Introduction of the Contributions of KIZUNA and KIKU No. 8 in Disaster Management

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Contents

1. Overview of KIZUNA
   (WINDS:Wideband InterNetworking test and Demonstration Satellite)
2. KIZUNA Experiments
3. Sentinel Asia Project
4. Outline of KIKU-No.8
   (ETS-8:Engineering Test Satellite No.8)
5. Summary

Features of KIZUNA

■ **High-Speed Data Communication Rate**

- 155 Mbps for home use
  (small terminal with 0.45m diameter class antenna)
- 1.2Gbps for business use
  (large station with 5m diameter class antenna)

■ **Wide Coverage**

Ultra-high-data rate communications in a wide area of Asia /Pacific region

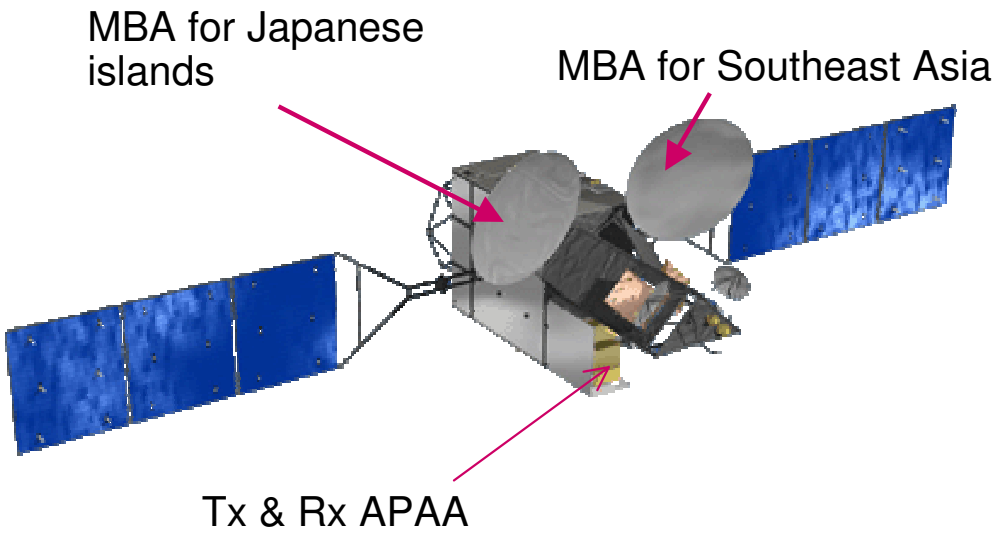
■ **Establishment of the Flexible Satellite Communication network**

On-board switching provides the flexible network.

Remarks:

KIZUNA is a R&D satellite and is open to the experiment users, such as of the institutes and universities, who study and develop the satellite communications technologies.

Outline of KIZUNA

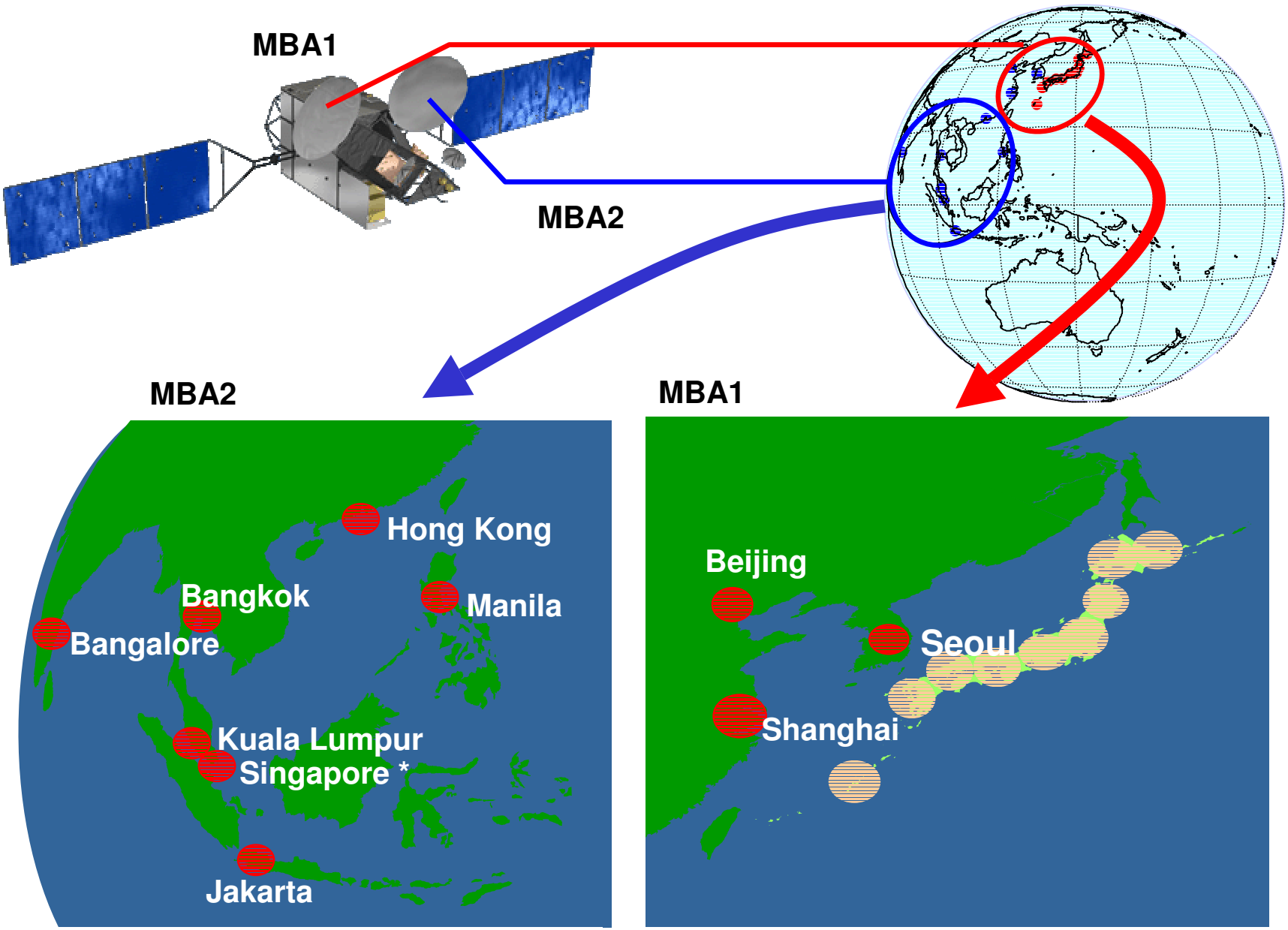


Outline of KIZUNA System

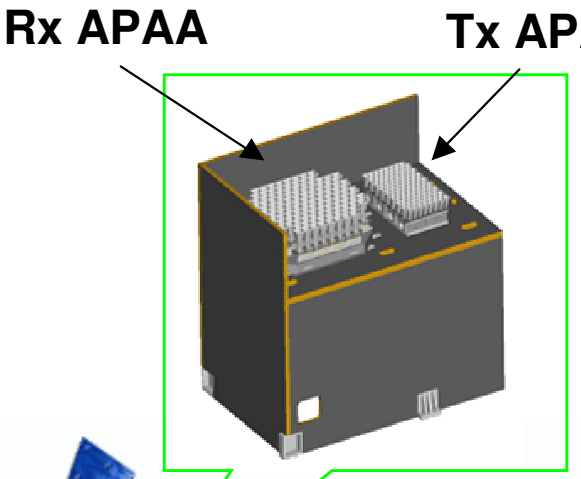
- Ka-band Satellite with High Speed Transmission Capability Gbps order
- Bent pipe and Onboard ATM Switching
- Multi-Beam Antennas(MBA) and Active Phased Array Antennas(APAA) with high speed scanning capability

