MRA　International workshop

Logistics drone initiatives

3/16-17/2023

Kawasaki Heavy Industries, Ltd.

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Outline

Kawasaki Heavy Industries is developing unmanned mobility and providing new logistics services in order to help solve social issues such as the declining birthrate and aging population.

Crewless VTOL K-RACER

Delivery Robot FORRO

Multipurpose UGV
UGV:Unmanned Ground Vehicle

Developing a goods transportation business using the unmanned VTOL K-RACER is a part of this. The plan is to commercialize the goods transportation service to mountain huts where securing a sustainable logistics service is challenging.

In fiscal 2021, we were entrusted with the project to build a goods transportation platform using unmanned VTOL aircraft, which Ina City is carrying out as one of the Society 5.0 projects. We are working on development with the aim of commercialization from fiscal 2026.

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MIC MRA International Workshop2023

4K Video Transmission Test Using iNET RF Network
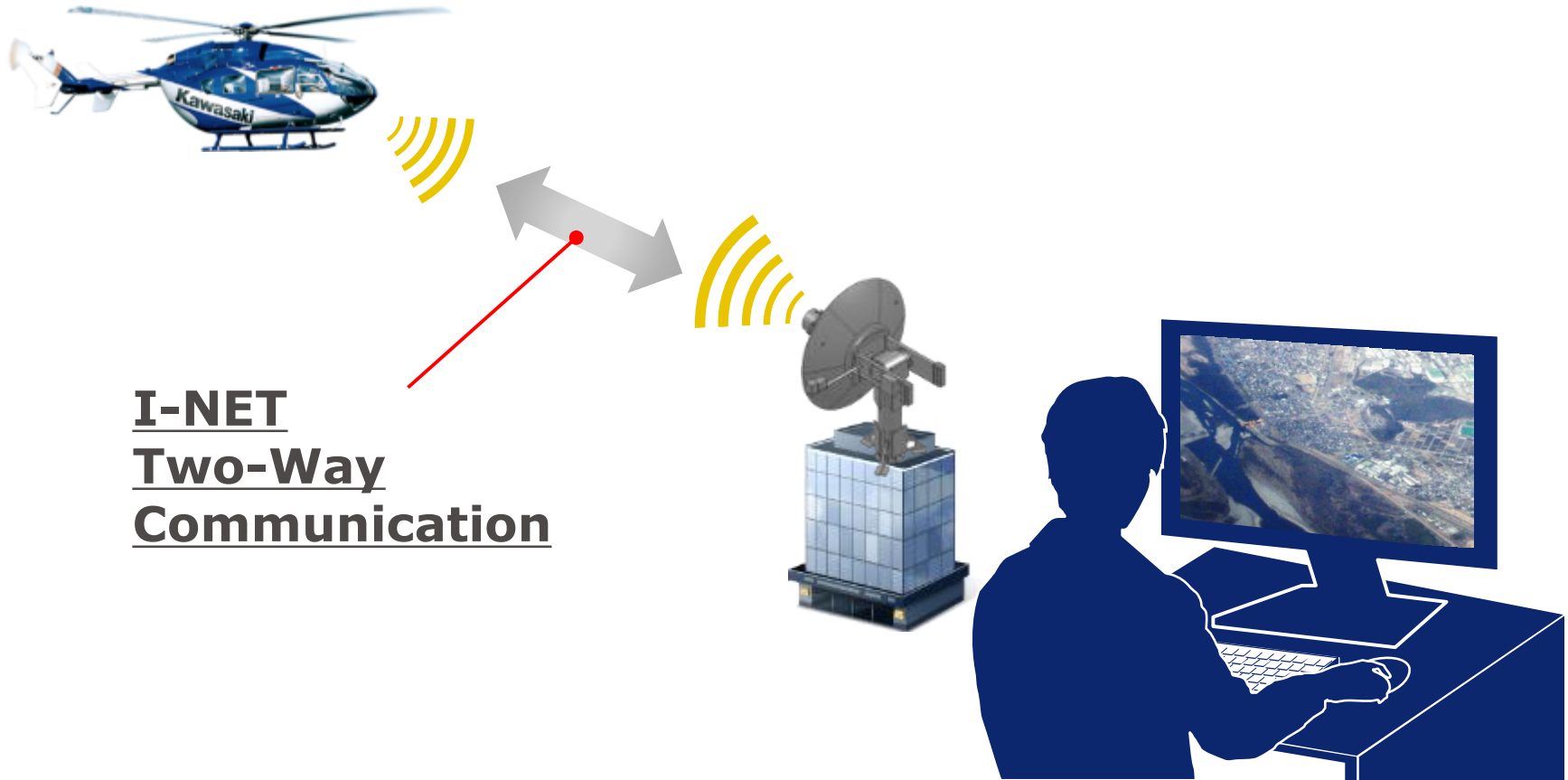
3/16-17 2023

