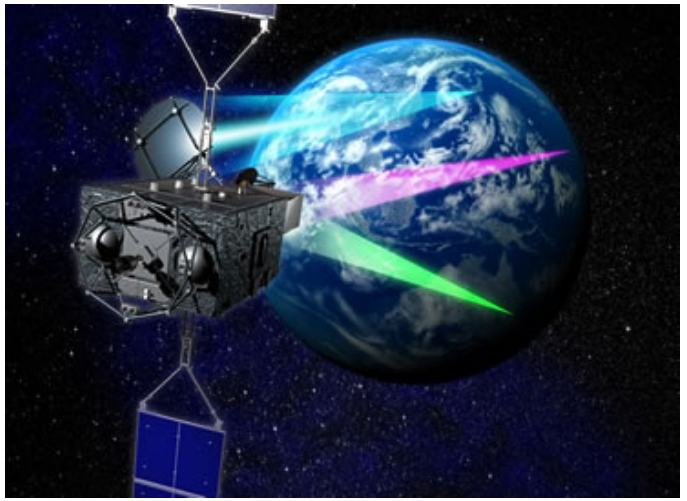
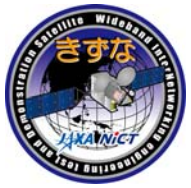
“KIZUNA” (WINDS)
(Wideband InterNetworking engineering test and Demonstration Satellite)
(Launched by H-IIA F14)



WINDS Project Team, Office of Space Applications
Japan Aerospace Exploration Agency

Objectives of KIZUNA (WINDS)



Development and verification of ultra high data rate satellite communications technology

① Necessary technology for improving communication data rate to ultra high data rate

- Mainly for houses with a 0.45-meter class antenna for 6 Mbps (transmission) and 155 Mbps (reception)
- Principally for businesses with a 5-meter class antenna for 1.2 Gbps

② Necessary technology for covering broader areas

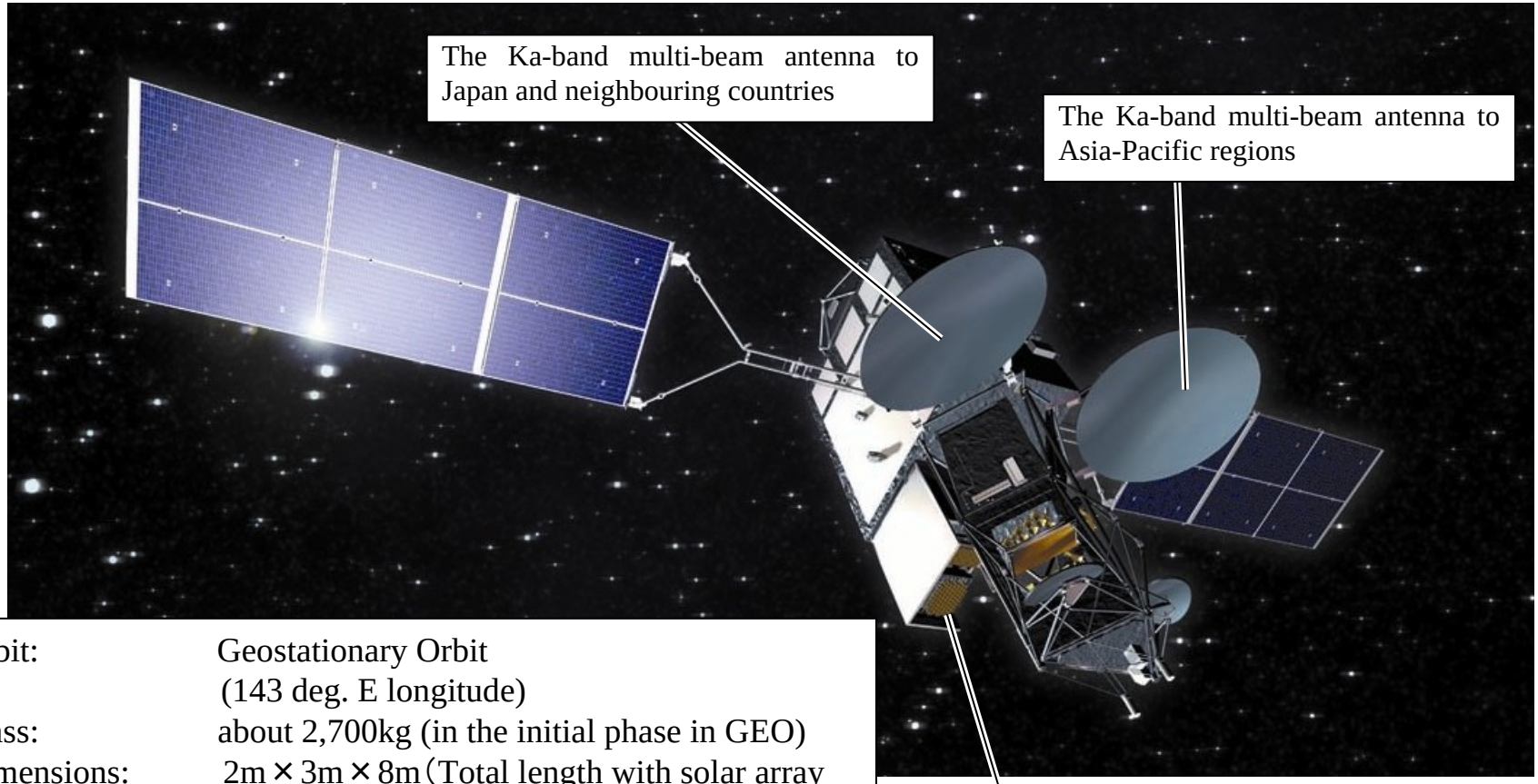
- Development and verification of technology that enables ultra high data rate communications covering broader areas in the Asia-Pacific region

