

"Dream comes true"

10-year experience in Mongolian Space Education

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It is located on average altitude is 1580 meters above the sea level.

Mongolia's climate is semi-arid and markedly continental with generally extremely cold, dry winters and warm, wet summers.



The NUM-ITC-UNESCO Remote Sensing and Space Science laboratory, National University of Mongolia (NUM) established in 2003

- UNISEC-Mongolia (7 universities in Mongolia)
- Graduate courses for Remote Sensing and Geographic Information Systems
- Nano/Micro satellite development and its utilization
- Nano satellite's architecture
- Astrophysics and Astronomy



The CanSat Leader Training Program (CLTP) 11

CLTP is a program on space education. It aims to learn the actual process in space development by going through the whole process of satellite system integration, using the HEPTA-Sat kit.

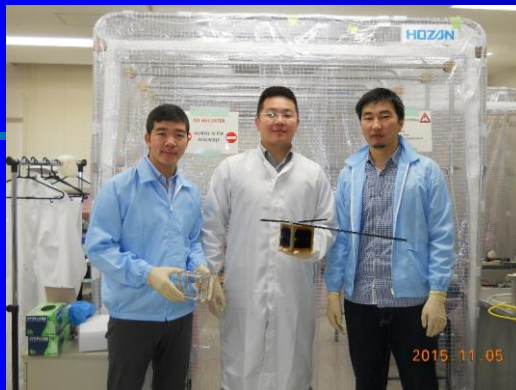
18-31 August, 2022





Satellite development project “Temuulel” NUMSAT2 Mongolian Space Technology Association (MOSTA)

хиймэл дагуулын төсөл



Temuulel satellite development team



Temuulel (NumSat-2) project

Capacity building

Development Space engineering

Design test



2019 оны 10 сарын 31.

Team members:

Bachelor 31

Graduate students 5

Budget 150, 000\$

Launch 2024



Design, manufacturer, assemble, integrate and operate 1U CubeSats

Lesson learnt from BIRDS1 and BIRDS3

No harness



1. OBC/EPS/COM
2. Battery
3. Tx 1200bps/Rx
4. Tx 9600bps
5. External interface
6. Antenna deployment
7. Camera for visible and infrared
8. Backplane
9. Solar Panel (x5)
10. Antenna (2-rod, 1-patch)

Тэнхлэг удирдлага

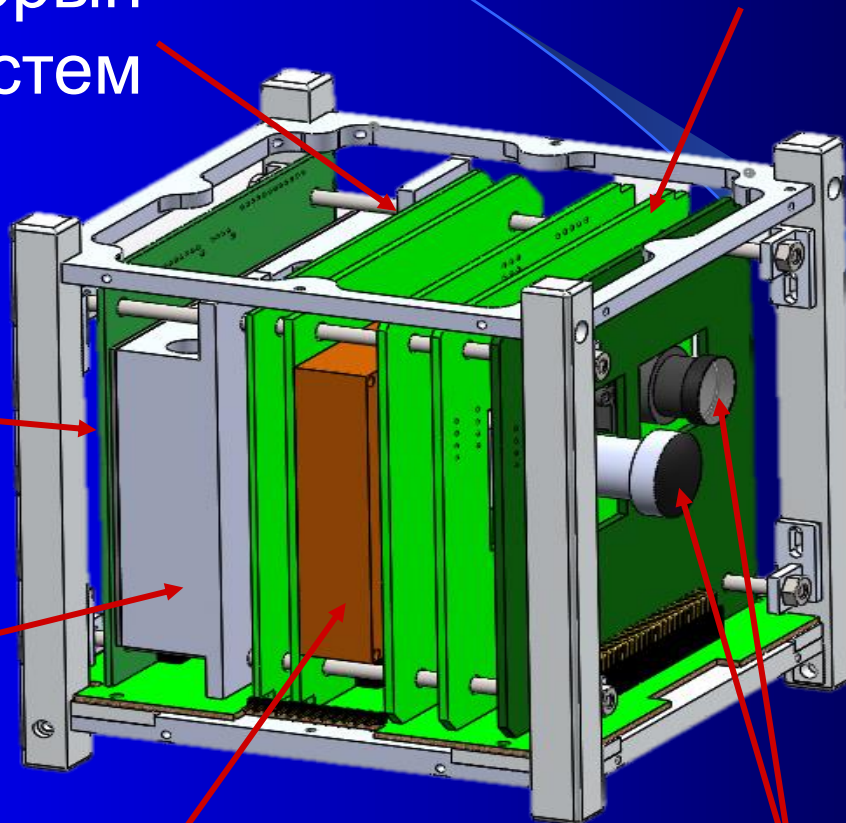
Төв процессорын
систем

Цахилгаан
тэжээлийн
систем

Баттерей

Холбооны
систем

Камерын
систем



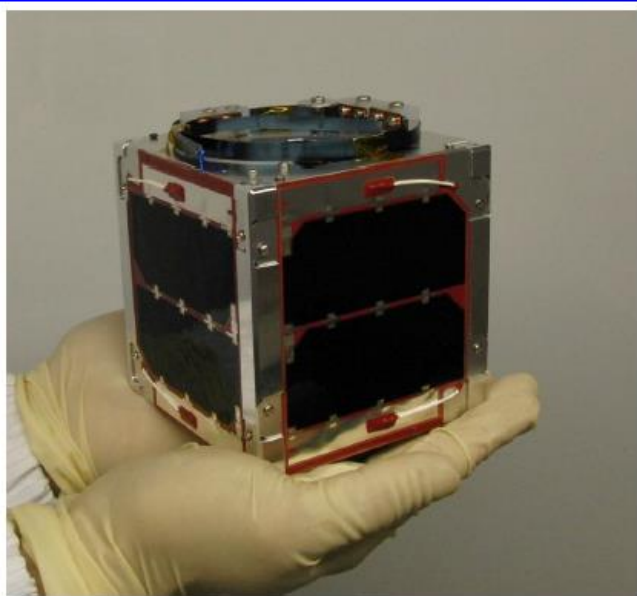




Winter time!

Temuulel satellite

- 1U satellite, 2024



1U cubesat example
(roughly 10cm x 10cm x 10cm)

**To launch satellite
How to find funding?**



Kyutech, ONDO Space LLC and the National Space Council of Mongolia (under the Ministry of Digital Development and Telecommunication) agreed on the international cooperative project to promote sustainable space technology development in Mongolia.



- Japanese Grand Sumo legend, the 69th Yokozuna, Mr. Hakuho Sho (born in Mongolia), who is one of the most symbolic bridge between Japan and also joined the signing ceremony as a witness to express his support for the project.



Kyutech assists ONDO Space with research and testing of satellites, and capacity development program for Mongolian engineers

ONDO Space provides opportunities for Mongolian engineers to build satellites and to contribute to the development of space technology in Mongolia



The National Space Council of Mongolia provides possible support for Mongolian engineers to study space technology at Kyutech.

Partner Institutions since 2016

MJEED project



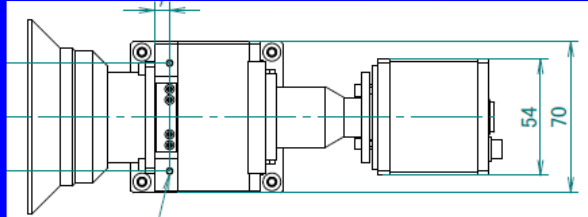


**LCTF (liquid crystal tunable filter) camera
for spectral measurement with drone
developed by Hokkaido University**



1.5 kg in total

Liquid Crystal Tunable Filter (LCTF) camera

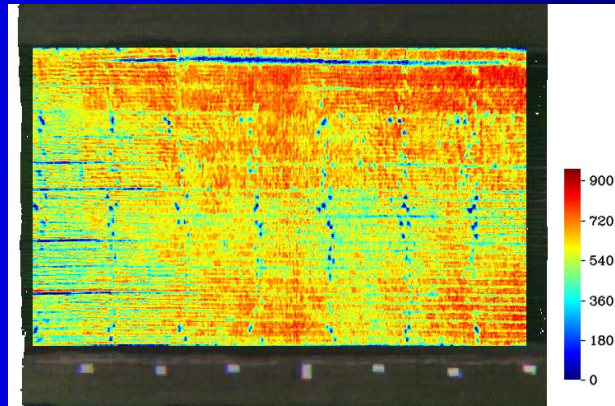
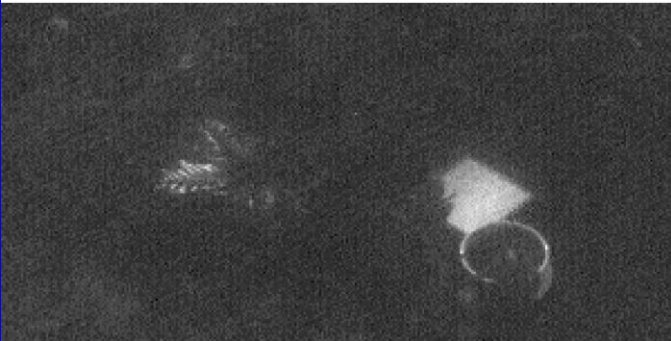


