



*Research and development in
Space Internet Technology and
Mobile Satellite Communication*

Naokazu Hamamoto
Communications Research Laboratory

Satellite Communication Technology



- ⌘ Important infrastructure for wide coverage services
- ⌘ More user friendly by technology development
 - ☒ Services for voice, Internet, video, via satellite directory
- ⌘ Examples in the world
 - ☒ Mobile satellite communications
 - ