CubeSat'03

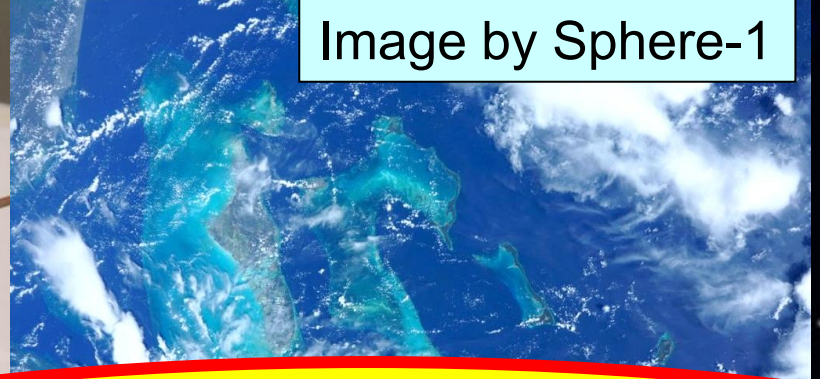
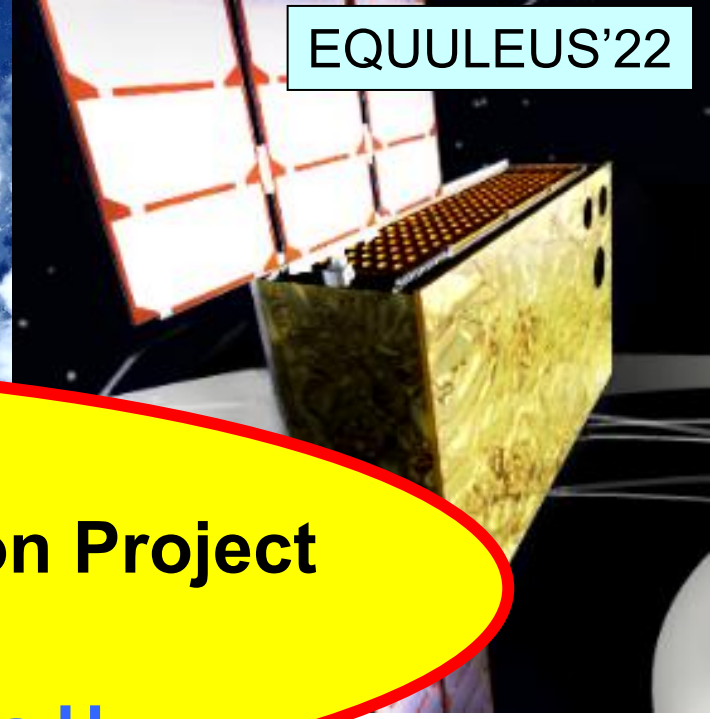