③ Preparing a communication network system to expand usage

Functional verification of ultra high data rate satellite communication network

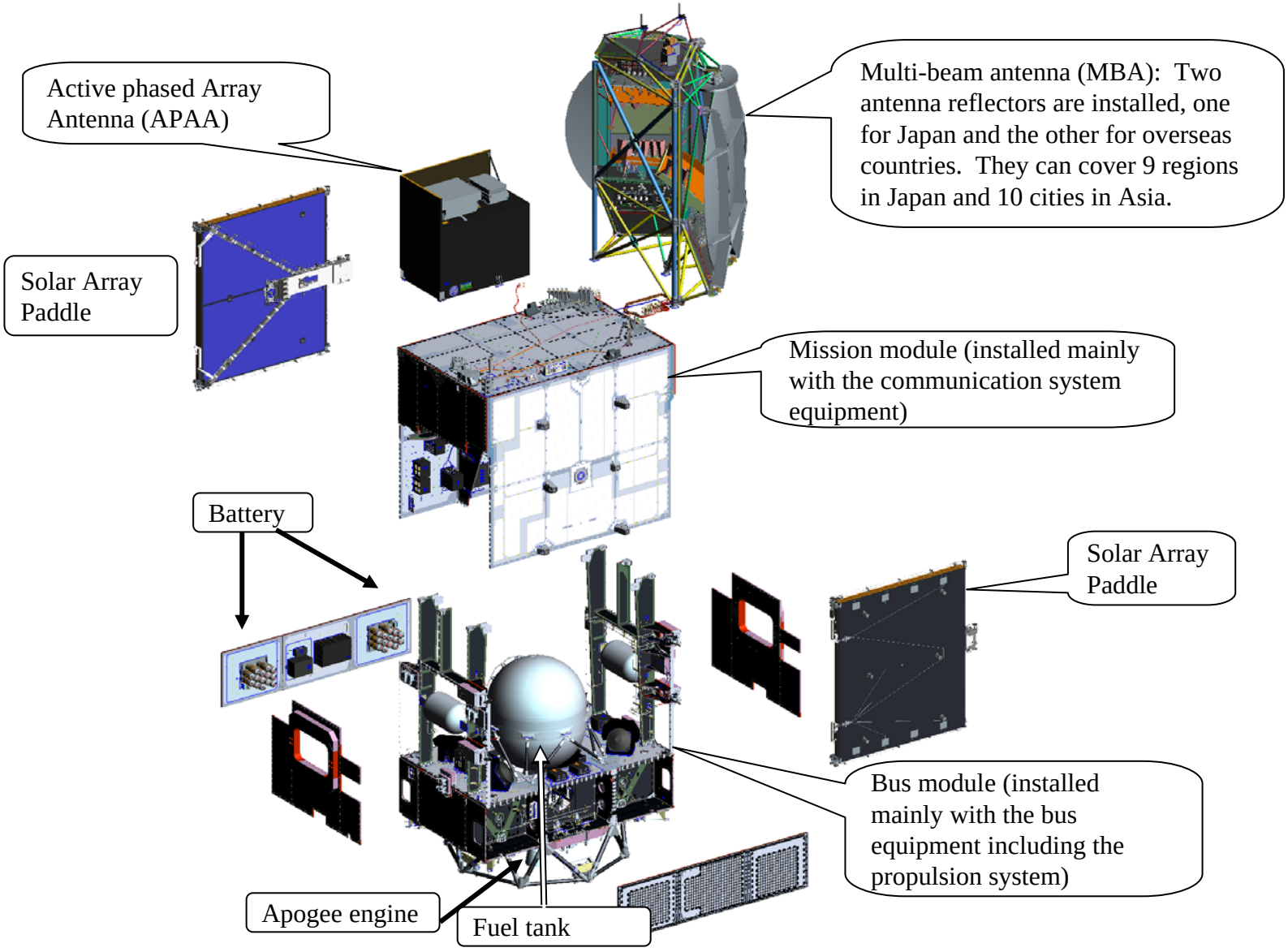
Encouraging the verification and testing of ultra high data rate communication network

KIZUNA（WINDS）Overview



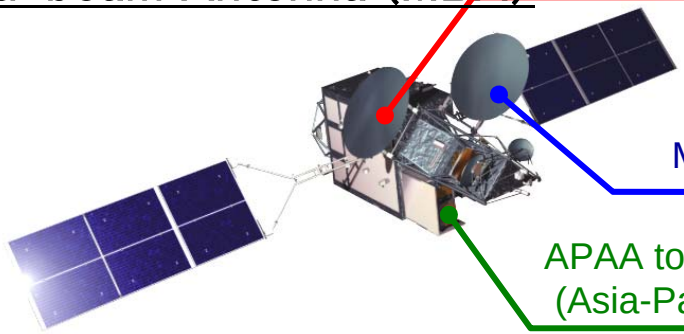
Orbit:	Geostationary Orbit (143 deg. E longitude)
Mass:	about 2,700kg (in the initial phase in GEO)
Dimensions:	2m × 3m × 8m（Total length with solar array deployed: 21.5 m)
Designed life:	five years after liftoff (target)
Power generation:	5,200W or more
Launch:	by H-IIA Launch Vehicle in Feb. 2008

KIZUNA（WINDS）Overview



KIZUNA (WINDS) Overview

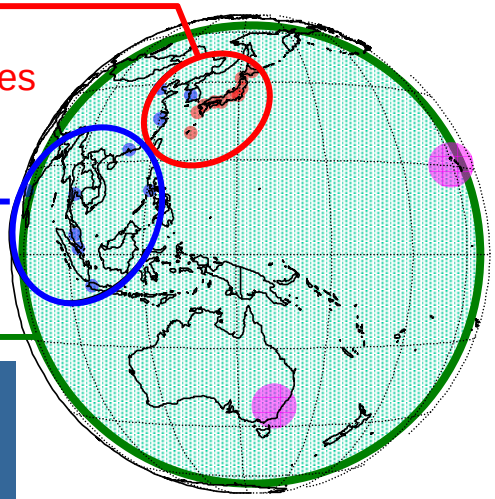
Multi-beam Antenna (MBA)

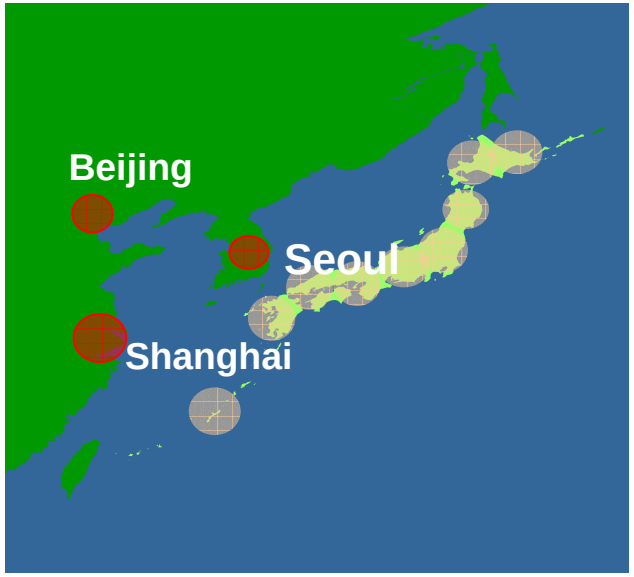


MBA to Japan and neighbouring countries

MBA to Asia-Pacific countries

APAA to broader regions (Asia-Pacific region)





Ka-band high-gain antenna covers major cities in Japan and Asia-Pacific countries.