Launch Schedule	February 23rd, 2008 by H2A Launcher
Mission Life	5 years
Location	143 degree E
Dimension	3 x 2 x 8m Span of Solar Paddles: 21.5m
MASS	4,850 kg (lift off)
Electric Power	5,200W / EOL, Summer Solstice
Attitude Control	Zero-momentum 3-Axis Control
Frequency	U/L : 27.5 – 28.6 GHz D/L : 17.7 – 18.8 GHz
Satellite G/T	> 18 dB/K (MBA) > 7 dB/K (APAA)
Satellite EIRP	> 68 dBW (MBA) > 55 dBW (APAA)
Onboard Processing	ATM Baseband SW

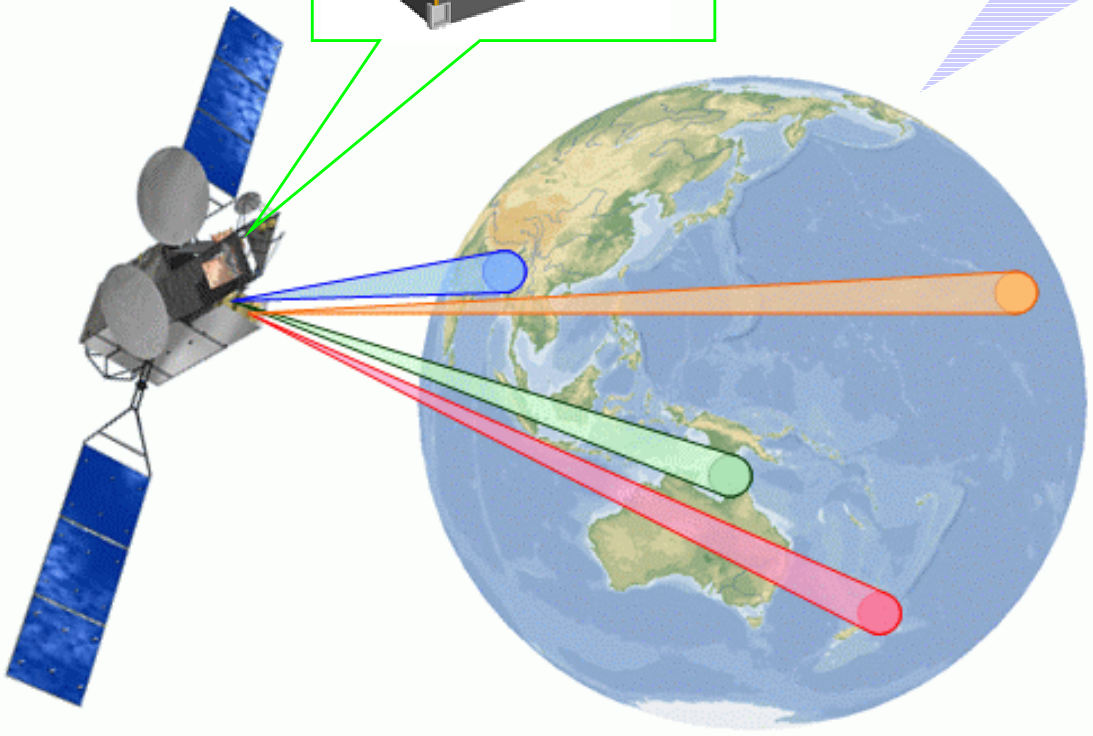
MBA (Multi Beam Antenna)



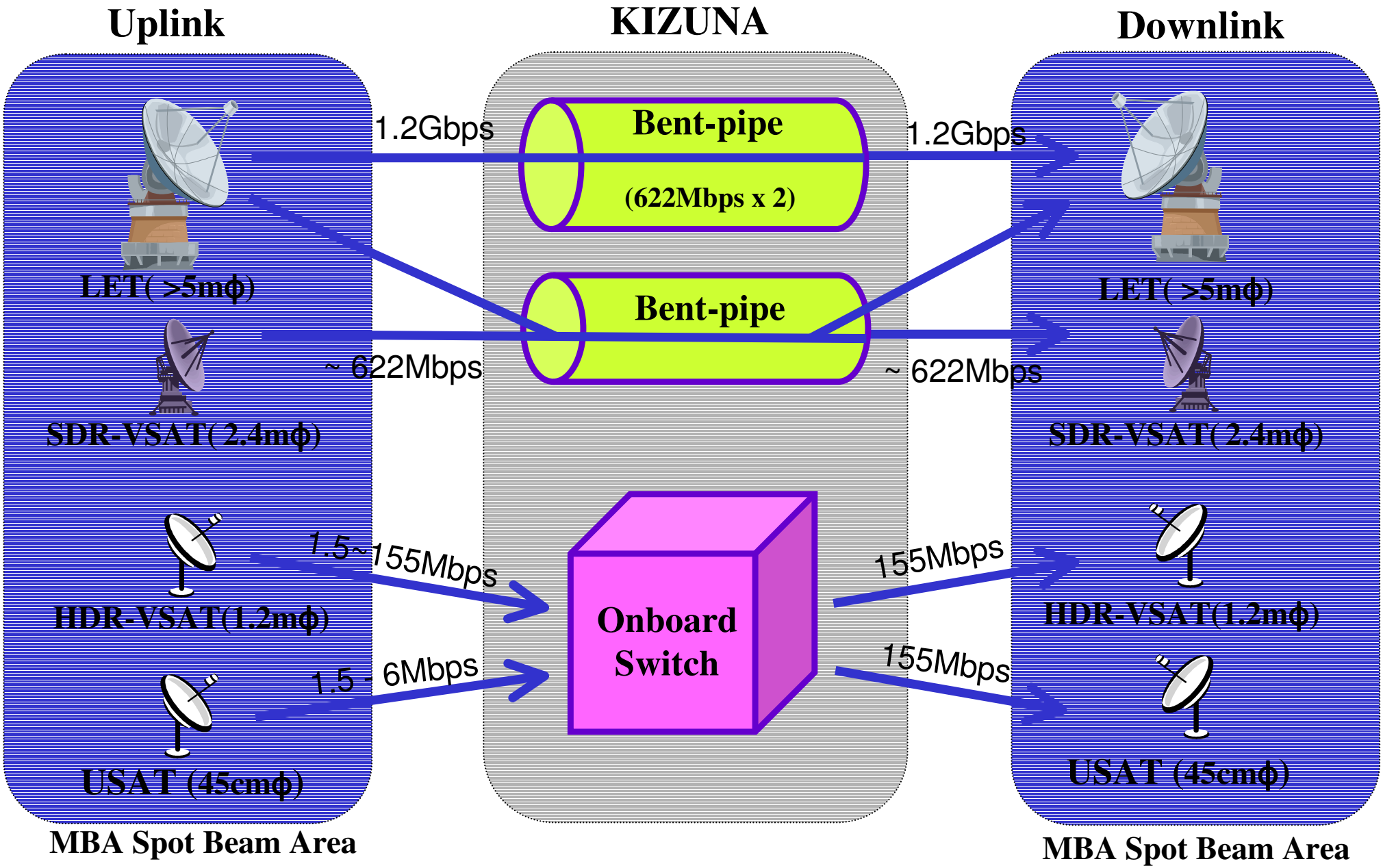
APAA (Active Phased Array Antenna)



APAA can hop its beams to required points in 2msec interval to provide a wide coverage area.



Ground Terminals vs. Data Rate



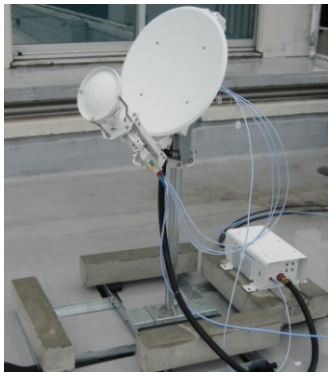
KIZUNA User Terminals

LET (Large Earth Station Terminal)
(NICT)

SDR-VSAT
(NICT)

NICT: National Institute of Information and Communications Technology

KIZUNA User Terminals (Fixed Type) (for MBA area)

	HDR-VSAT	REF-VSAT	USAT
Antenna System	Diameter: 1.2 m 	Diameter: 1.2 m 	Diameter: 45 cm 
Frequency Band	Uplink 27.5 - 28.1 GHz Downlink 17.7 - 18.3 GHz		
Maximum Data Rate*	Uplink 1.5-155 Mbps Downlink 155 Mbps	Uplink 1.5-51 Mbps Downlink 155 Mbps	Uplink 1.5 - 6 Mbps Downlink 155 Mbps
HPA (High Power Amplifier)	100 W (250W TWTA)	40 W (SSPA)	5-10 W (20W TWTA)
Maximum EIRP	66.9 dBW	61.7 dBW	48.8 dBW
G/T (Figure of Merit)	19.0 dB/K	19.0 dB/K	11.5 dB/K
Modulation	QPSK		
Weight	Approx. 4420kg	Approx. 300kg	Approx. 76kg
Power consumption	1,200W	1,100W	700W

* This data rate is for the satellite link, and includes overhead bits.

KIZUNA User Terminals (Portable Type) (for MBA area)

	Portable VSAT	Portable USAT
Antenna System	Diameter: 1.0 m 	Diameter: 45 cm 
Frequency Band	Uplink 27.5 - 28.1 GHz Downlink 17.7 - 18.3 GHz	
Maximum Data Rate*	Uplink 1.5-24 Mbps Downlink 155 Mbps	Uplink 1.5 - 6 Mbps Downlink 155 Mbps
HPA (High Power Amplifier)	40 W (SSPA)	10 W (SSPA)
Maximum EIRP	60.0 dBW	48.8 dBW
G/T (Figure of Merit)	19.0 dB/K	11.5 dB/K
Modulation	QPSK	
Weight	Approx. 250kg	Approx. 53kg
Power consumption	1,100W	700W

* This data rate is for the satellite link, and includes overhead bits.

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KIZUNA Experiments

Basic Experiments:

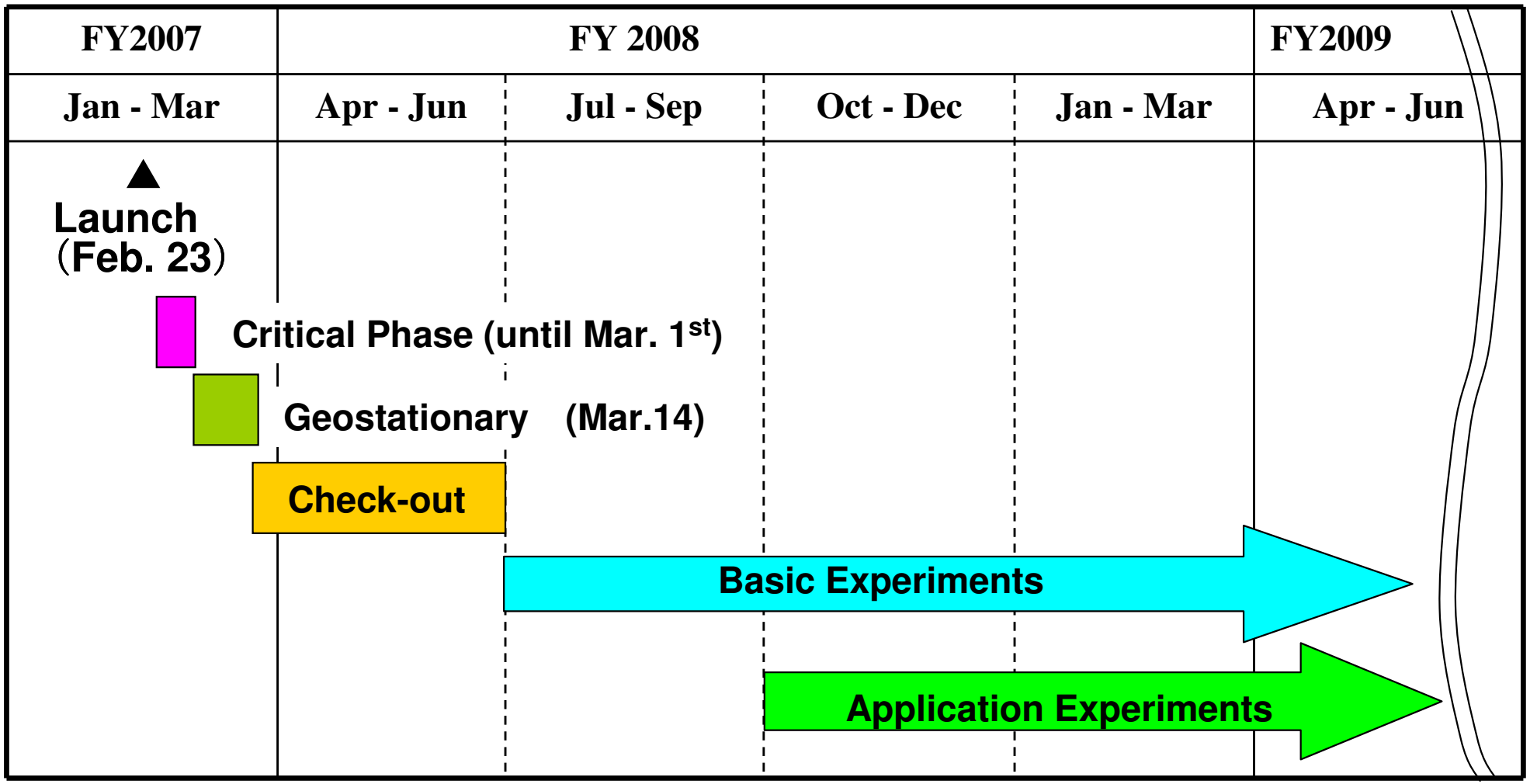
The experiments to be carried out by the satellite development agencies such as JAXA and NICT* in order to confirm the normality of the KIZUNA satellite functions and to demonstrate some applications of the broadband satellite communications system.