Image by Sphere-1



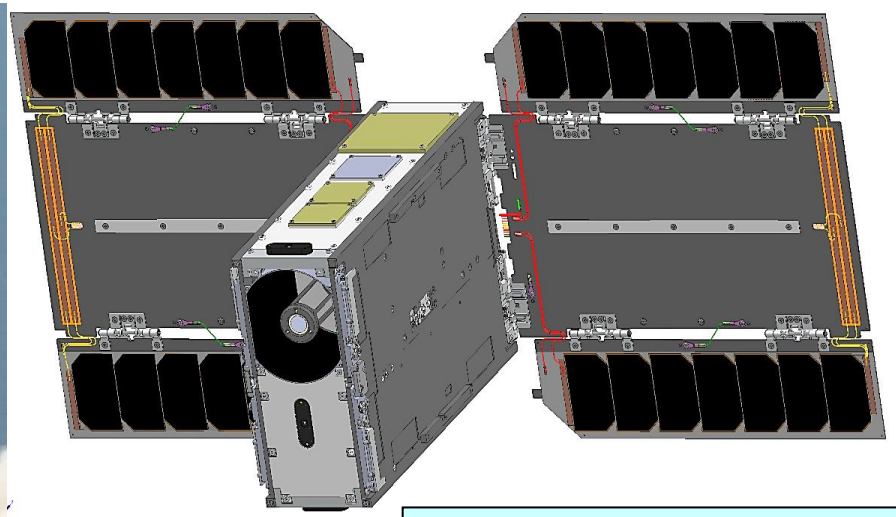
EQUULEUS'22

Next Step of UNISEC-GLOBAL IoT Constellation Project

Shinichi Nakasuka
University of Tokyo and Cross U

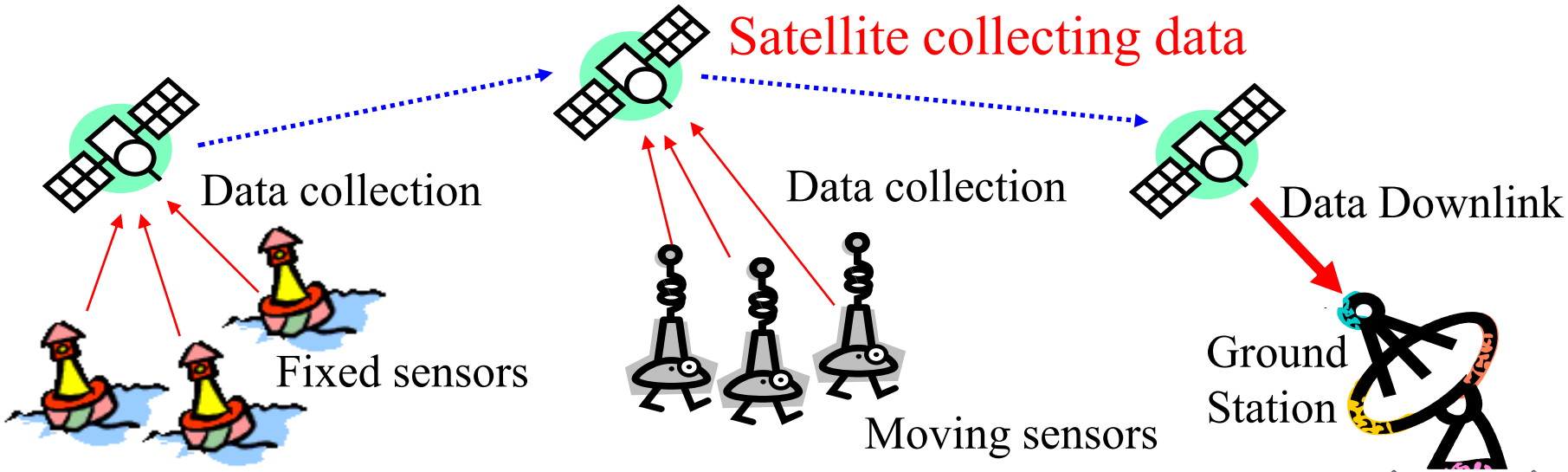
Hodoyoshi-3,4 '14