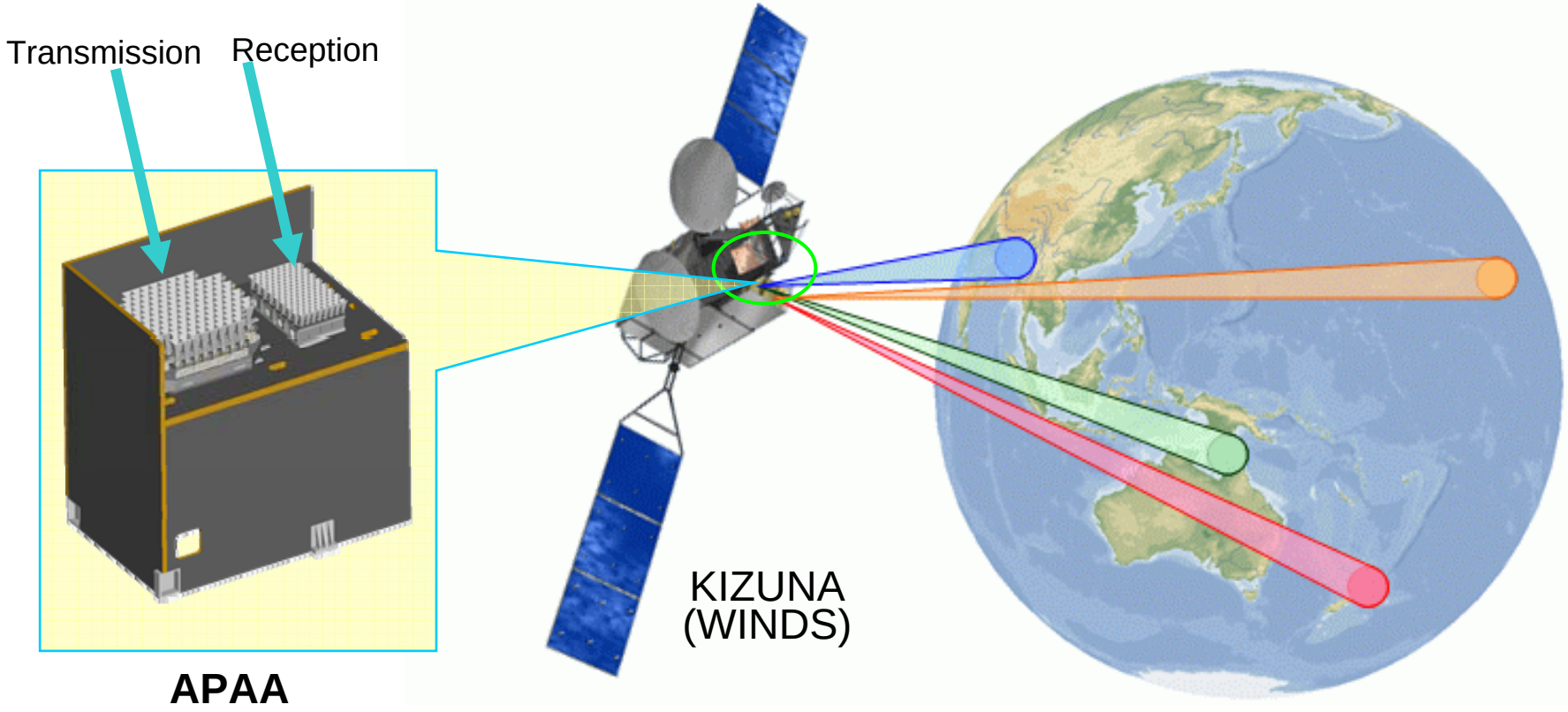
MBA for Japan and neighbouring countries: covering nine regions in Japan, Seoul, Beijing, and Shanghai

MBA for Asia-Pacific countries: covering Hong Kong, Manila, Bangkok, Kuala Lumpur, Singapore, Jakarta, Bangalore

KIZUNA（WINDS）Overview

Active Phased Array Antenna (APAA)

With the APAA, timely and speedy communication is possible to an area requiring quick correspondence.
Communication areas of the APAA can be switched every two milliseconds in the broad Asia-Pacific region.