Application Experiments:

The experiments to be carried out by the users who proposed the KIZUNA experiments under the open invitation made by the government of Japan (MIC*) and approved their experiments by the government of Japan.

NICT: National Institute of Information and Communications Technology
MIC: Ministry of Internal Affairs and Communications

Milestones for KIZUNA Experiments



Launch Operation of "KIZUNA" (WINDS)

- JAXA successfully launched the KIZUNA by the H-IIA Launch Vehicle No.14 at 5:55 p.m. on February 23, 2008 (Japan Standard Time, JST) from the Tanegashima Space Center.

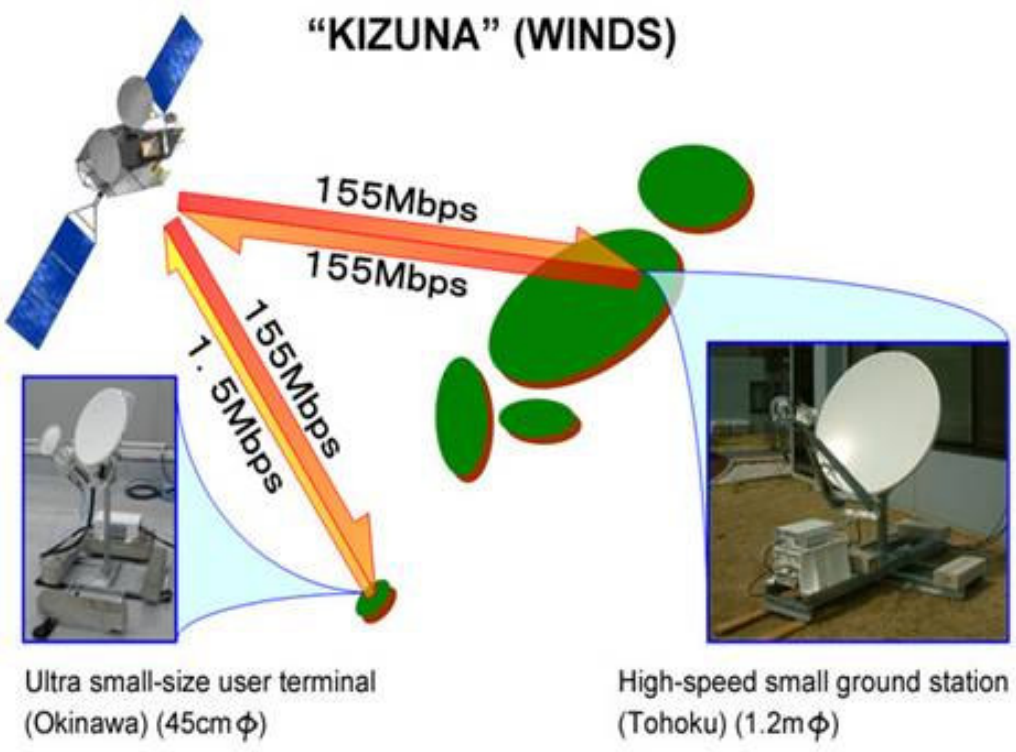
Satellite
functional check

Satellite
/Fairing Installation

Fairing
/Rocket combination

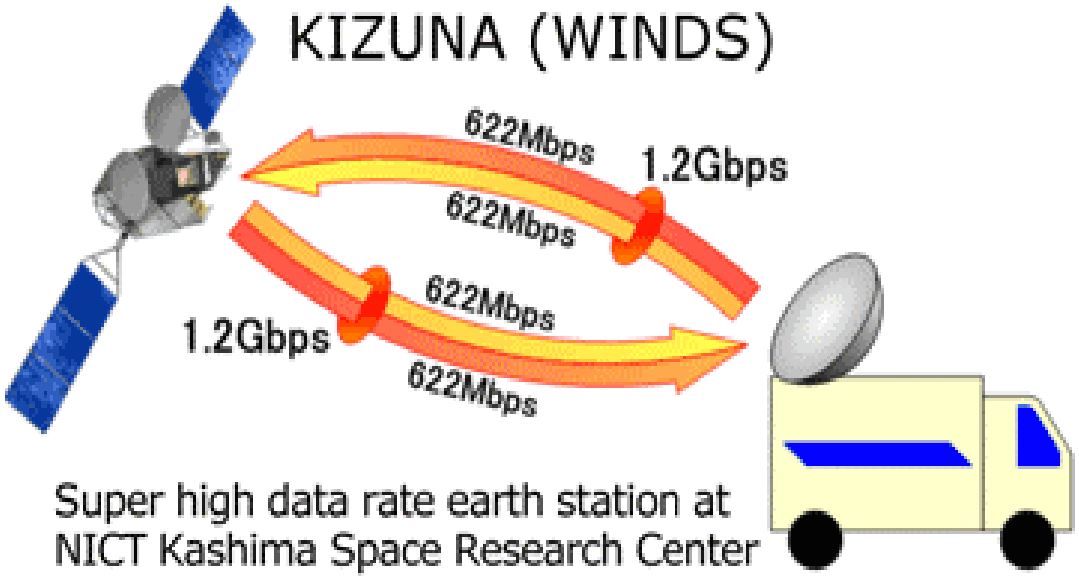
World's Fastest Satellite Internet Connection to 45 cm User Terminal Using "KIZUNA" (WINDS)

JAXA and NICT performed in 2008 a verification of regenerative switching functions between an USAT (ultra small-size user terminal with 45 cm-diameter antenna and a HDR-VSAT (high-speed small ground station with1.2 m-diameter antenna using the onboard multi-beam antenna (MBA) of KIZUNA, and confirmed that Internet protocol (IP) communications with a transmission speed of 155 Mbps were successfully performed.



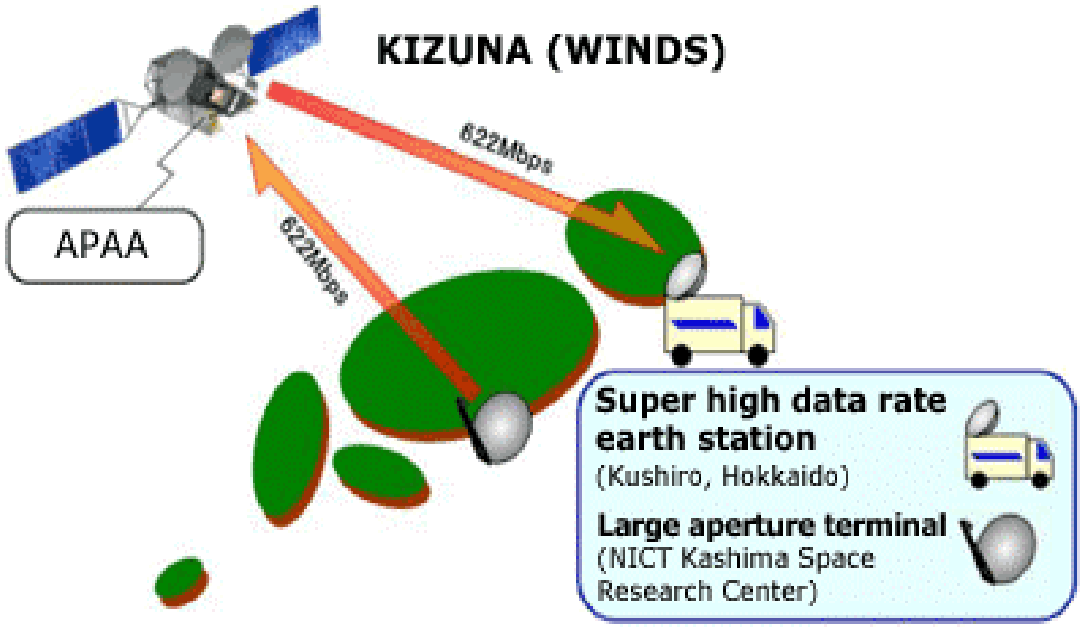
Carries out World's Fastest Satellite Data Communication at Speed of 1.2 Gbps

On May 2, 2008, JAXA and NICT successfully achieved ultra high data rate communication at a speed of 1.2 Gigabit per second (1.2 Gbps: 622 Mbps x 2 waves), which is the fastest communication speed in the world through communication satellites. This was achieved when a communication test was conducted between the KIZUNA's multi-beam antenna and a super high data rate earth station (a 2.4m diameter antenna) set on a car at the NICT Kashima Space Research Center during the initial functional verification operations of the KIZUNA that were jointly carried out by JAXA and NICT.

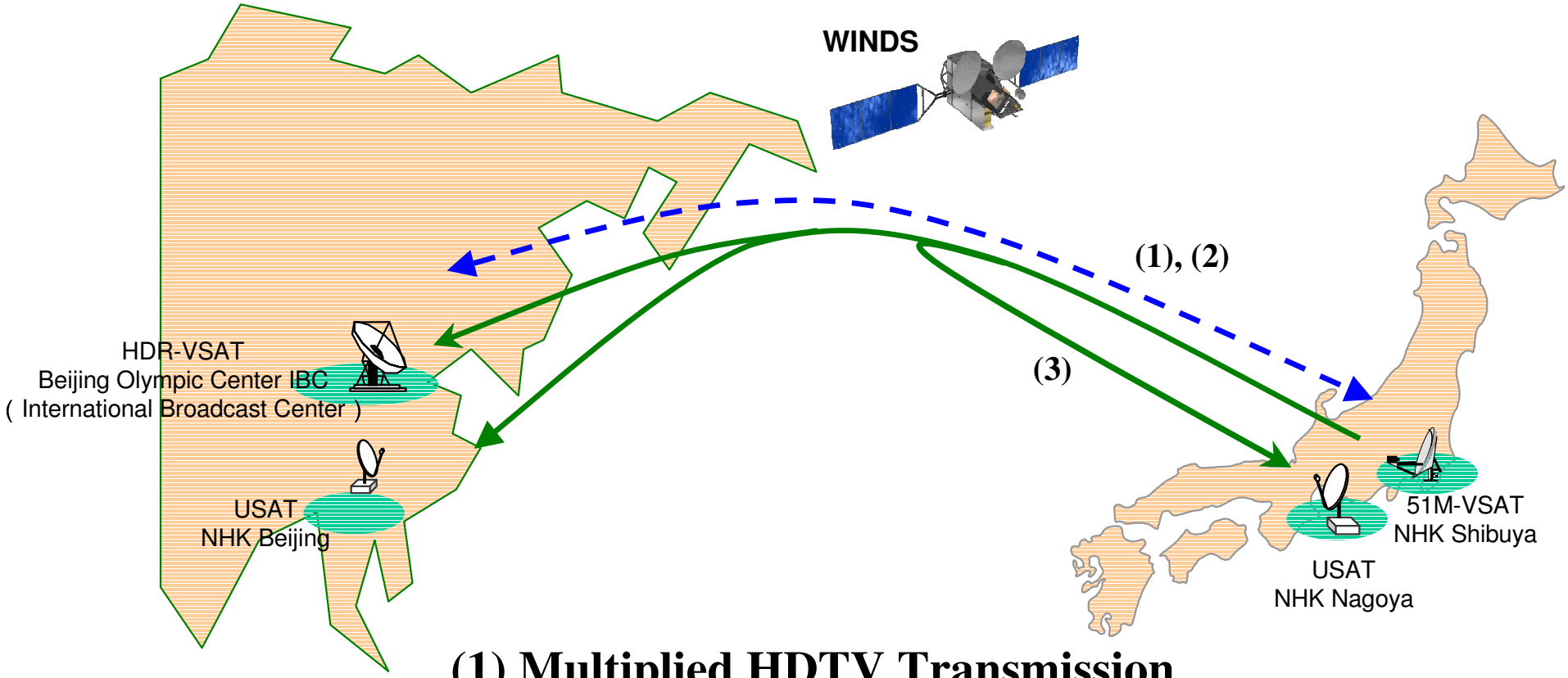


Successful Satellite Data Communication at Speed of 622 Mbps by the Active Phased Array Antenna (APAA)

On May 12, 2008, JAXA and NICT successfully achieved high data rate communication at a speed of 622 Mega bit per second (622Mbps) using the KIZUNA's Ka-band Active Phased Array Antenna (APAA) between Large Aperture Terminal (5 m diameter antenna) in the NICT Kashima Space Research Center and a super high data rate earth station (a 2.4 m diameter antenna) set on a car in Kushiro, Hokkaido. The speed was achieved during the initial functional verification operations of the KIZUNA jointly carried out by JAXA and NICT. It is the fastest speed in the world using active phased array antenna.



HDTV Transmission Experiments in Beijing Olympics



(1) Multiplied HDTV Transmission

(2) Remote Editing of HDTV Program

(3) Multicast of HDTV video signals

HDTV Transmission Experiments in Beijing Olympics

51M-VSAT
NHK Shibuya

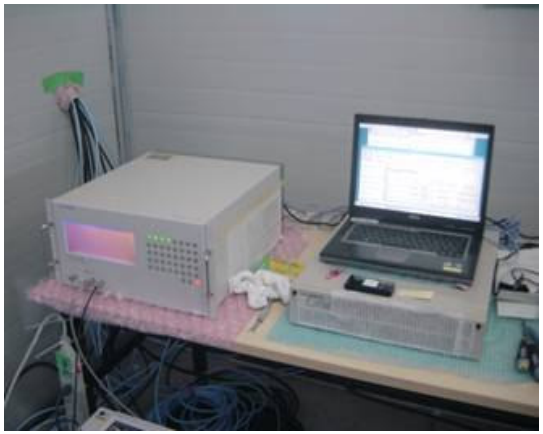
Remote Editing of Video Program

H.264 H.264 MPEG-2

3 HDTV Channel s via the
WINDS Transmission

NHK Shibuya Broadcast Center

HDR-VSAT
Beijing Olympic Center



IDU of HDR-VSAT

Operator in Beijing

IBC (International Broadcast Center) in Beijing

Emergency Transmission Experiments

(participating in the Disaster Drill in Tokushima Pref.)