TRICOM-1R launch '18



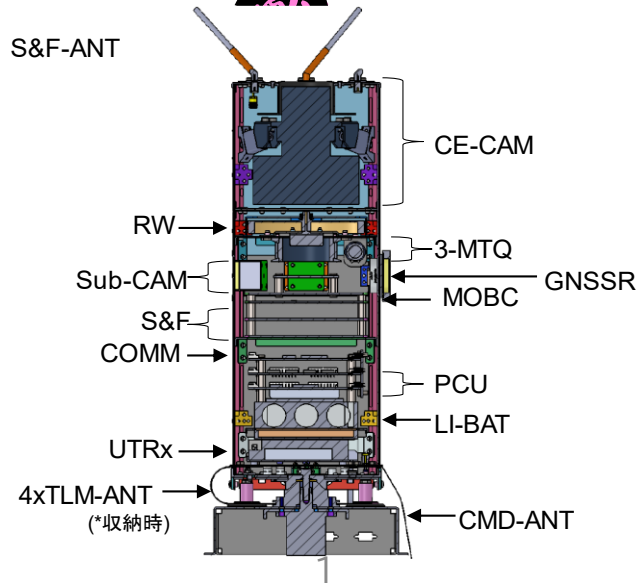
ONGLAISAT '24

What is “IoT Mission”?- Collects ground information



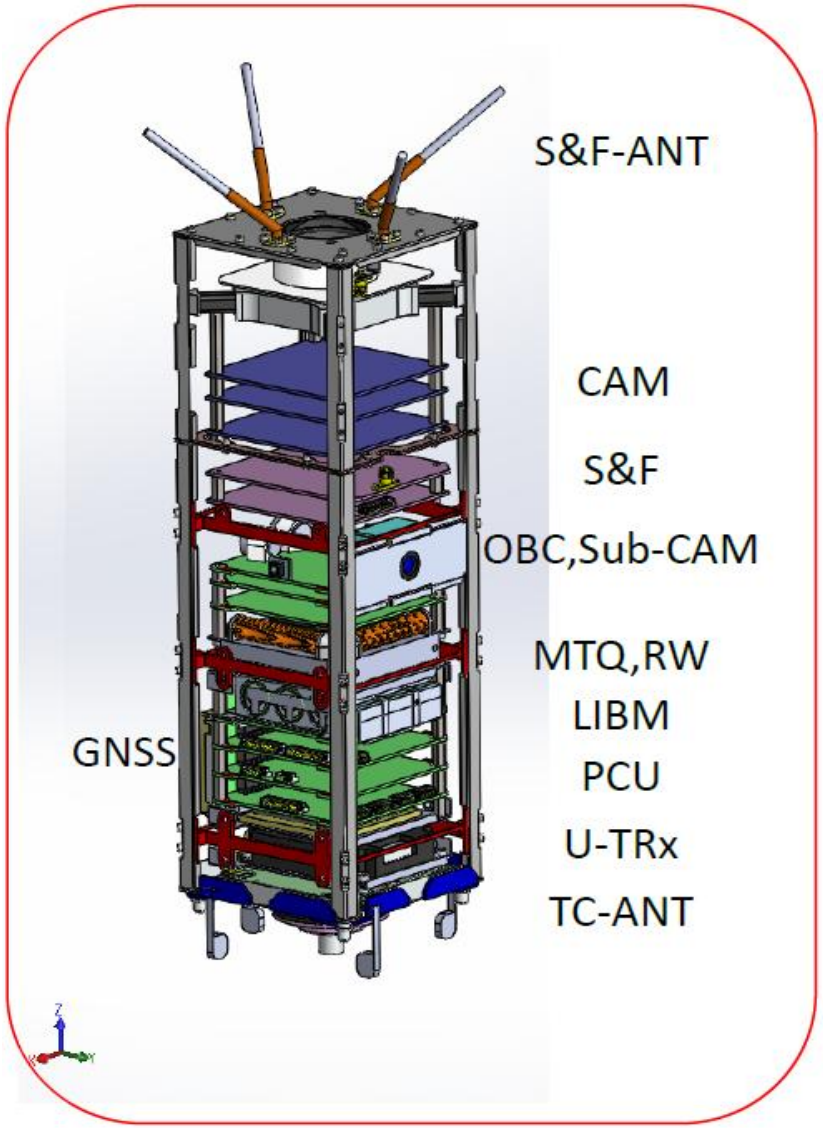
Application areas: disaster prediction, water level monitoring, soil moisture, PH…..