Characteristics of KIZUNA（WINDS）

1. High data rate communication even with a small aperture terminal

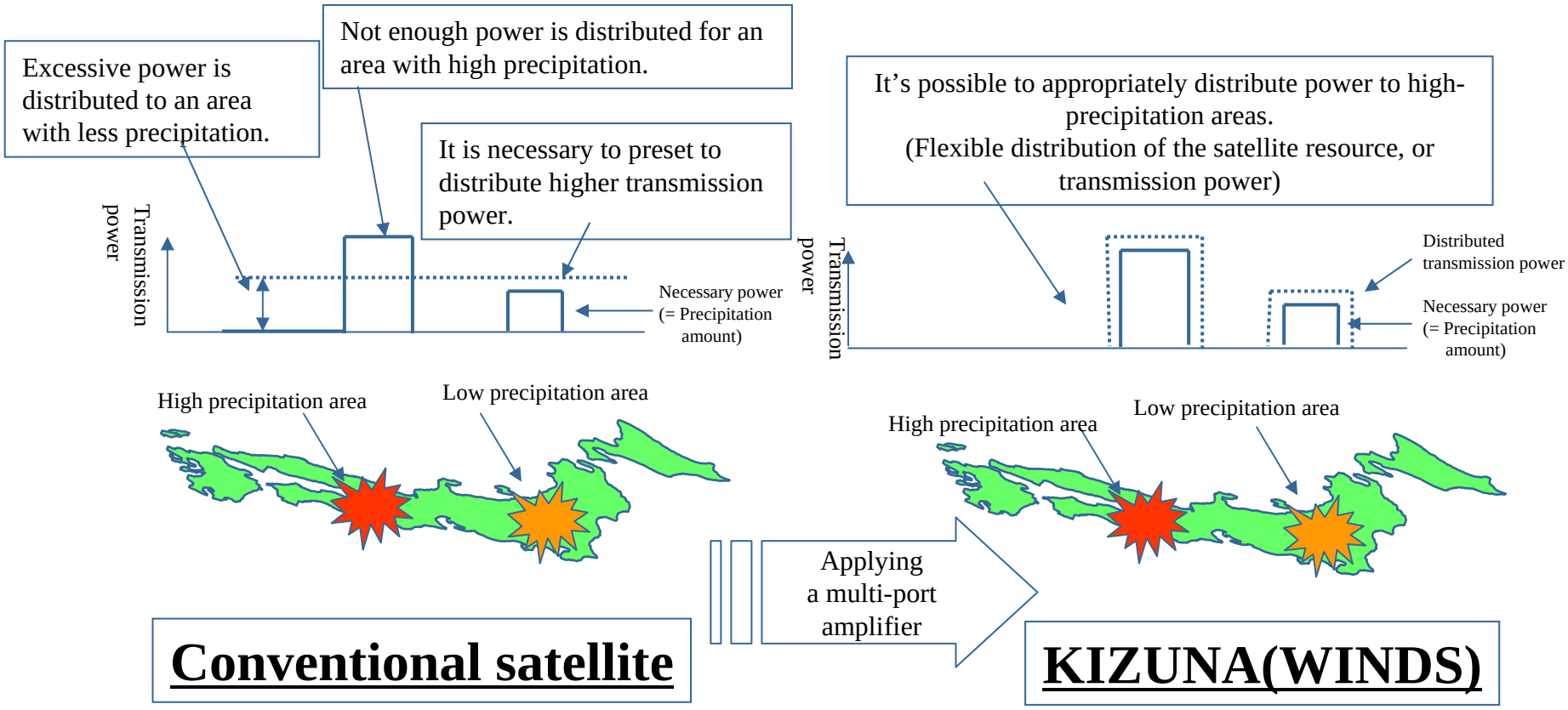
High data rate communication with small aperture terminals is possible by the highly effective isotropic radiated power (EIRP) of the Ka-band multi-beam antenna and high power transmitter.

KIZUNA(WINDS)		Conventional satellite
Ground antenna diameter 5m class	Transmission/Reception 1.2Gbps	Difficult to achieve
1.2m	Transmission/Reception 155Mbps	Difficult to achieve
0.45m	Reception 155Mbps	2.4m
0.45m	Transmission 6Mbps	0.75m

Characteristics of KIZUNA (WINDS)

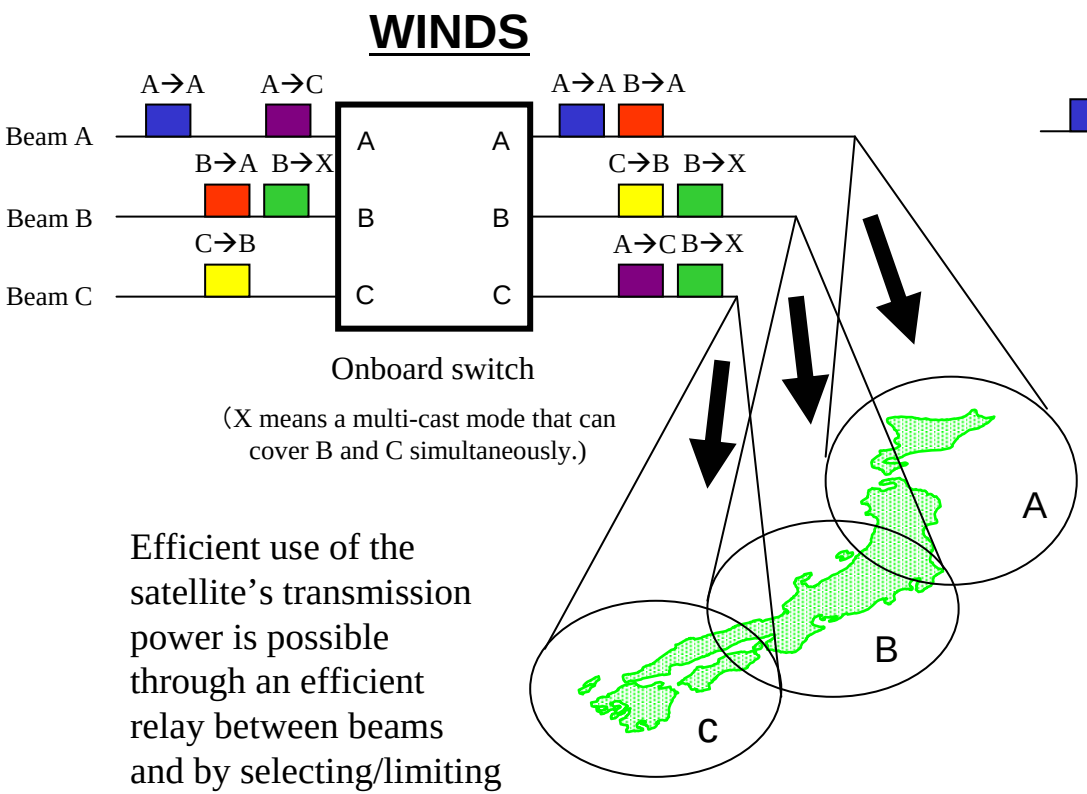
2. Reliable communications can be maintained even on rainy conditions

Although the Ka-band (20 to 30 GHz) frequency is strong at high data rate transmission, its weakness is attenuation due to rain. With the high output multi-port amplifier and high-gain multi-beam antenna, we achieved high data rate communication and controllable transmission power distribution.

