy/ Separated Antennas Reconfigurable Array	USA (student)
MIC 2 (2012) (Business model)	Underground and surface water detection and monitoring using a microsatellite	South Africa (student)
MIC 3 (2013)	Clouds Height Mission	Germany, Italy, Slovenia (professional)
MIC 4 (2016)	CubeSat constellation for monitoring and detection of bushfires in Australia	Australia (student)
MIC 5 (2018)	Smallsat Ionosphere Exploration at Several Times and Altitudes,	Taiwan, USA, India (student)
MIC 6 (2019) (ISS-IceCube)	MUSA: An ISS Experiment for research of a dual culture for Panama Disease	Costa Rica (student)
MIC6 (2019) (ISS-iSEEP)	Spectrum Monitoring from Space with i-SEEP (SMoSiS)	Philippines (professional)

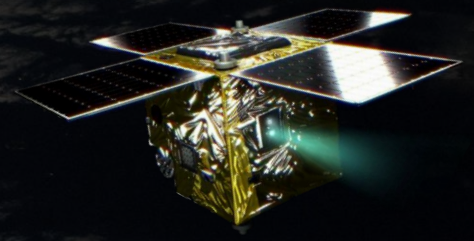
7TH MISSION IDEA CONTEST

for Deep Space Science and Exploration with Micro/Nano Satellites

Requirement:

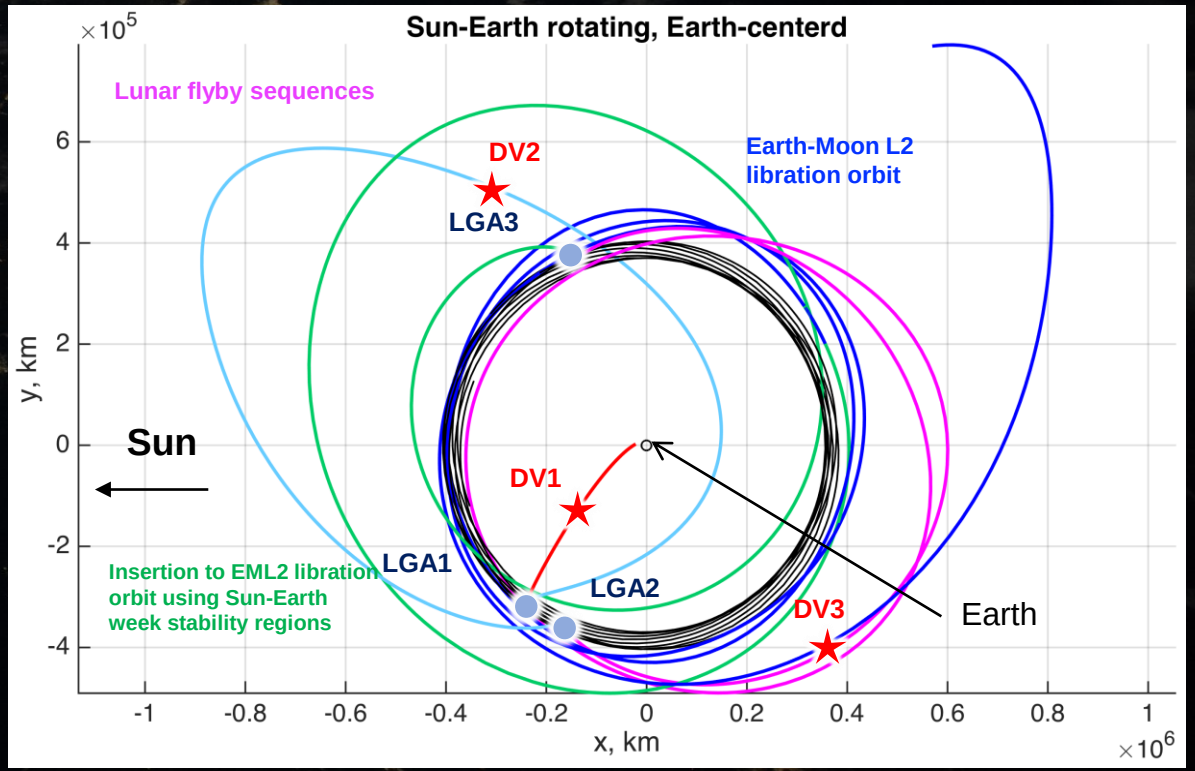
Propose deep space science and exploration mission with micro/nano satellites





Constraints:

- Spacecraft envelope size is less than 1.0 m x1.0 m x1.0 m size with less than 100 kg in weight (Multiple satellites are acceptable within the envelope area).
- cis-lunar orbit or deep space trajectory orbit with the relative velocity to the Earth (excess velocity) greater than 0 km/s and the deliverable spacecraft mass is given in a figure.
- You can use a transponder onboard of PROCYON.
- You can assume you can use Earth ground stations for deep space missions like DSN (Deep Space Network).
- You can take continuous 8 hours for spacecraft operation every day.
- The lifetime is a free parameter. But you should consider the effect of radiation for the proposed lifetime.
- The proposed launch date should be before 2030.