Low power transmission is key: 20 -130 mW RF power, low data rate (300bps) transmission was successful. (2018)



3kg TRICOM-1R

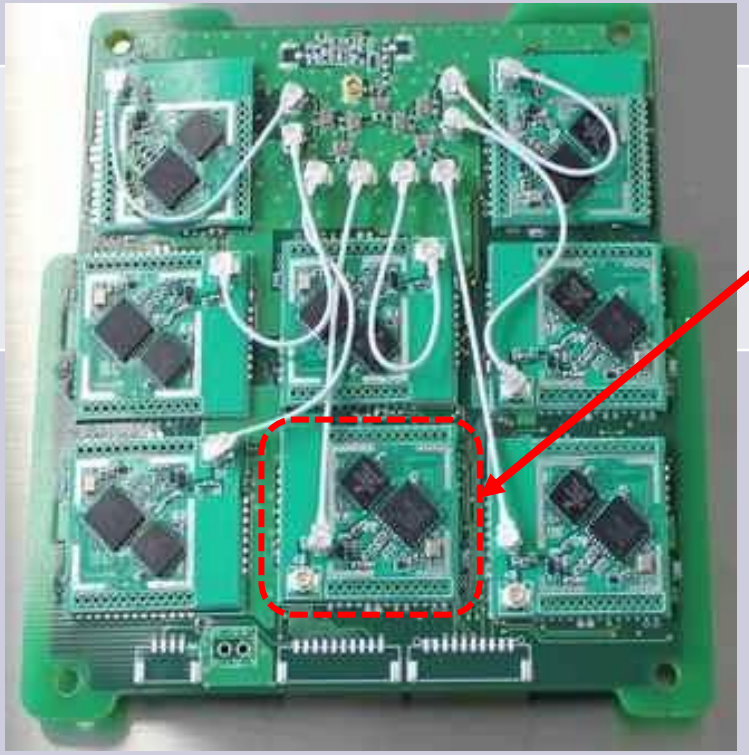
3U CubeSat “TRICOM-1R” - S&F Test Satellite (2018.1) -