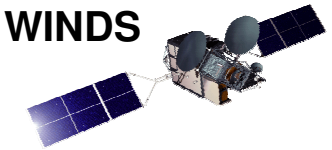
HQ in Local Government

Meeting Room of Disaster Prevention Center

Video Conference

Image of disaster area

WINDS

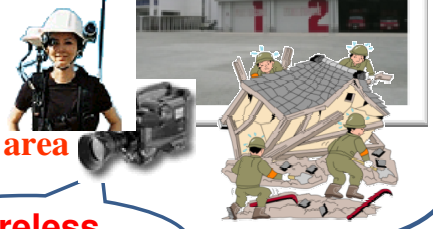


(1) Video Transmission

Disaster Hitted Area

Ground of Disaster Prevention Center

Video of disaster area

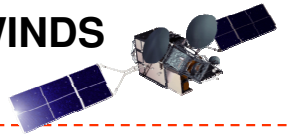


Wireless LAN

ALOS

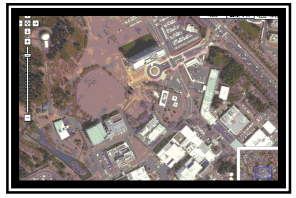
Emergency Observation

WINDS



(3) Sharing of the information relating to the disaster

Video Conference



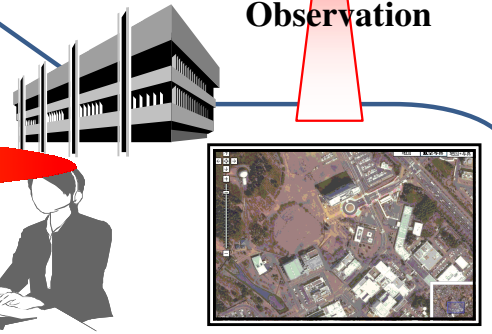
ALOS Satellite Image

Conf. Room of Disaster Prevention Center

HQ in Municipal Office

WINDS

(2) Distribution of Satellite Image data distribution



Satellite Image Data

JAXA Earth Observation Center
(Hatoyama in Saitama Pref.)

Emergency Transmission Experiments

(participating in the Disaster Drill in Tokushima Pref.)

Shooting the disaster area by HDTV handy camera

Earth Observation Satellite image

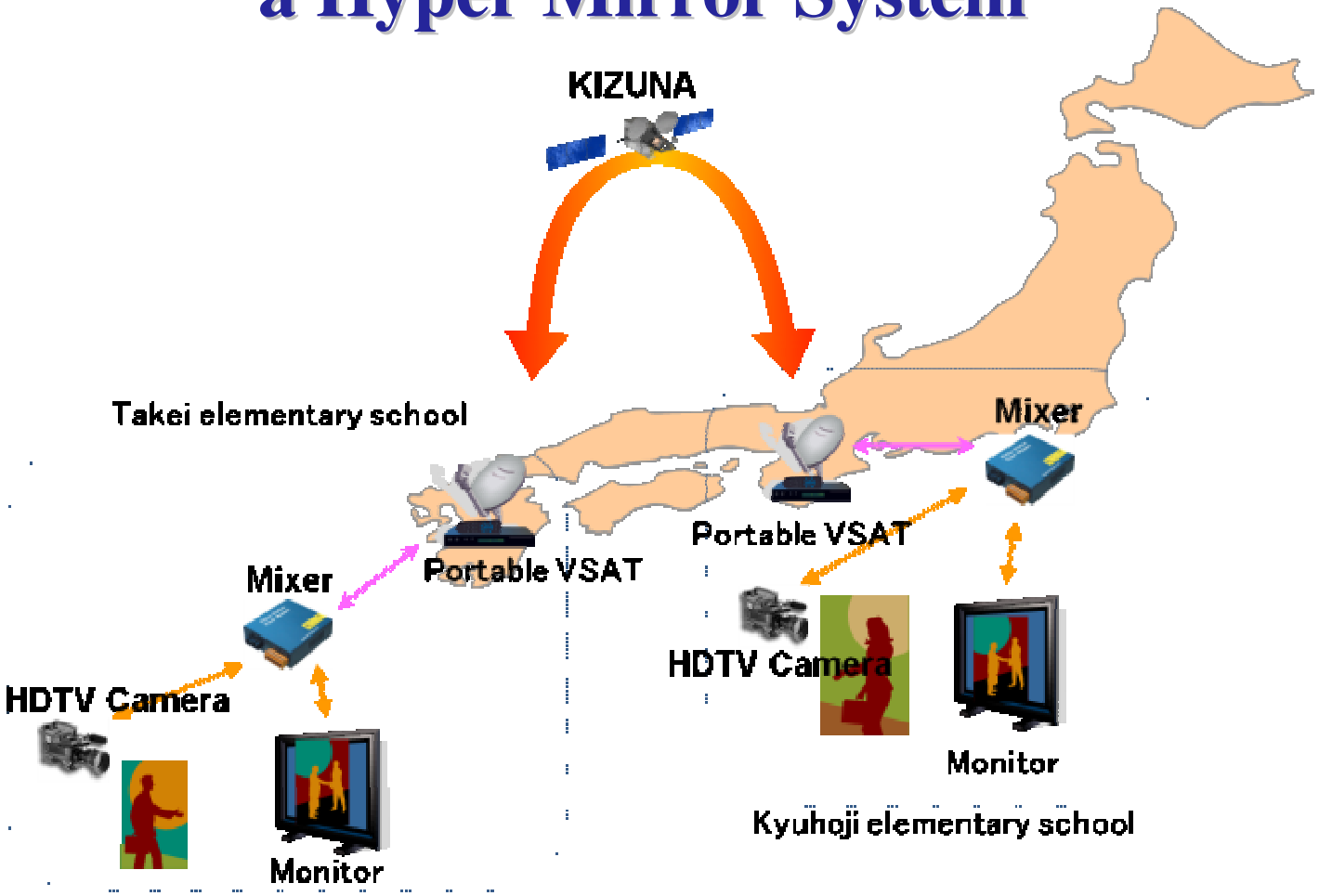
Sharing the information relating to the disaster

HDTV video image of the disaster area

Demonstration of WINDS portable terminal

Characters on the board are visible clearly on the HDTV display

Remote Education Experiment using a Hyper Mirror System



(1)The children of both sides between two elementary schools took a class with a hyper mirror system*.

(2)Transmission HDTV images of the class between both schools.

(3)To confirm that the KIZUNA communication network system is effective for the large-capacity, real-time two-way communication which is necessary for E-Learning in digital divide area.

***Hyper mirror system**

A system to electrically create a new environment (like a world in a mirror) for conversation. Unlike conventional conversation, the system enables all participants to feel that they are talking at the same place through synthetic images.

Scenes of Experiments on DVD

1. **HDTV Transmission Experiment in Beijing Olympics**

2. **Emergency Transmission Experiments**
   (participating in the Disaster Drill in Tokushima Pref.)