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INDEX

1. Introduction

- 2007   Launch Research
- 2014   Performance Test (Tethered Aerostat) ITC 2015
- 2016-18 Performance Test (Helicopter)   ITC 2018
- 2021-22 Video Transmission Test (Helicopter)   ITC 2022

**I-NET
Two-Way
Communication**

2. Key Components (1) IP Transceiver

Curtiss-Wright Corporation's nXCVR

Frequencies	2,200〜2,400MHz
Bandwidth	Up to 20MHz
Output Power	80 W peak
Modulation	OFDM(802.11a)-BPSK,QPSK,16QAM
Interface	Ethernet

2. Key Components (2) Video Encoder

Haivision Makito X4 Rugged

Video Resolution	SD / HD720 / HD1080 / 4K UHD
Video Compression	H.264 / H.265
Network Interface	10 / 100 / 1000 Base-T
Protocol	UDP / SRT*
Bit Rates	32kbps – 120Mbps

*SRT : Secure Reliable Transport

(a)Common protocol (ex. UDP)

source: https://www.paltek.co.jp/

(b) SRT

source: https://www.paltek.co.jp/

2. Key Components (2) Video Encoder - SRT

(b) SRT
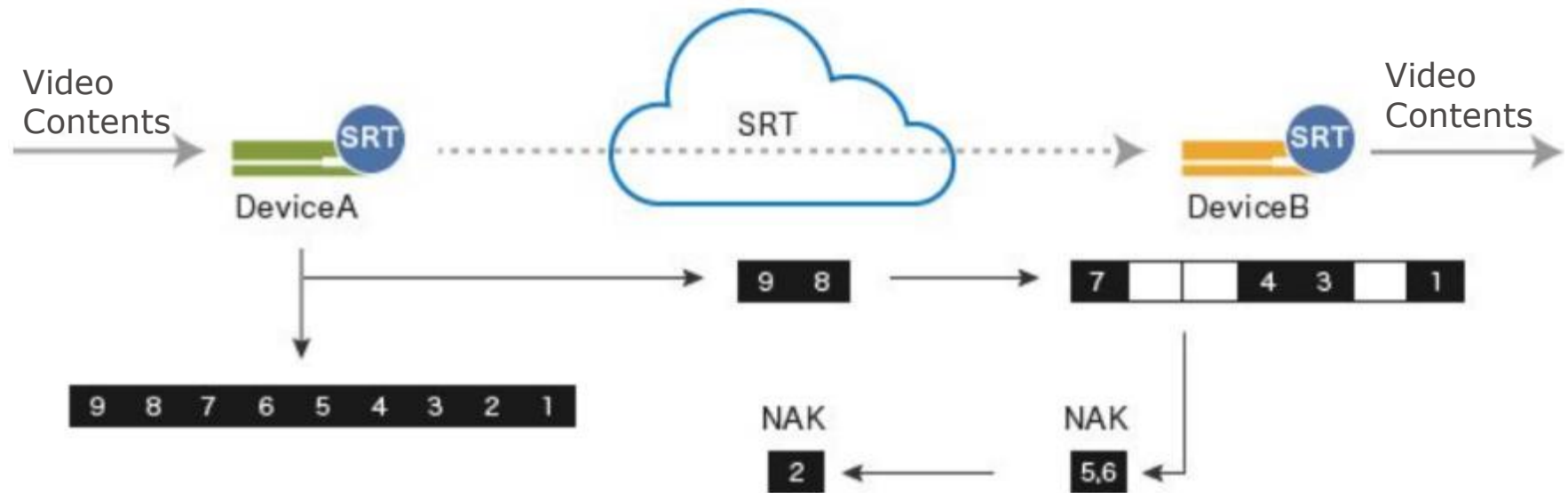
NAK : Negative Acknowledge

source: https://www.explorer-inc.co.jp/

3. System Configuration (1)On-Board System

Video Transmission System

- Video Camera
- Aircraft Power (28V)
- Video Encoder
- Ethernet SW
- IP Transceiver
- GPS ANT.
- TLM ANT.
- Ground ANT.
- GPS ANT.
- IP Transceiver
- Ethernet SW
- Control PC
- Video Decoder
- Ground facilities
- 4K Display
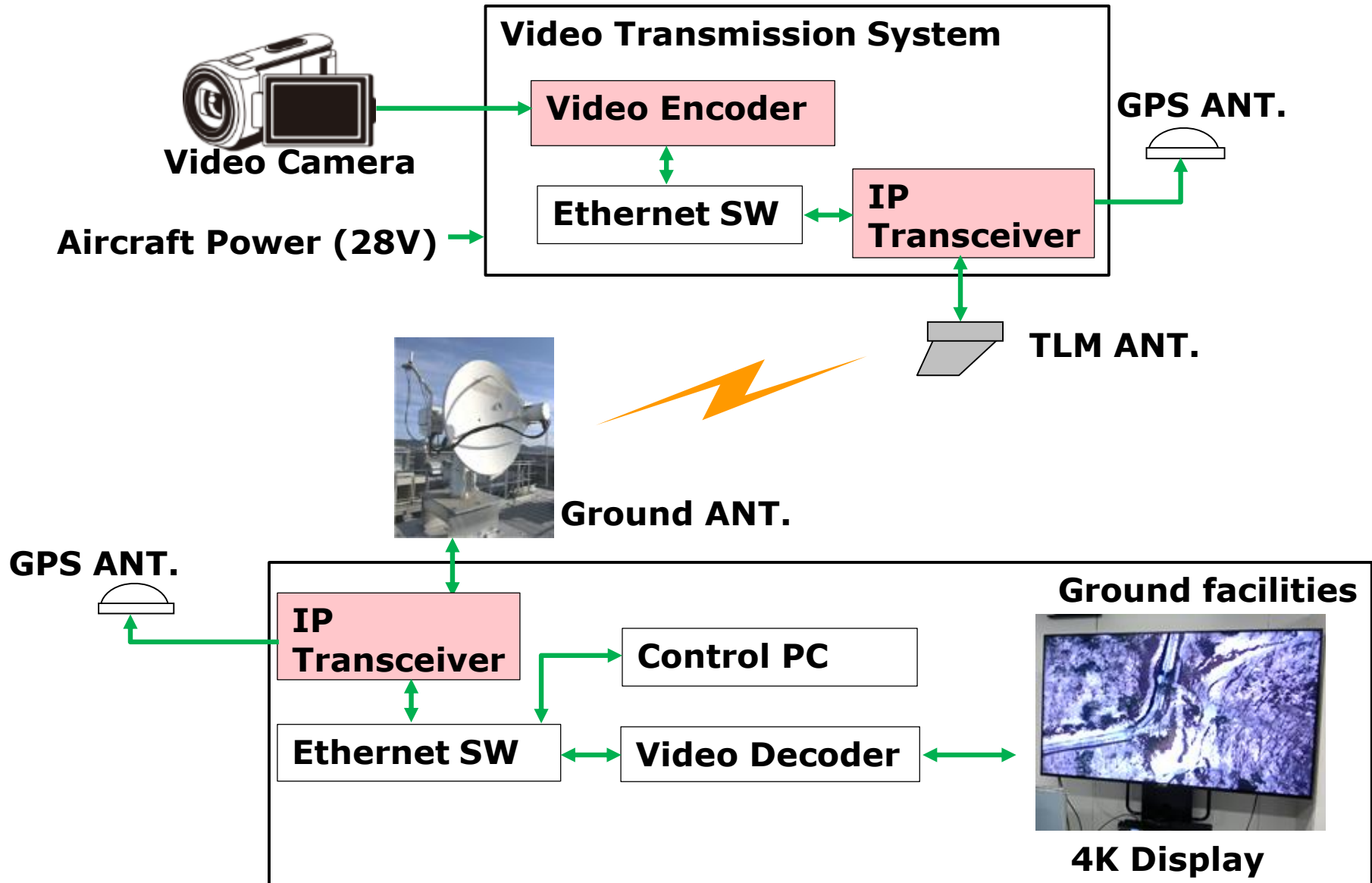
3. System Configuration (2)Installation