APRSAF
ASIA-PACIFIC REGIONAL SPACE AGENCY FORUM

International Academy of Astronautics

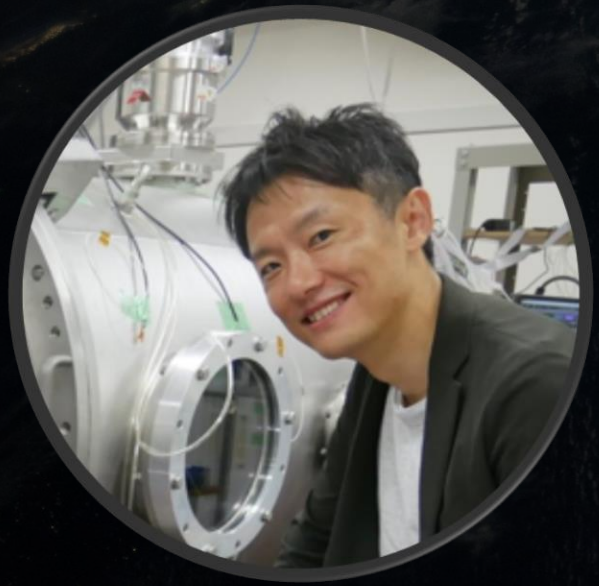
Collaborator

UNISEC GLOBAL

ONLINE LECTURE SERIES

Professor Ryu Funase,
ISAS/JAXA and the University of Tokyo.
Lecture 1, February 15th 2021
"New Challenges for Deep Space Exploration with Micro/Nano Satellites"

Professor Munetaka Ueno,
JAXA and Kobe University.
Lecture 2, February 18th 2021
"Science operations of Space missions"



Professor Hiroyuki Koizumi,
University of Tokyo.
Lecture 3, February 25th 2021
"Deep space exploration and micropropulsion"

Professor Atsushi TOMIKI,
JAXA.
Lecture 5, March 19th 2021
"Ultra-Small Deep Space Mission Tele-communication Systems Design"

Assistant Professor Naoya OZAKI,
JAXA.
Lecture 4, March 1st 2021
"Trajectory Design for Deep Space Exploration Missions"

APRSAF
ASIA-PACIFIC REGIONAL SPACE AGENCY FORUM

http://www.spacemic.net

Sponsor

The University of Tokyo, Institute for Open Innovation

UNISEC GLOBAL

HYBRID PRESENTATION

Shinichi Nakasuka, Univ of Tokyo

Ryu Funase, Univ of Tokyo

Munetaka Ueno, Kobe University

Rainer Sandau, IAA

Herman Steyn, Stellenbosch University

Naoya Ozaki, ISAS/JAXA

MIC 7 REVIEW TEAM

PARS: Precursor Asteroid Remote Survey

Batu Candan, Cansu Yildirim, Derya Sarmisak, Mehmet Esit, Sahin Ulas Koprucu, Sefa Cengiz, Semra Sultan Uzun, Sirin Yakupoglu, Middle East Technical University

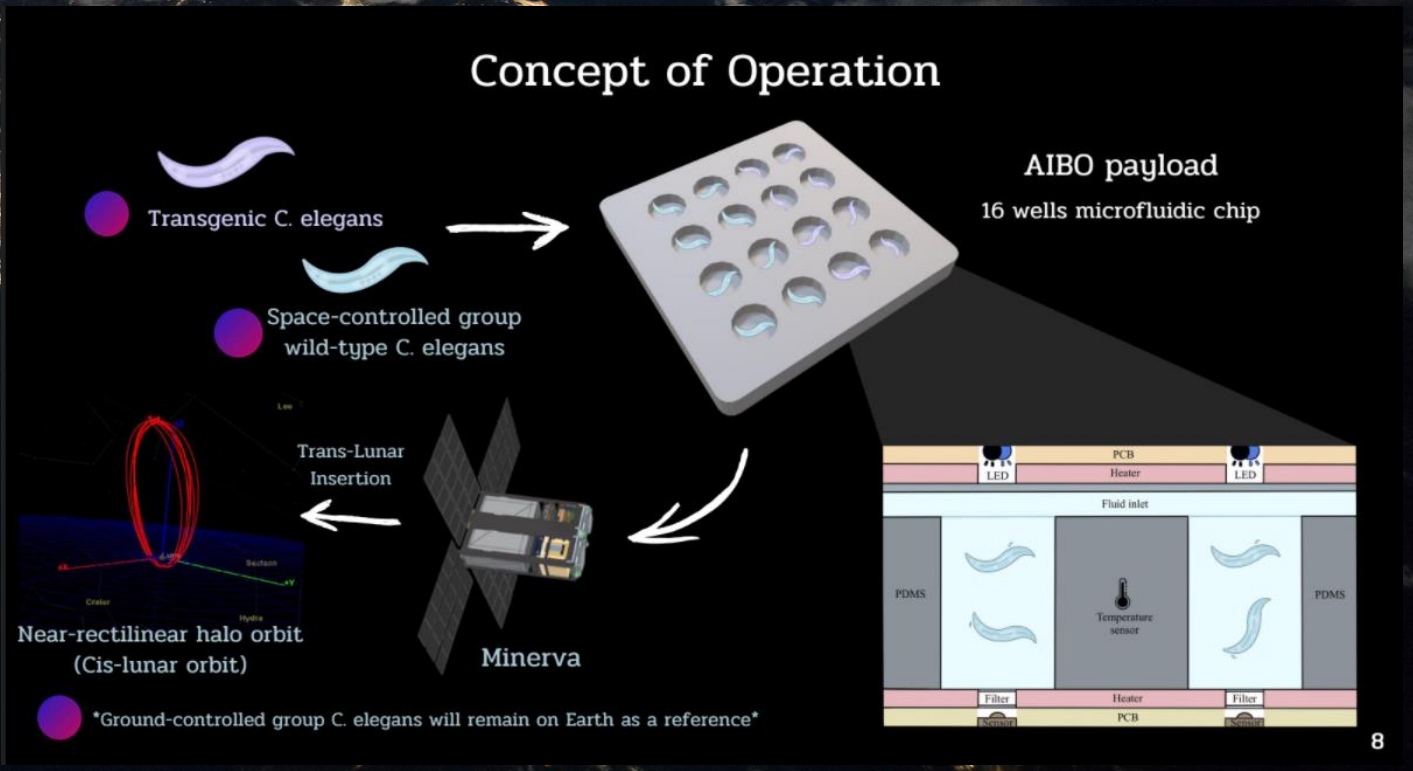
2ND PLACE WINNER

MINERVA: A CubeSat for demonstrating DNA damage mitigation against space radiation in C.elegans by using genetic modification

Sumeth Klomchitcharoen, Tanchanok Tangwattanasirikun, Sean Gallup, Noparin Smerwong, Peetimon Arunwiriyahkit, Pisitchai Tachavises, Jin Tangkijngamwong, Pichamon Phatthanaanukun, Benjamard Jirapanyalerd, Siripak Chattanupakorn, Visarut Rungpongvanich, Norawit Nangsue, Krai Meemon, Patompon Wongtrakoongate, Suradej Hongeng, Yodchanan Wongsawat

Mahidol University, Nakhon Pathom, THAILAND

An experiment to transform a creature with radiation intolerance into a transgenic organism that is radiation-tolerant when exposed to Galactic Cosmic Rays. Caenorhabditis elegans (C. elegans) is utilized as a model organism to study its biological effect on the Minerva mission in a Near-Rectilinear Halo Orbit