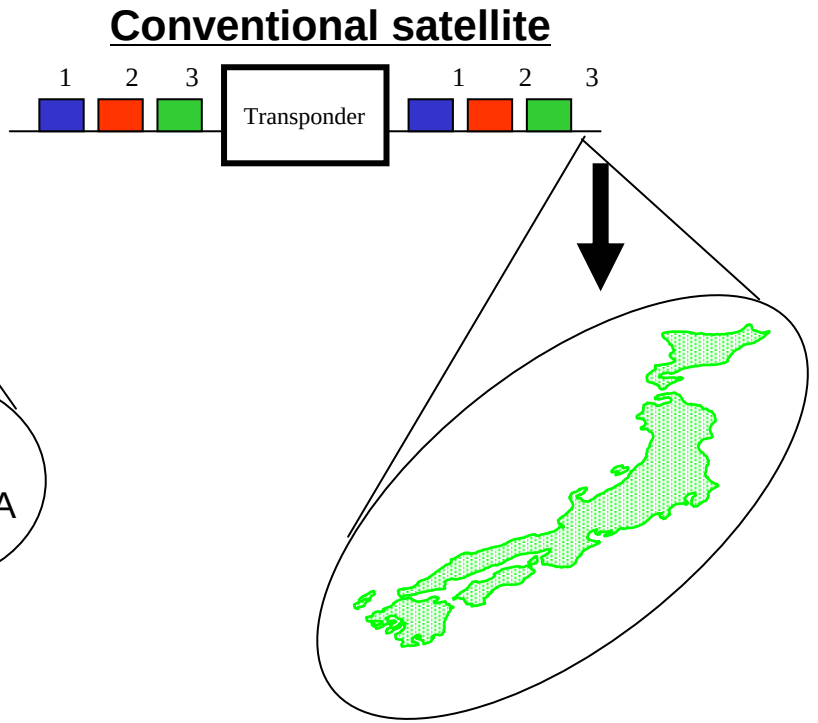


Characteristics of KIZUNA (WINDS)

3. Selection and concentration (efficient use of satellite's transmission power by selecting a specific transmission area through the onboard switch).



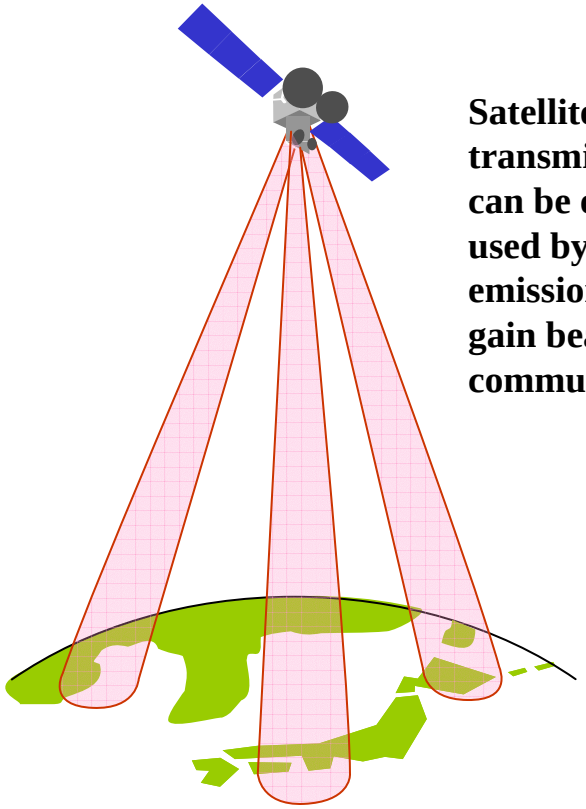
Efficient use of the satellite's transmission power is possible through an efficient relay between beams and by selecting/limiting a communication area.



Characteristics of KIZUNA (WINDS)

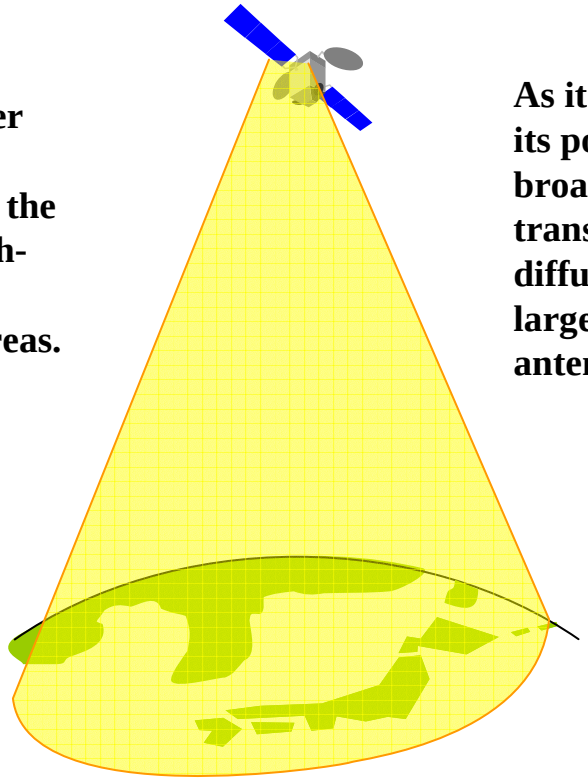
4. Always on, always connected (communication lines can be established whenever and wherever necessary).

WINDS



Satellite's transmission power can be efficiently used by allocating the emission of its high-gain beam to communication areas.