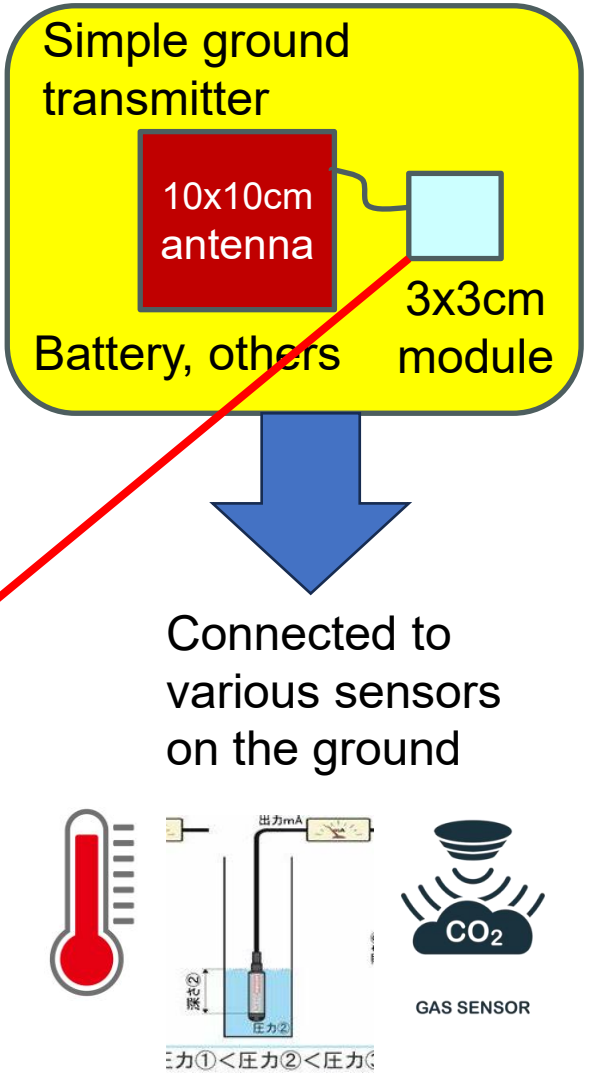


Items	Values	Miscellaneous
Size	10x10x30cm	3U size
Weight	< 3kg	
OBC	"Bocchan"board	Internal made
Power (average)	4W	AZUR GaAs cell
Battery	Li-Ion 41 wh	LIBM
Downlink (H/K&data)	W 1.2kbps	460MHz AFSK "U-TRx"
Uplink(H/K)	50W 9600bps	401MHz
Attitude	Simple 3 axis	B-dot law only
Sensor	magnetic sensor,gyro GPS receiver	"GNSS"
Actuators	magnet torquer despun wheel	"MTQ" "RW"
Camera	GSD 314 m VGA @180km	"CAM"
Sub-Camera	GSD 67 m @600km	"Sub-CAM"

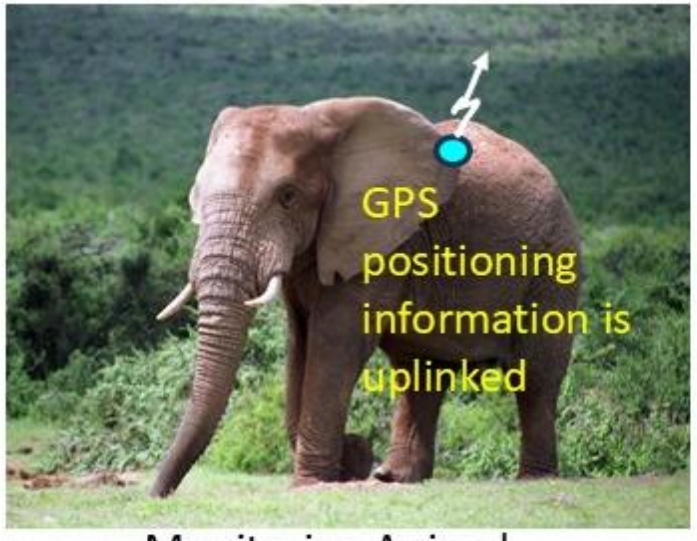
TRICOM-1R Weak Signal Receiver for Data Collection Capability

Item	Specification
bit rate	300 bps, maximum 8 channels in parallel
Transmission duration	< 300 sec
Transmission power from ground	20 mW
Frequency band	920 MHz (no license of usage is required if using 20mW power)





We need to find “use cases” for IoT mission



Monitoring Animal
Movements over wide area

Wild Fire Detection and Monitoring
(temperature sensor network)

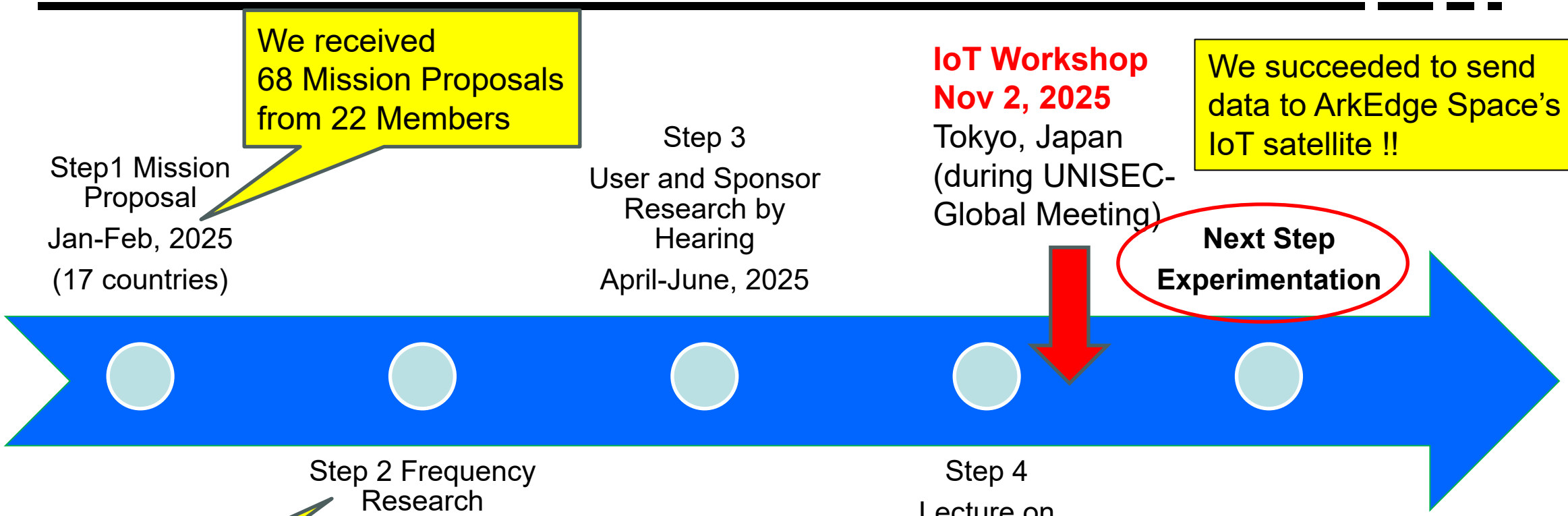
Flood Detection and Monitoring
(Water Leven Sensor Network)