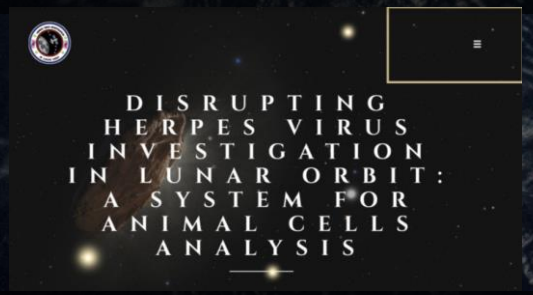
STUDENT PRIZE 1

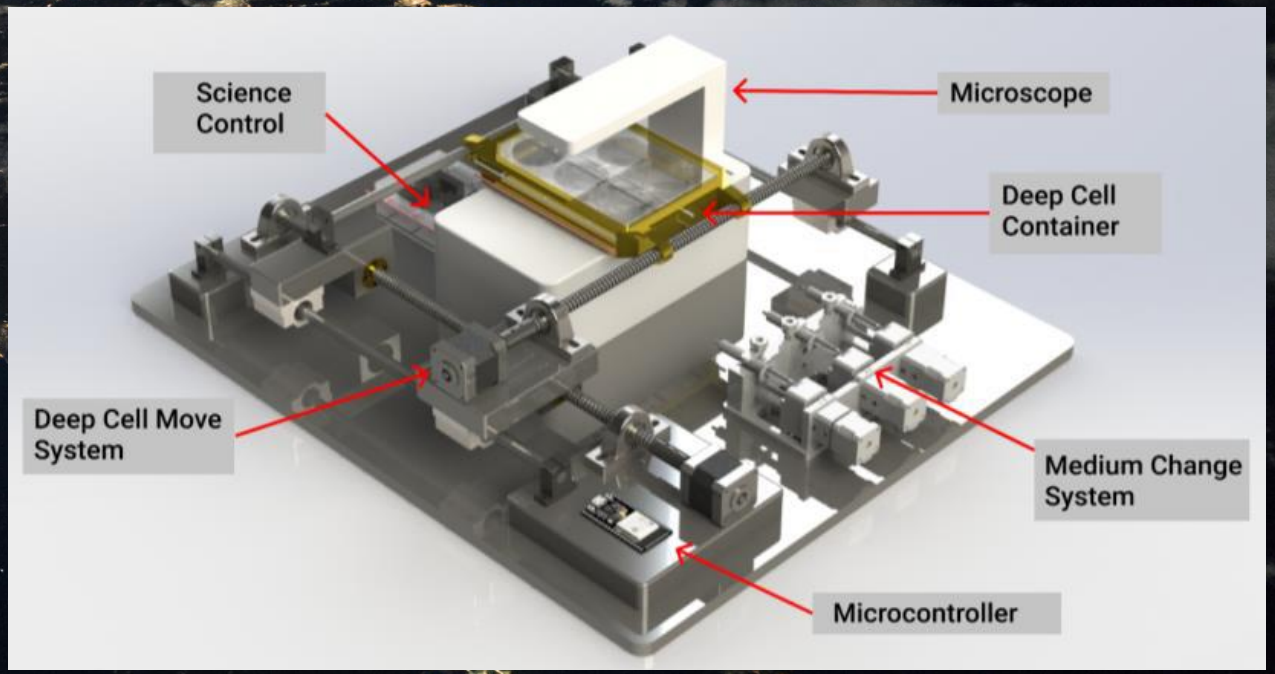
Disrupting Herpes virus investigation in lunar orbit: A system for animal cell analysis

André Arias Ovares, Andrés Cubero Salas, Ariadna Hernández Montoya, Carlos Montoya Marín, Daniel ChacónMora, Fabián Fernández Aguilar, Karol Cerdas Mejías, Kenneth Chacón Fernández, Kevin Sánchez Ramírez, Marco Corrales Barrantes, María Francini Mora Chacón

University of Costa Rica and Costa Rican Institute of Technology, COSTA RICA

This paper investigates the latent reactivation of a specific Herpes virus called Epstein Barr virus into an animal cell line taken to lunar orbit. The results can prevent the virus in the international astronautical community for their future space travels in deep space and can help with the investigation for the treatment of this disease on Earth by finding the virus reactivation by any particular parameter during a 6-week travel in a lunar orbit environment.