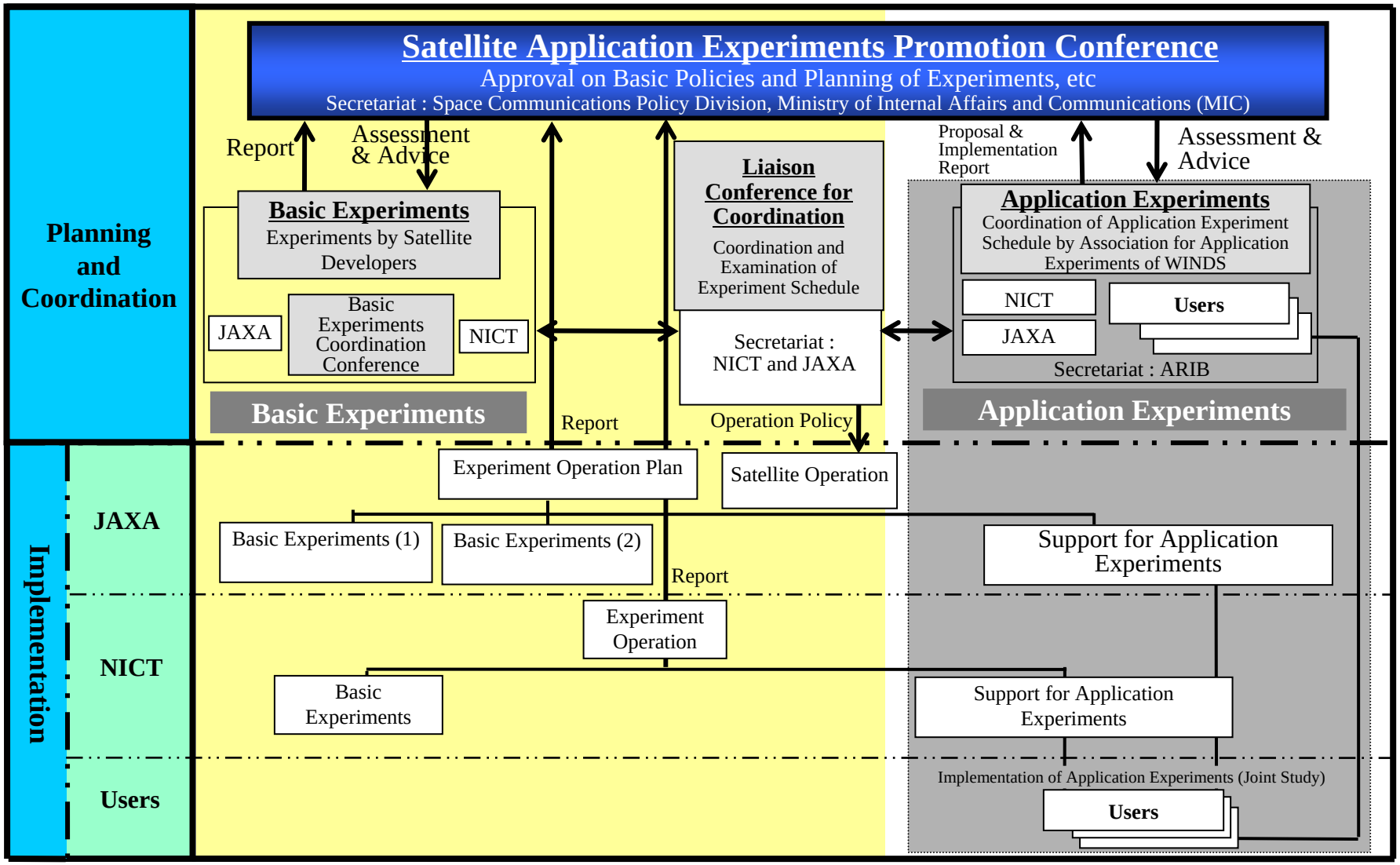
Conventional satellite



As it constantly emits its power to a broader area, its transmission power is diffused, thus a larger ground antenna is required.

Application of KIZUNA（WINDS）

Implementation Structure



Application of KIZUNA（WINDS）

Experiment Plan

1. Basic Experiments

Two types of basic experiments are planned. Basic Experiment (1) is functional and performance verification of on-board equipment through the cooperation of JAXA and the National Institute of Information and Communications Technology (NICT.) Basic Experiment (2) is to verify the validity of the WINDS (KIZUNA) communication network system. The following are the themes of the basic experiments that will be performed by JAXA.

(1) Basic Experiment (1)

I. Checkout of the performance of WINDS communications network system

Confirmatory experiment to keep integrated communication characteristics of WINDS and to provide users with a stable experimental environment

II. Evaluation of WINDS on-board equipment performance

Experiment to evaluate capability and performance of equipment such as MBA and APAA and to reflect these in the WINDS operation

(2) Basic Experiment (2)

I. Multi-cast Experiment

II. Access Patch Experiment (for disaster management and image transmission)

III. Experiment to help solve digital divide

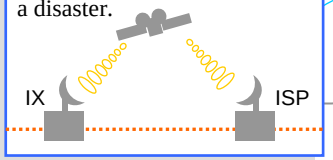
2. Application Experiments

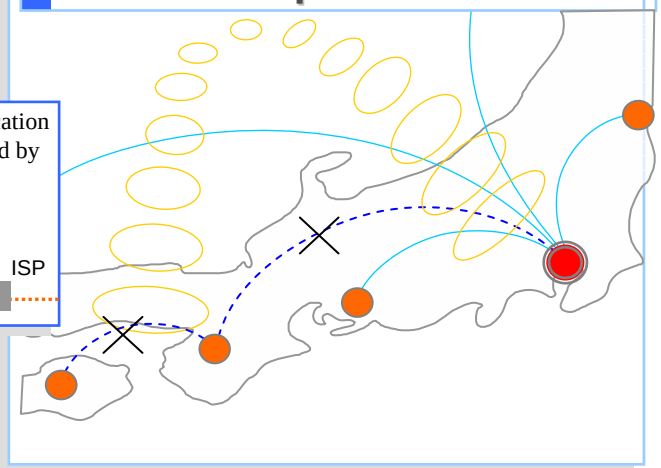
Experiments using WINDS to contribute to the advancement of satellite communications and development of satellite applications. Application experiments were selected through public offering by Ministry of Internal Affairs and Communications (MIC).

Utilization of KIZUNA (WINDS)

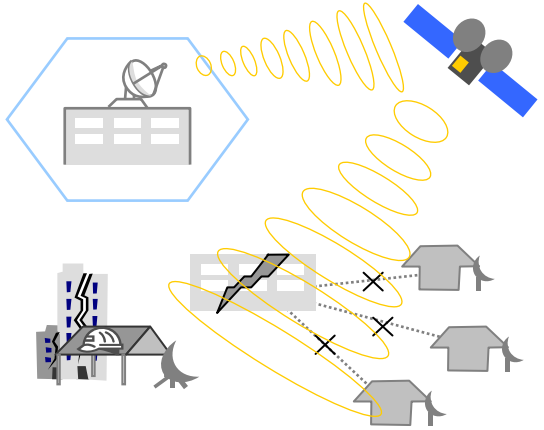
Backbone patch

Complement a communication backbone that was severed by a disaster.