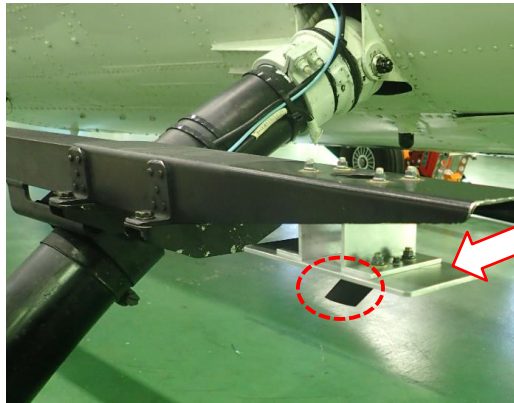**Video Transmission System**

GPS Antenna

Kawasaki BK117

Telemetry Antenna

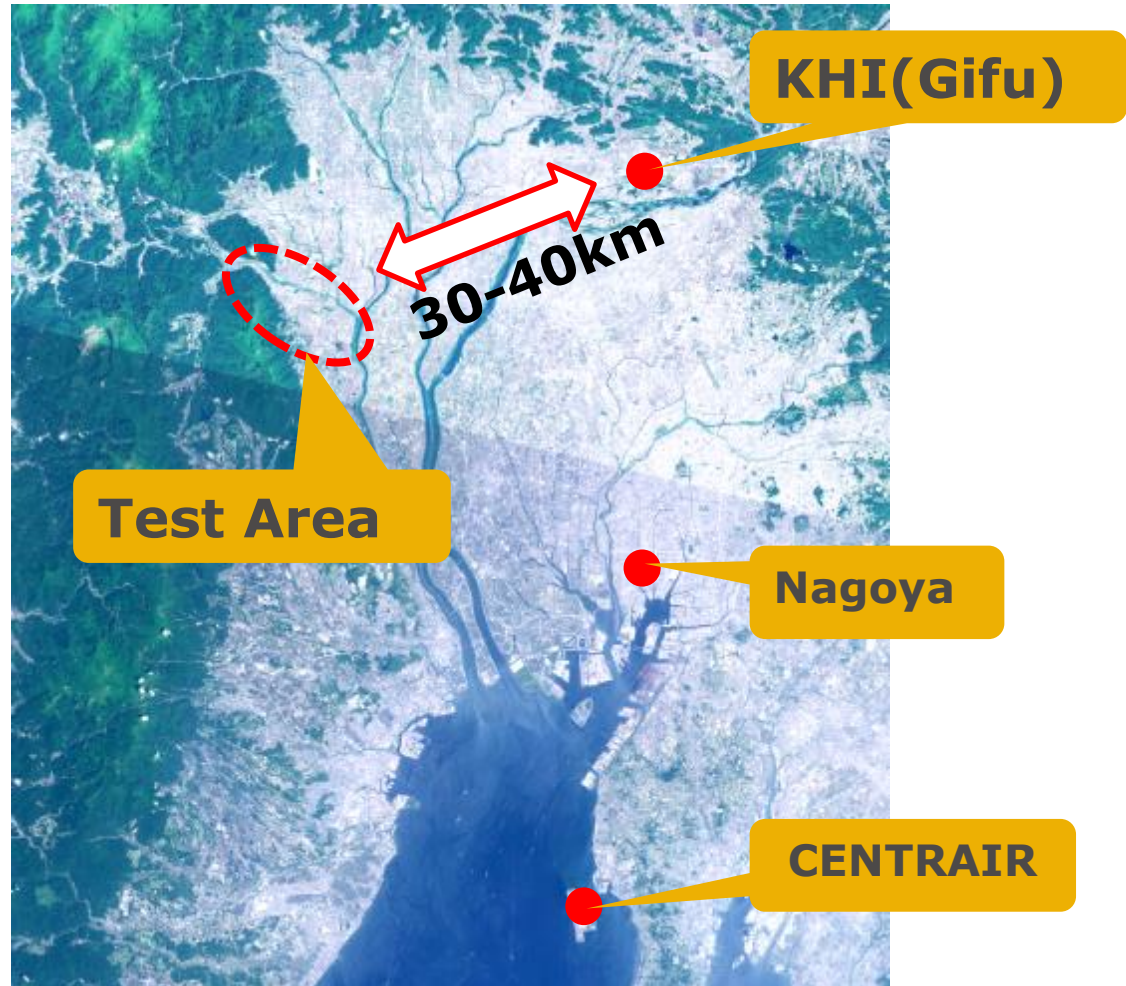# 3. System Configuration (3)Ground Facilities