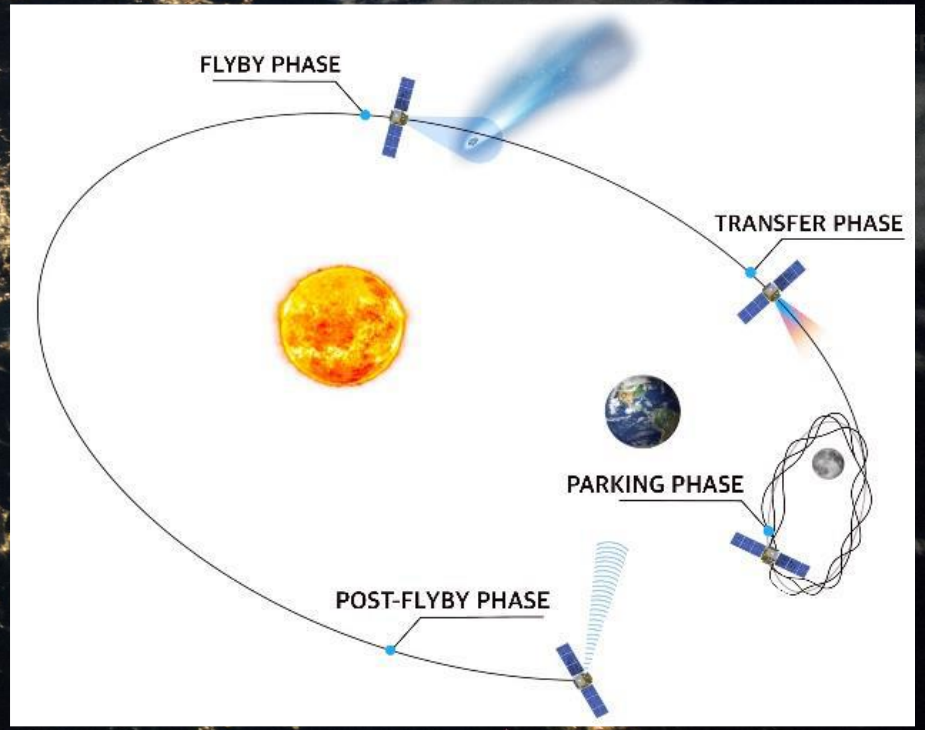
STUDENT PRIZE 2

SCORE: Observation and exploration of a long period comet using microsatellites

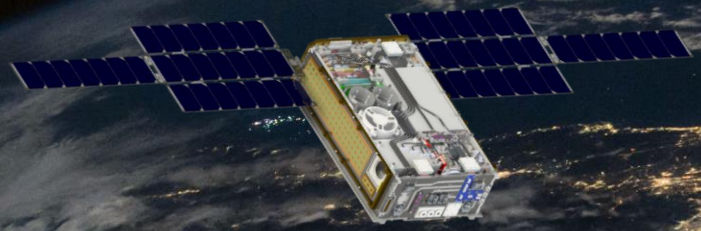
Vincenzo Porrino, Annarita Argirò, Marcello Chiariello, Alessia Contaldi, Antonio Cristiano, Luca D'Albenzio, Barbara De Leonardis, Carmen Di Mauro, Francisco Javier Fernàndez Fernàndez, Mirca Gargiulo, Riccardo Guida, Claudio Rosario Ibello, Gaetano Montano, Lorenzo Zennamo, Giorgio Isoletta, Alessia Nocerino, Alfredo Renga

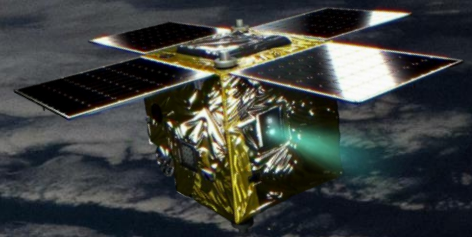
University of Napels Federico II, ITALY

The paper represents an overview of the SCORE project (Scientific mission for Comet Observation, Research and Exploration), a space mission using a micro-satellite with a wet mass of 100 kg, aimed at performing a flyby with a Long Period Comet. The spacecraft is deployed in cis-lunar space by another mission (e.g. Lunar Gateway) and will wait on a parking Near Rectilinear Halo Orbit until a suitable target is detected.