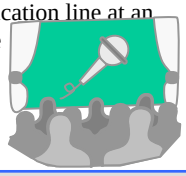


Mobile model (Access patch)



Provide images and information on a disaster-stricken area from a mobile station to residents of the area

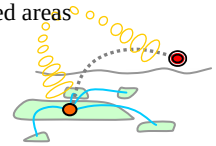
Set up a temporary communication line at an event site

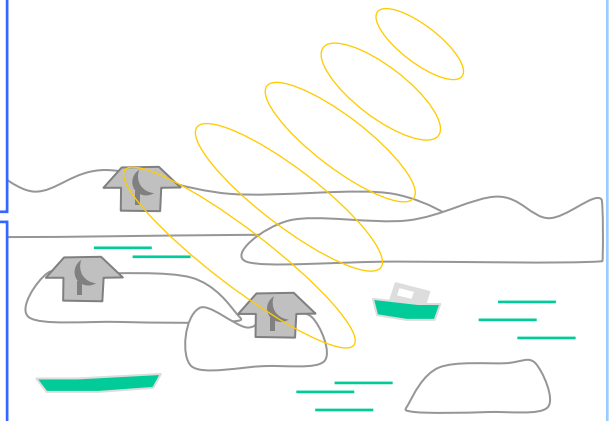


Remote islands and Asian model

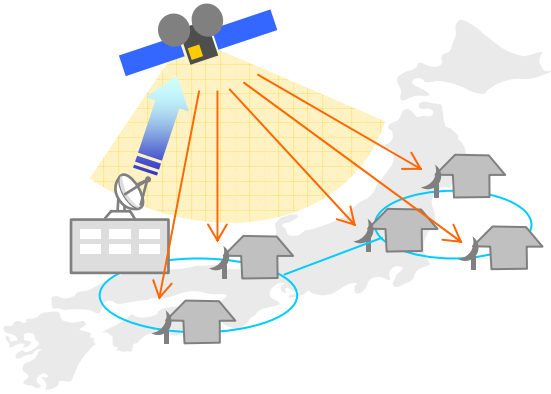
High data rate Internet through a simple facility