Camera

IP Transceiver

Ethernet

Dish Antenna (Φ1.2m)

Camera Display

Antenna Control Unit

Ethernet

4K Display

Control PC
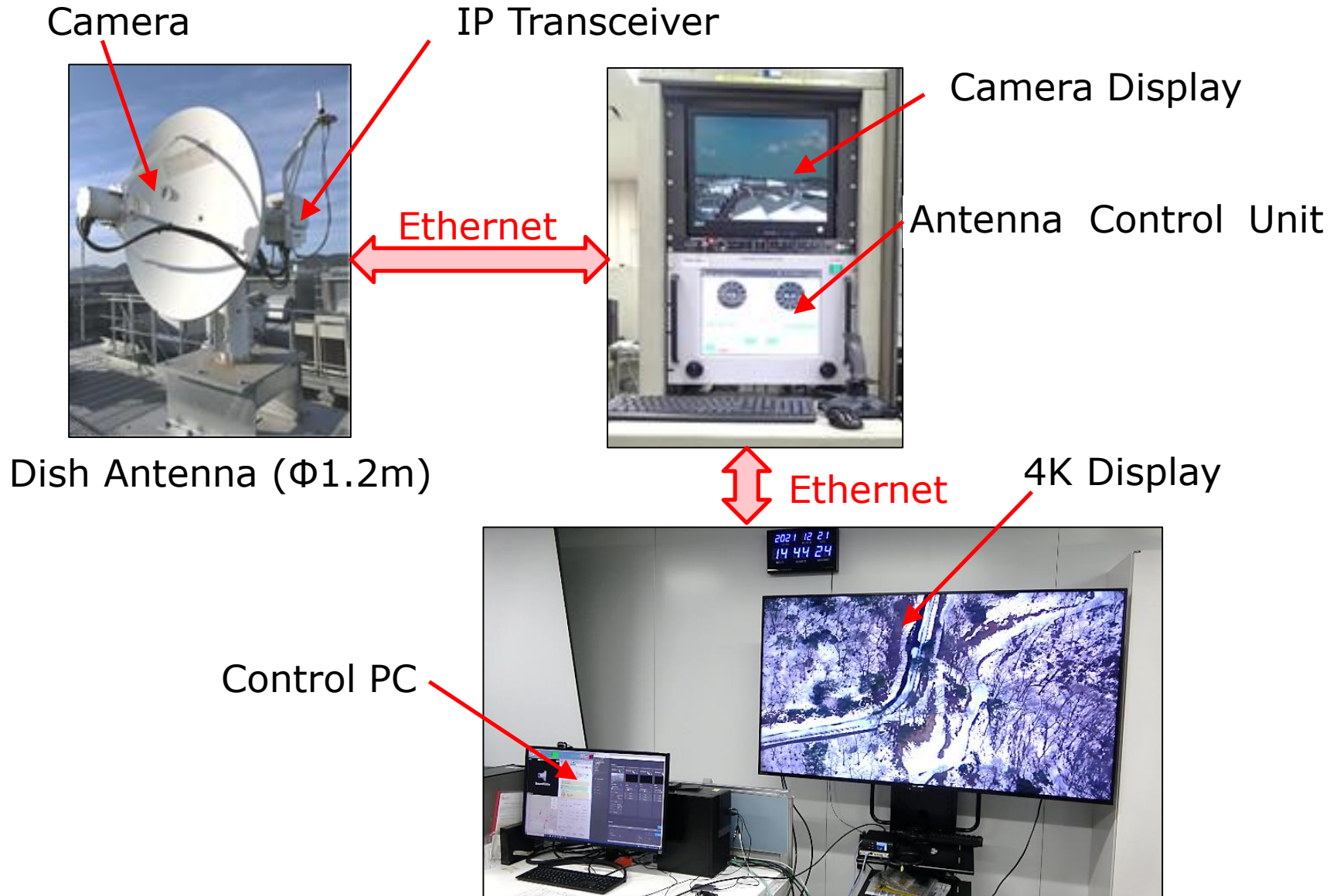
4．Test Results (1) Test Area

source: https://maps.gsi.go.jp/

KHI(Gifu)

30-40km

Test Area

Nagoya

CENTRAIR

source: https://maps.gsi.go.jp/

4. Test Results (2) Test Settings

Range(30-40km)

Settings
- ・ IP XCVR : QPSK(10Mbps)
- ・ Video : 4K/6Mbps
- ・ Compression : H.265
- ・ Bit Rates : 6Mbps
- ・ Protocol : UDP/SRT

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4. Test Results (3) 4K Video Transmission

Example of Transmitted 4K Videos

4. Test Results (4) Effectiveness of SRT

Test results at packet error rates：**1%-2%**

(a)UDP

Distortion

(b)SRT

No Distortion!

4. Test Results (4) Effectiveness of SRT

Example of Transmitted 4K Videos

4. Test Results (4) Effectiveness of SRT

SRT test results at packet error rates:5%-10%
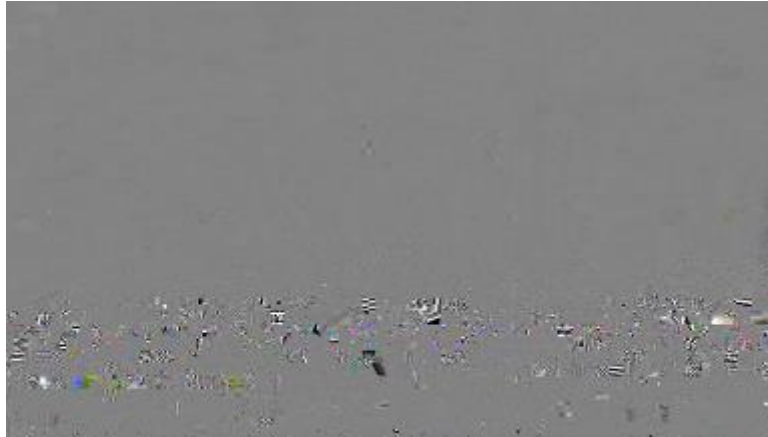
(a)5%

Clear

(b)10%

Block Noise

4. Test Results (4) Effectiveness of SRT

SRT test results at packet error rates:15%

(c)15%

Full of Noise

5. Conclusions

✓ **We succeeded in transmitting 4K video in real-time in the range of 30 to 40km.** (According to our study in 2018*, it should be possible in the range of 100km.)

   *We demonstrated two-way communication of 10Mbps in the range of 100km in 2018

✓ **We demonstrated that SRT is effective for video transmission under unstable RF environment.**

6. Future Plans

・ **Development of the small Antenna for Air to Air Communication.**

・ **Air to Air Communication Tests Using the Above Antennas.**

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