Agriculture Field Monitoring
(PH, moisture level sensors)

Merits of IoT Mission as UNIGLO Collaboration

- Even with small number of satellites, we can do certain missions. And, the more satellites, the higher time resolution.
  - Number of satellites will be increased with more funds obtained.
- Developing only ground sensors also contributes to the overall program.
  - The first step to enter the project is much easier and less expensive.
  - If you develop good sensors, they can also be used by other countries (so it can lead to a certain business)
- You can prove to your governments that space technologies are really useful to solving various social or global issues
  - In order to obtain continuous funds from your government, this is essential.
- And in future, we would like to contribute to all the humankind by providing various data obtained all over the world

Current Status of IoT Program in UNISEC-GLOBAL



How to Experiment IoT Transmission to ArkEdge Satellite?

- Please develop LoRa transmission module with components which you can buy in your countries.
  - Required specifications for LoRa module will be provided by ArkEdge Space（frequency, bit rate, bandwidth, data length, etc)
  - A simple guidebook on how to develop the uplink system will be provided, too.
  - Recommendation on antenna shape, gain and other specifications will be given, too.
- We will use 920MHz band (920.6 MHz to 923.4MHz) transmission frequency as the first step to match the receiver on the ArkEdge Space's satellites
  - Please contact your government's communication authority and ask them how to get a license (or license-free?) to use that frequency to send data to the satellite. Please take some effort to get, for example, "temporary experiment license"
  - Other frequency (such as band around 868MHz, 915MHz, 400MHz) will also be considered in future, but please focus on using 920MHz as the first step
- ArkEdge Space will announce a period of "IoT experiment campaign" when you can send data to a satellite and check the connectivity. Detailed information will be provided by ArkEdge Space in near future. (it may charge a certain handling fee)
  - We will highly recommend you will do ground to ground transmission test before that campaign

Important strategy is "**Standardization**"

- We will define the interface standard for IoT ground transmitter
- Based on the standards, participants can develop their own components by, for example, purchasing off-the-shelf components that can be obtained in participants' countries or developing the components by themselves. So "standard" is important.
- If you buy or develop such components, ArkEdge Space will provide some ways to confirm that the components can meet the standards by connection check or other means. **("IoT experiment campaign")**
- ArkEdge Space will provide a simple guidebook on how to develop IoT transmitter system.
  - In future, ArkEdge Space will also provide IoT Transmitter components (not free) which are already proved to meet the standards.
  - If the other company's IoT Transmitter meets the standard, you can also buy and use it
- For inquiries regarding IoT transmissions to ArkEdge satellite, please contact the address below.
  - **iot-support@unisec-global.org**