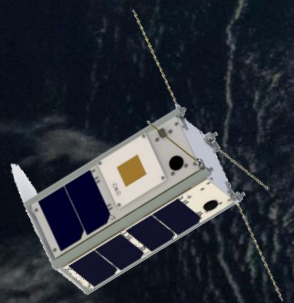
FUTURE ACTIVITIES





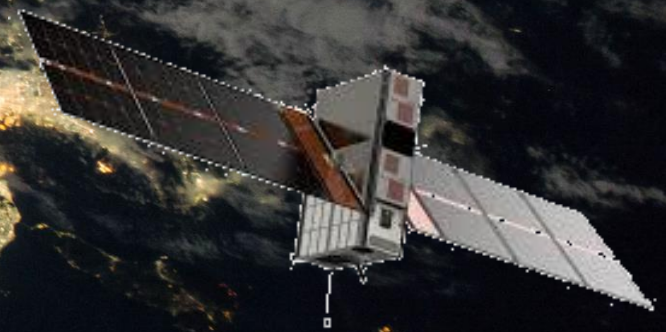
MIC 8 IS COMING

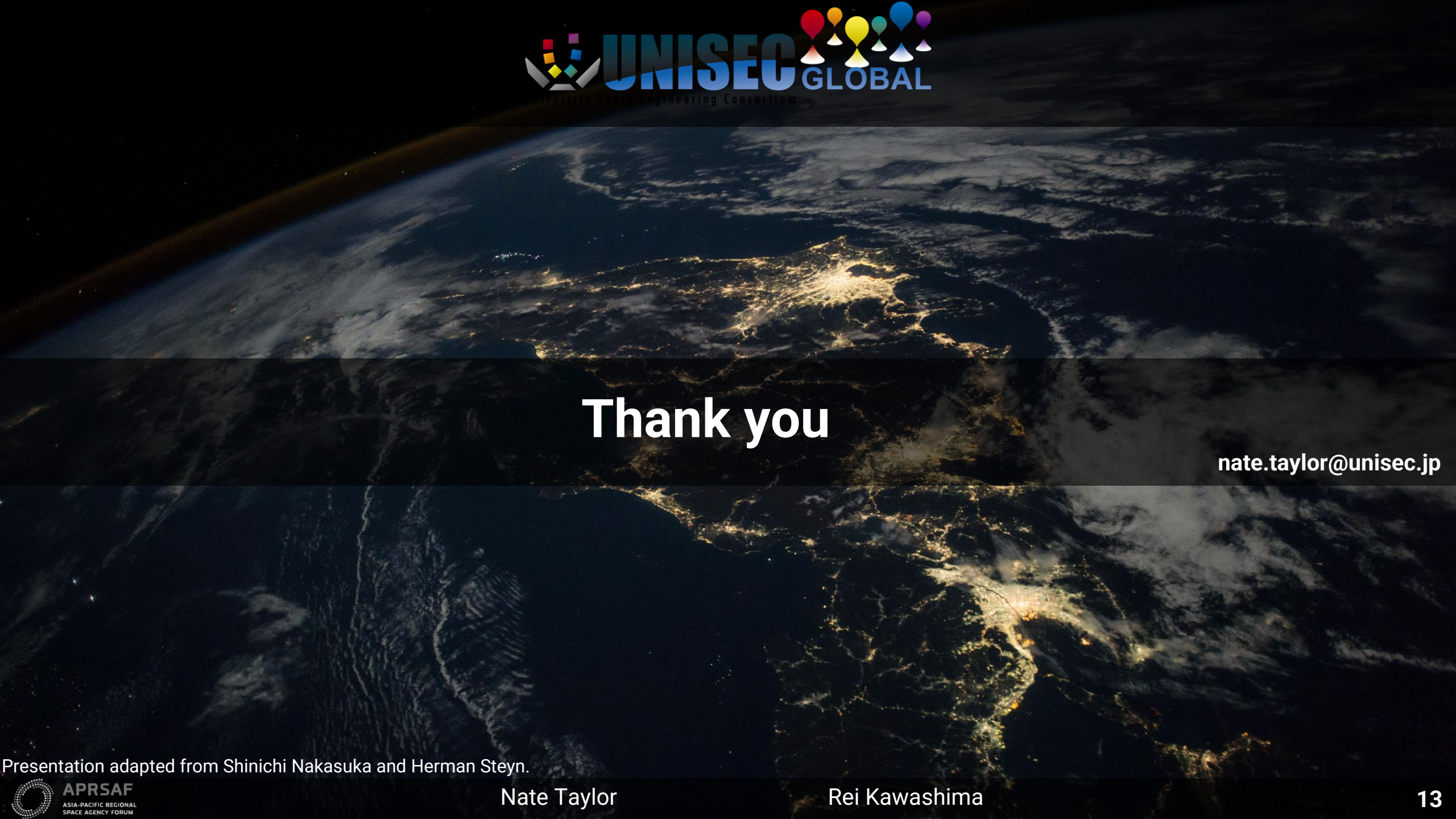
THEME: CONSTELLATIONS



Requirements:

- Multiple satellites smaller than 6U size
- Number of satellites is a free parameter (above 1)
- Illustrates clear benefits in having multiple satellites





Thank you

nate.taylor@unisec.jp

Presentation adapted from Shinichi Nakasuka and Herman Steyn.