- Wavelength: 460 to 780nm (visible 400-700nm)



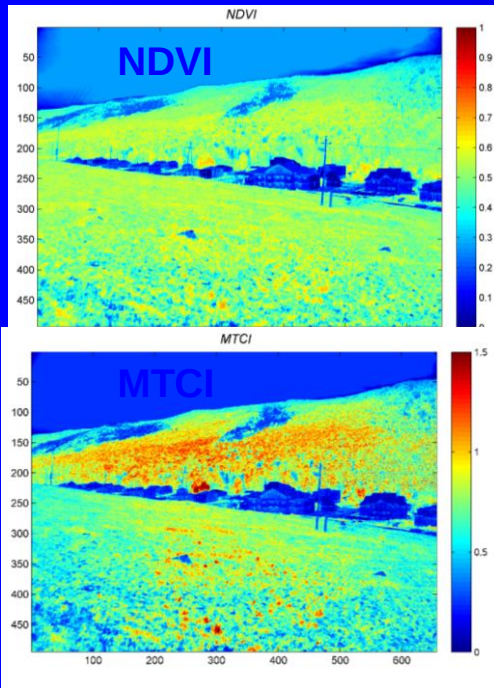
Yield Prediction

Wavelength, nm $\lambda=460$

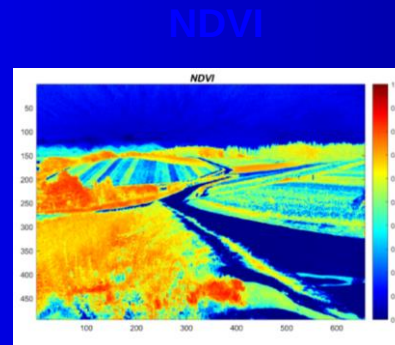


12/18/2022

Sample applications of multispectral LCTF camera

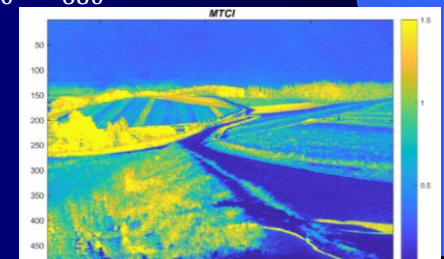


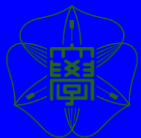
The fungus-like organism was identified from diseased area.



$$NDVI = \frac{R_{740} - R_{680}}{R_{740} + R_{680}}$$

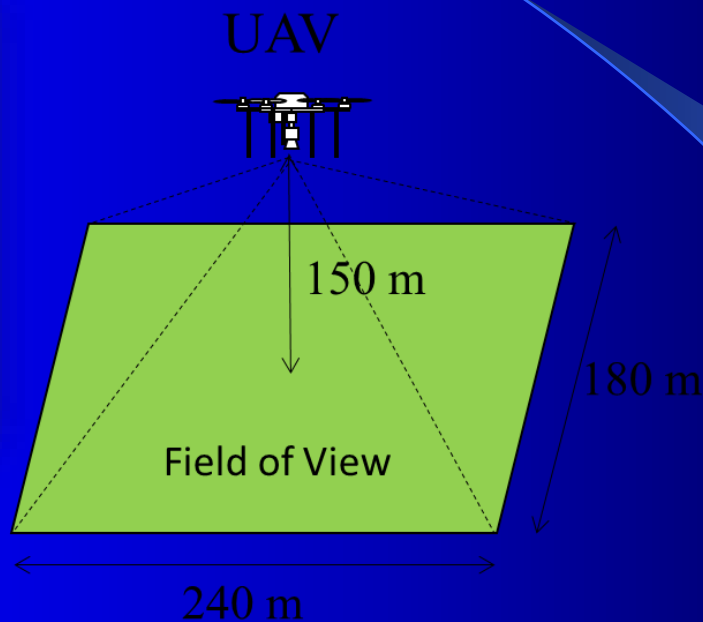
$$MTCI = \frac{R_{750} - R_{710}}{R_{710} - R_{680}}$$





HOKKAIDO
UNIVERSITY

Crop growth diagnosis using UAV-based multispectral remote sensing

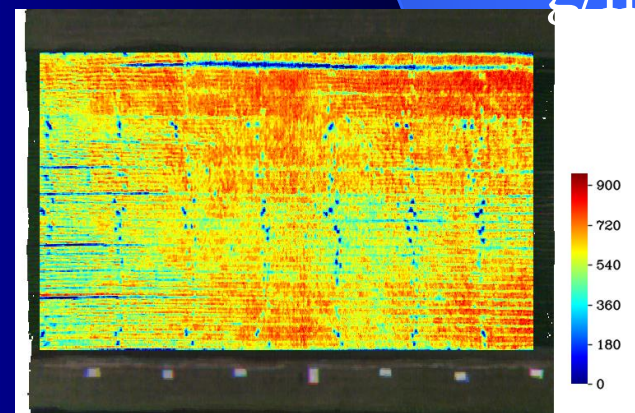


Yield Prediction

g/m



UAV-borne multispectral
camera
using LCTF technology

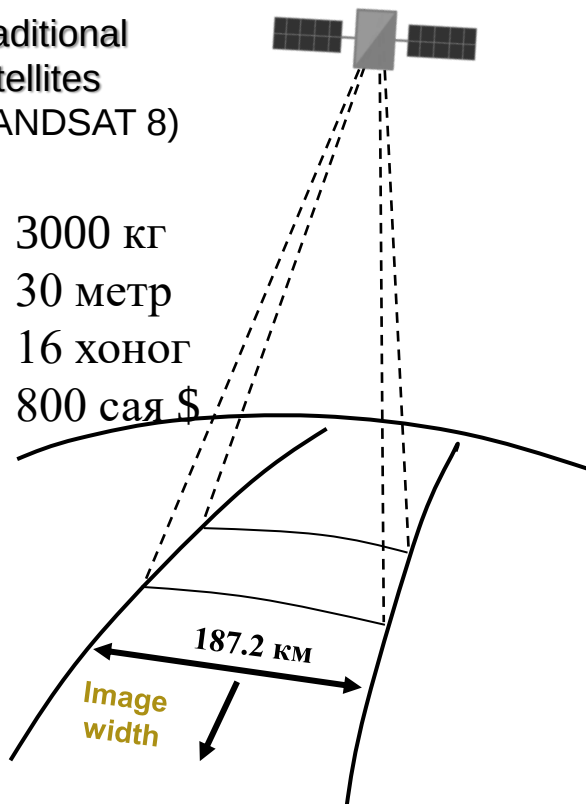


Microsat development in the near future



Traditional satellites (LANDSAT 8)

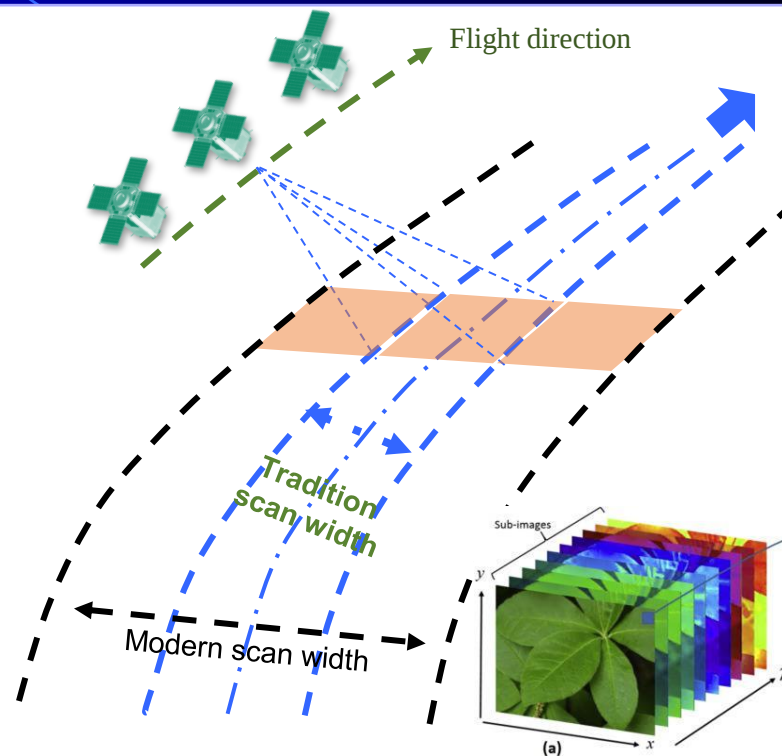
- 3000 кг
- 30 метр
- 16 хоног
- 800 сая \$