3. **Remote Education Experiment using a Hyper Mirror System**


00:59:50:00

Contents

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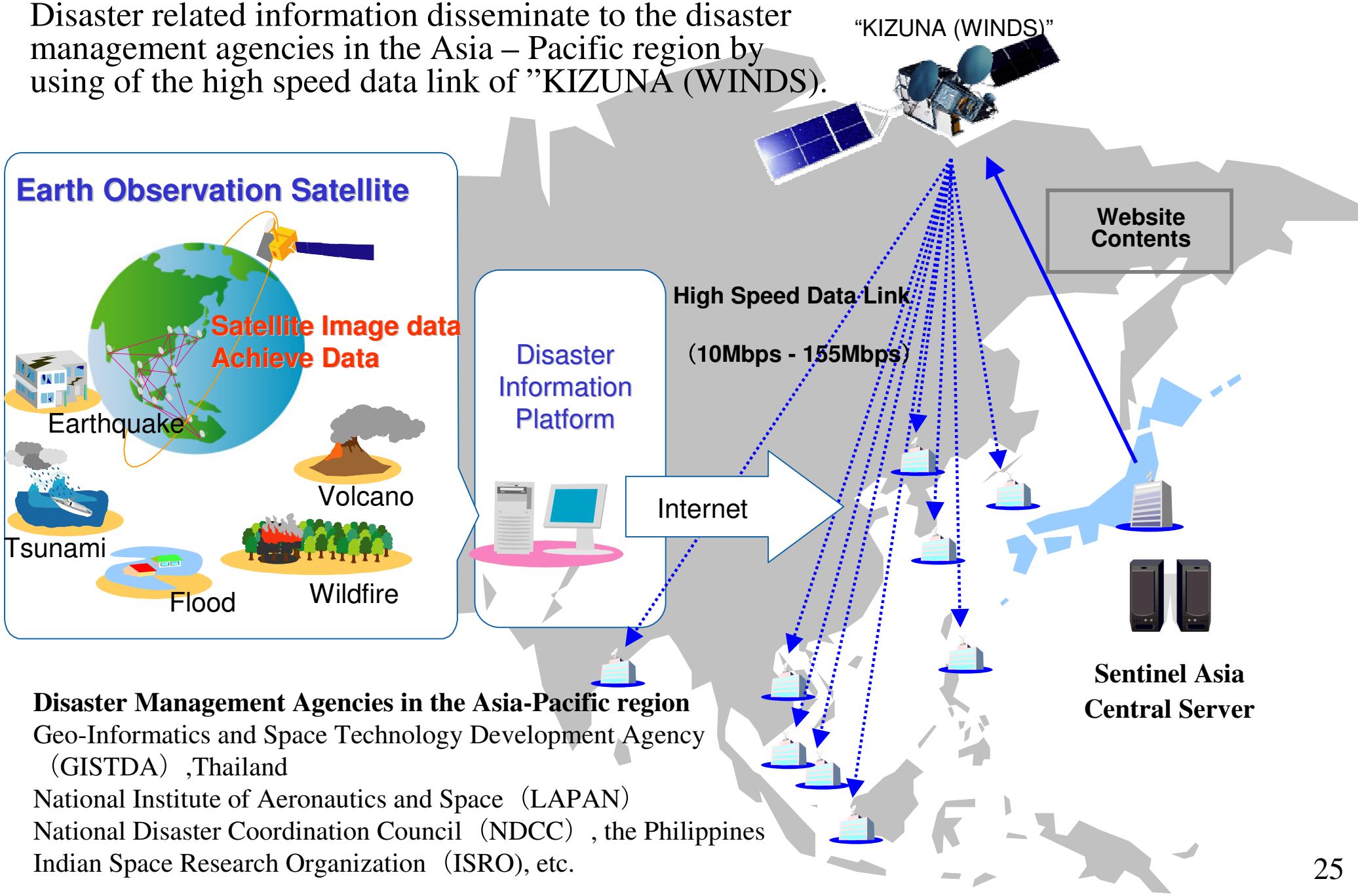
Utilization of KIZUNA for Sentinel Asia System

Disaster related information disseminate to the disaster management agencies in the Asia – Pacific region by using of the high speed data link of ”KIZUNA (WINDS).



Disaster Management Agencies in the Asia-Pacific region

Geo-Informatics and Space Technology Development Agency （GISTDA）,Thailand

National Institute of Aeronautics and Space（LAPAN）

National Disaster Coordination Council（NDCC）, the Philippines

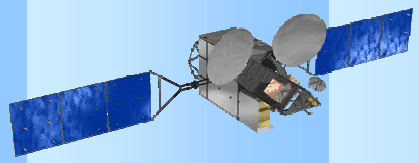
Indian Space Research Organization（ISRO), etc.

Milestones for KIZUNA Experiments

Year	2007	2008	2009	2010	2011

KIZUNA

Launch
23rd Feb.



C/O
Mar.-Jun.

Basic Experiment (~ 2010)

MIC invited the KIZUNA Application Experiments.

RFP

Application Experiment

Sentinel Asia

Step 1

Step 2
(KIZUNA Application)

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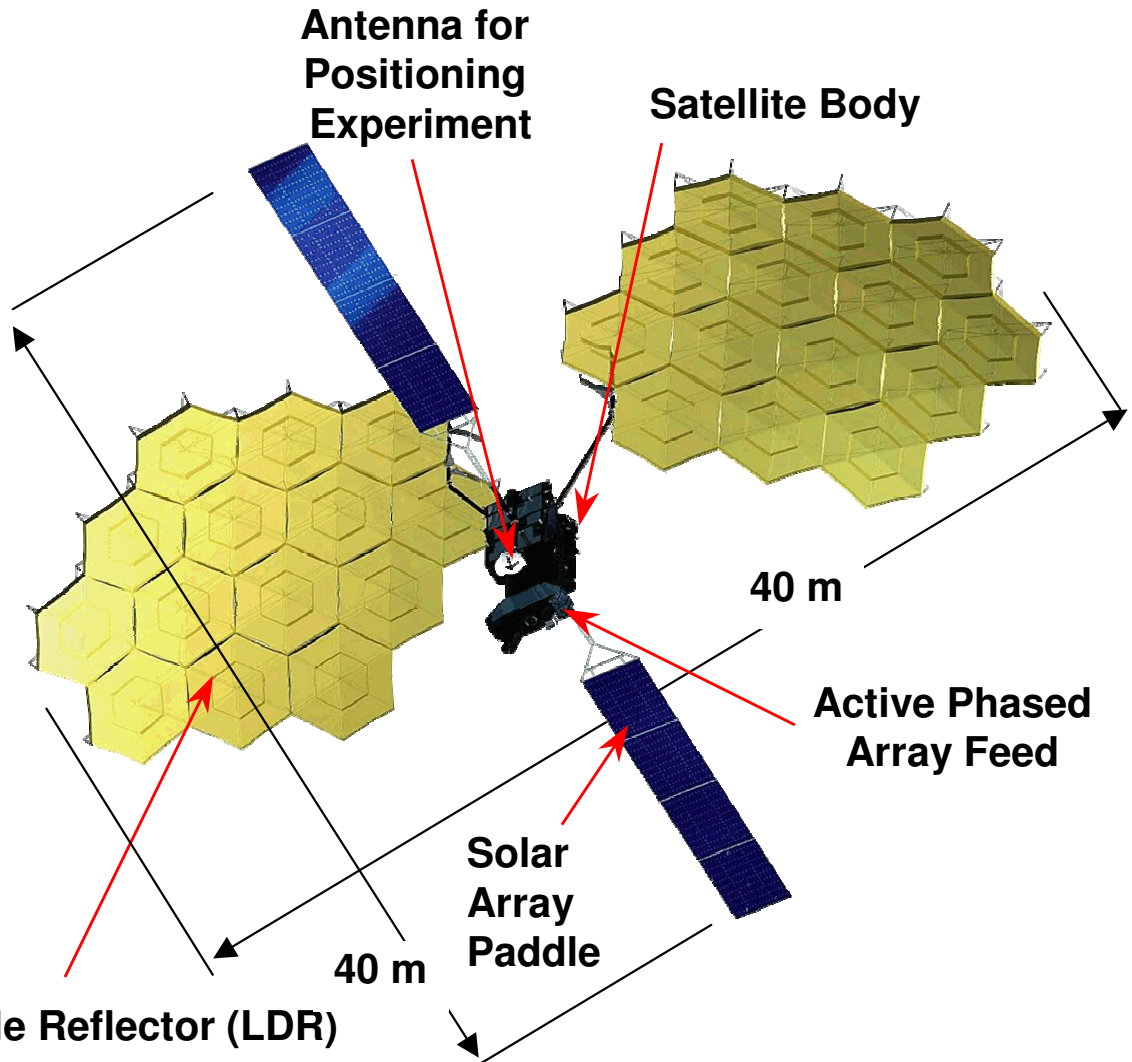
Outline of KIKU-8 (ETS-VIII)

Main Characteristics

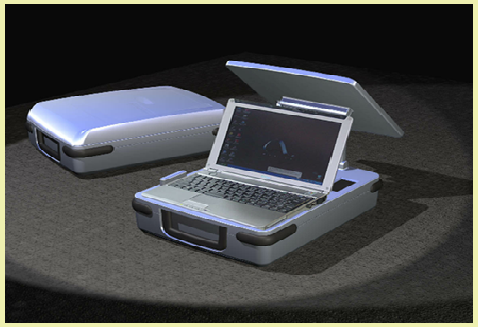
Item	Characteristics
Launch Date	December 18th, 2006
Orbit	Geostationary Orbit (GEO) Longitude 146ºE
Mass	5.8 ton (at launch) 3 ton (initially on GEO) 1.2 ton (payload mass)
Generated Electric Power	7,500 W (at summer solstice after 3 years)
Attitude Control	3-axis-stabilized

Missions

- 3-ton class geostationary satellite bus
- Large-scale deployable reflector (LDR)
- Mobile satellite communications and multimedia broadcasting system
- Satellite positioning



Demonstration for Disaster Management using KIKU-8



Portable Terminal (8 kg)
64 kbps – 1.5 Mbps

Handheld Terminal (300 g)
50 – 400 bps (TX)
1.6 kbps – 12.8 kbps (RX)

KIKU-8 satellite is used to demonstrate the effectiveness of the satellite communications for the disaster management support and relief requirements.

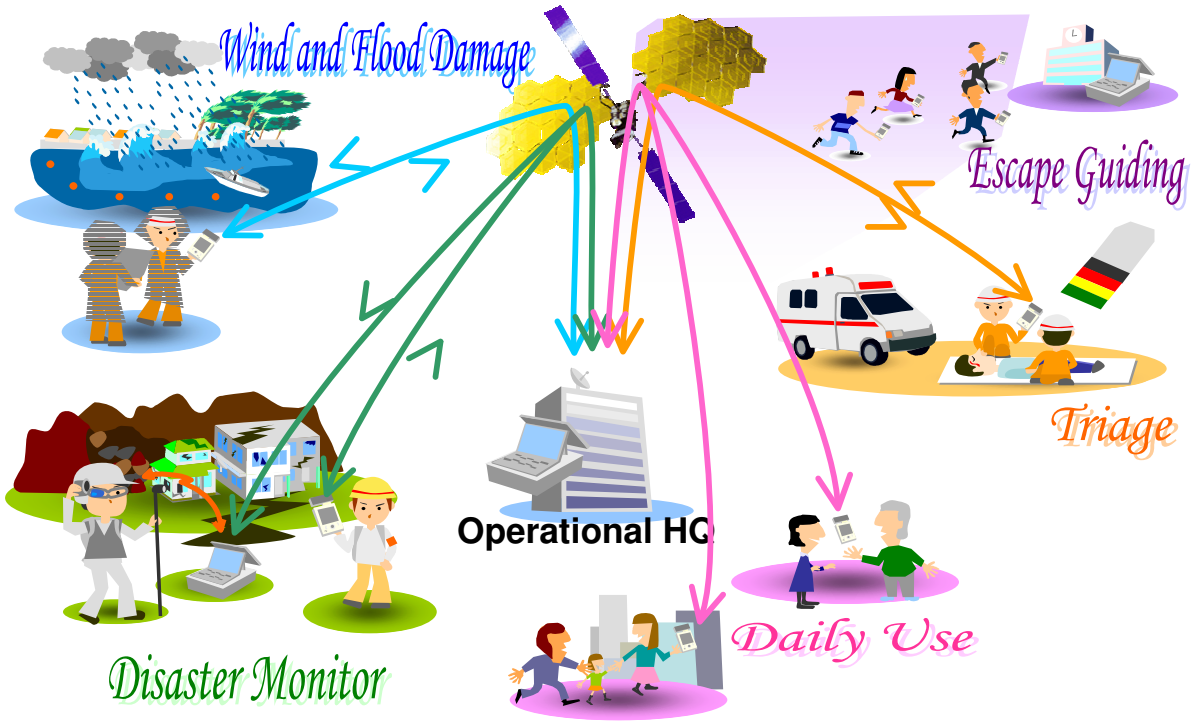


Image of Demonstration for Disaster Management

Summary of the Demonstration using KIKU-8

Demonstration

JAXA joined in disaster prevention trainings held by local governments and demonstrated emergency communications experiments via KIKU-8 with portable and handheld terminals.

(1) Victims management using RFID

(2) Visual confirmation of evacuation

(3) Visual confirmation in disaster site (Wearable camera)

(4) First-aid support in disaster site (Triage)

(5) Situation report from disaster site

Result

JAXA confirmed that;

- required stable satellite communications networks were established.
- mobility and correctness of disaster applications performed by KIKU-8.

JAXA also verified that;

- effectiveness of victims managemant and visual confirmation.
- effectiveness for relief support and evacuation center remote operation.

High appraisal from the local governments

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Summary of KIZUNA

1. The KIZUNA was successfully launched,and it is confirmed through various functional checkouts and tests of the satellite that the KIZUNA system is available to provide the high speed data link within the Asia-Pacific region.
2. Some basic and application experiments using the KIZUNA satellite have been conducted so far, and those experiments have achieved the expected results.
3. JAXA/NICT are continuously going to develop the above satellite communications system, and it should be considered that those small KIZUNA user terminals be used in the Sentinel Asia Step 2 system.

Summary of KIKU-8

1. The most remarkable feature of KIKU-8 is two large-scale deployable reflectors. These reflectors enable to communicate with very small user terminals.
2. JAXA joined in disaster prevention trainings held by local governments and demonstrated emergency communications experiments via KIKU-8 with the portable and handheld terminals.
3. As the result of this demonstration experiment,

   JAXA confirmed that;

   mobility and correctness of disaster applications performed by KIKU-8. JAXA also verified that;

   effectiveness of victims management and visual confirmation, and

   effectiveness for relief support and evacuation center remote operation.
4. From now on, JAXA will promote to utilize “disaster prevention application” to be practicable and apply among local governments.

Thank you for your attention
Please visit at JAXA website

http://www.jaxa.jp/projects/sat/winds/index_e.html

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