Ensure a broadband communication line in under served areas



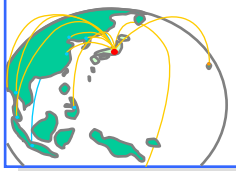


Multicast

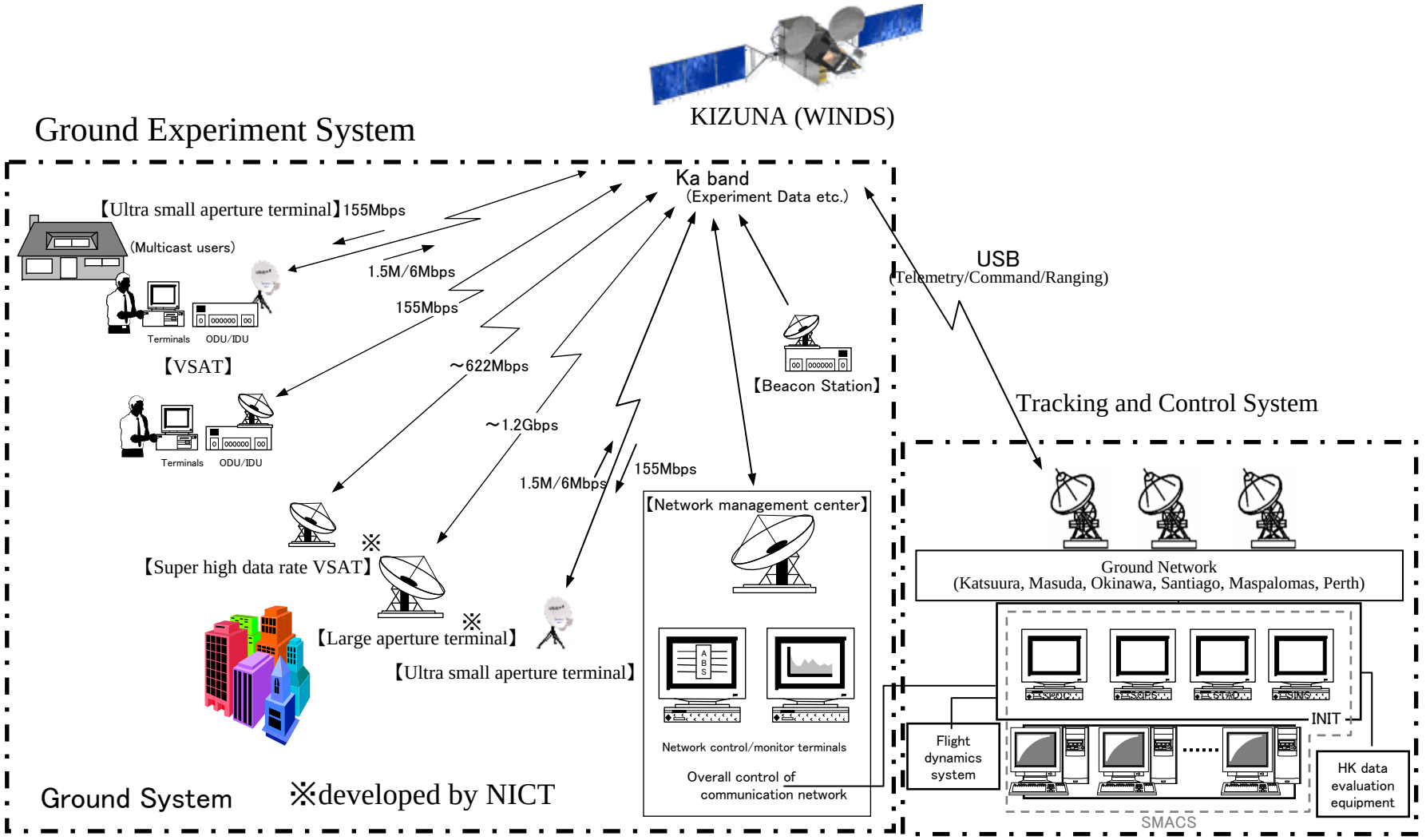


Remote learning connecting various locations

Distribution of image contents

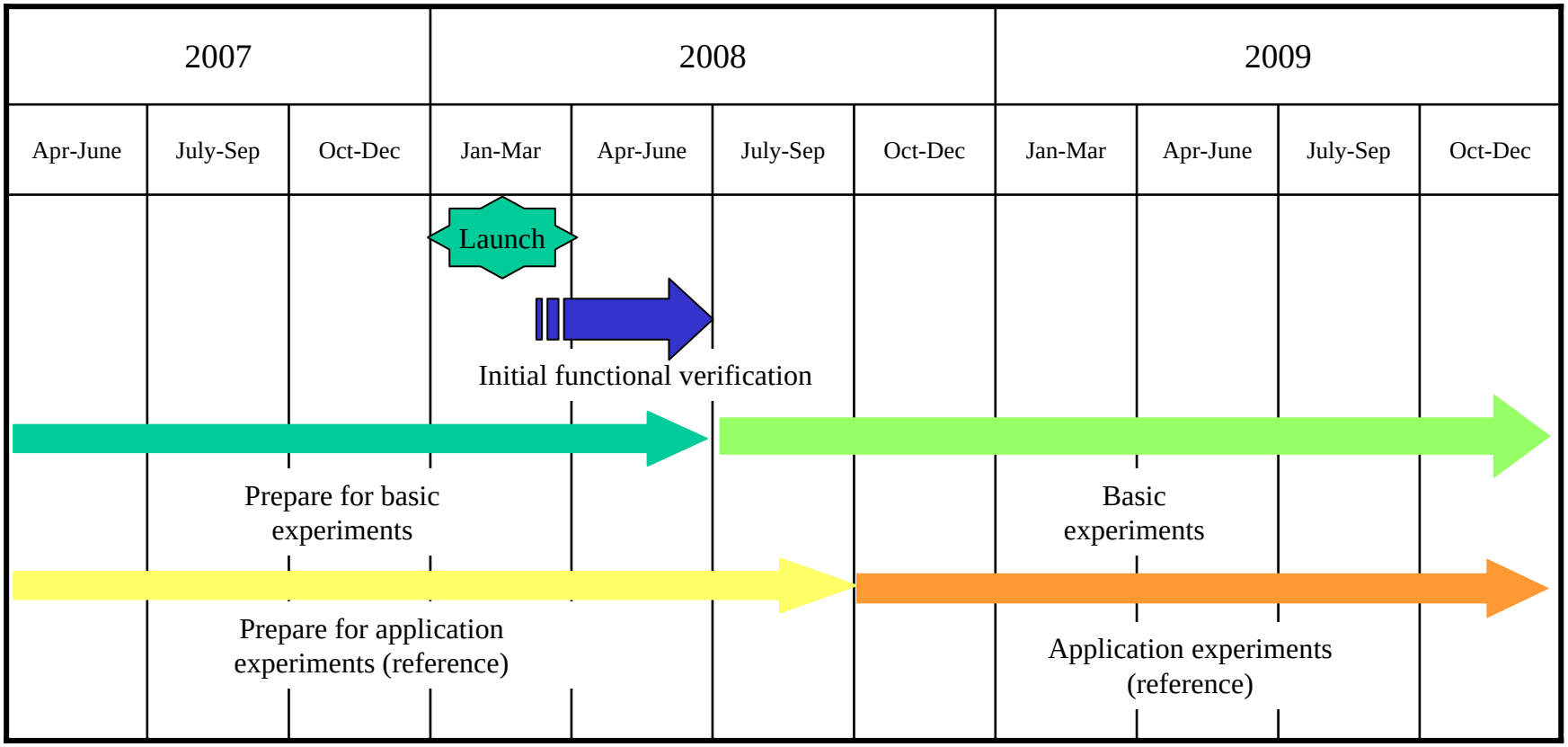


Overall System Structure



Post-launch Operation Schedule

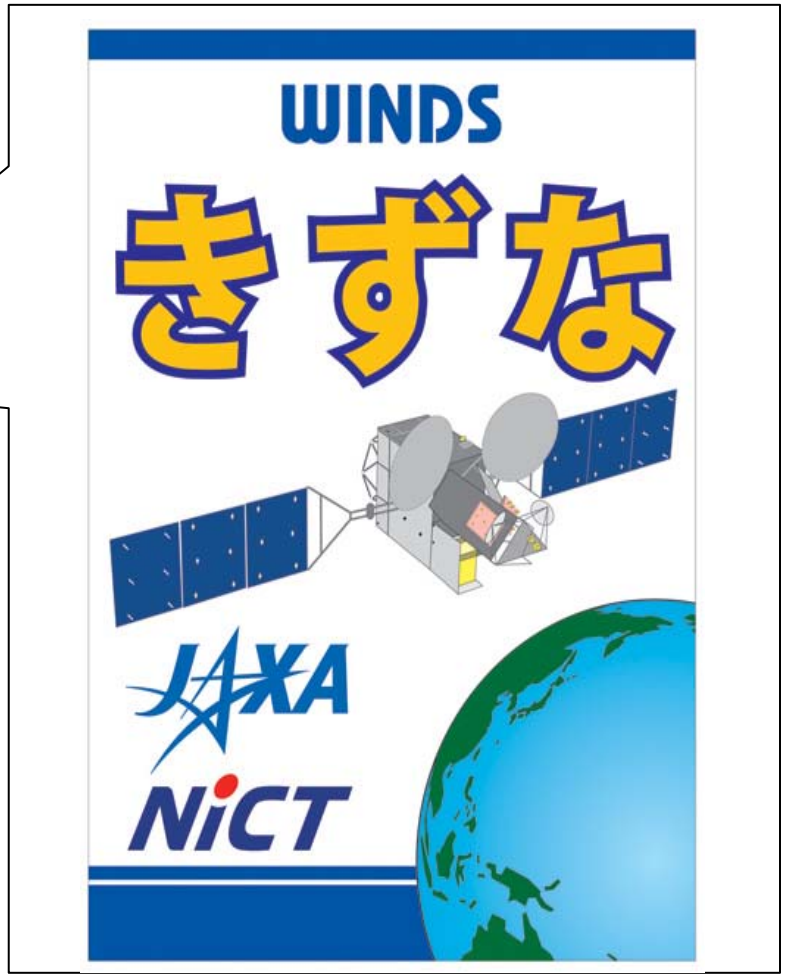
- About a week after launch: deploy the multi-beam antenna, establish three-axis stabilization
- By the end of June 2008: Complete the initial functional in-orbit test
- From July 2008: Basic experiment



Note: we plan to conduct the initial functional in-orbit test for about four months.

KIZUNA (WINDS)/H-IIA F14 Decal

(Front)



The KIZUNA was developed in collaboration by JAXA and the National Institute of Information and Communications Technology (NICT). The decal pasted on the front of the launch vehicle shows the two organizations.

Super high-speed Internet satellite “KIZUNA” (WINDS) Mission Logo

New Internet Society Using Satellite

- A society where necessary information is available to anyone, anytime, anywhere -

The nickname “KIZUNA” (meaning “ties between people”) was selected from many names that were submitted by the public to show people’s strong expectations for the satellite to play a key role in bringing people together.