Plan for launching satellite

Microsat

- 50кг
- 5метр
- 5 сая \$



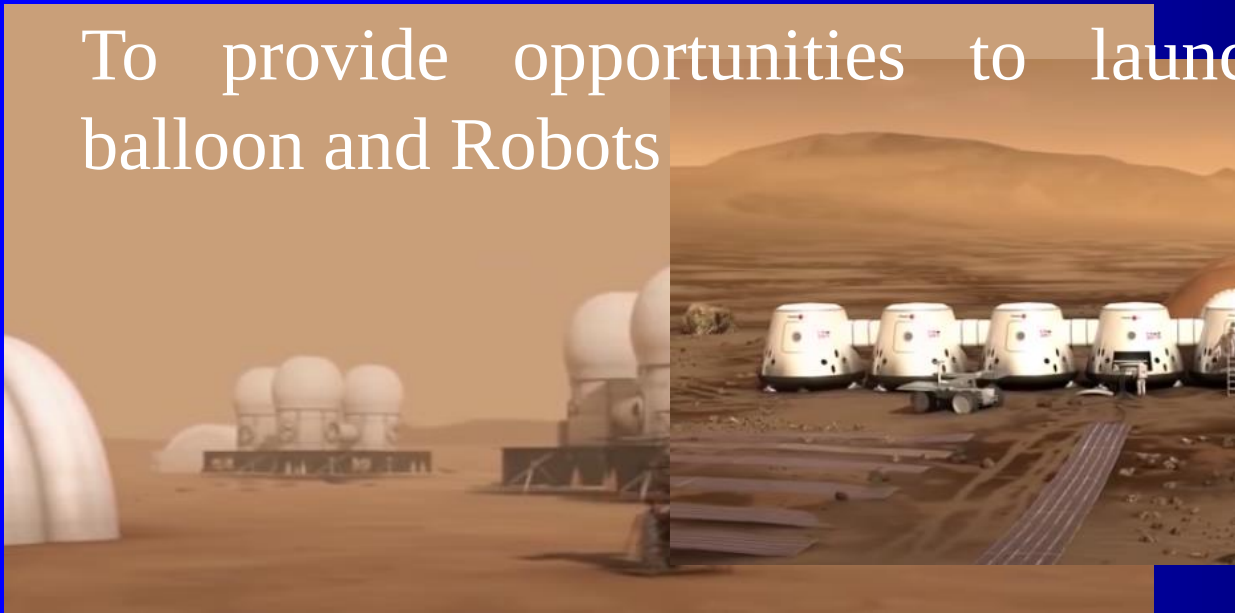
- Hyperspectral camera
- Change the viewing angle

Citizen Science project: MARS_V

To connect mankind's vision to reach Mars

To make environment that enables people to conduct experiments and develop technologies for colonizing Mars

To provide opportunities to launch Cansat, balloon and Robots



Why Mongolian GOBI similar to Mars's surface

Mongolian Gobi is one of the 24 biggest deserts in the world

Similar landscapes



Discussion

Development Small satellites can be Citizen Science project

Science Technology Engineering Mathematics
(STEM) program for high school and university students

Making satellite Combines **science** and **technology** with inspiration and excitement

It can play a unique role in facilitating *education* and *capacity building*

International Cooperation and Collaboration in many ways of satellite development is increasing in Mongolia

Thank you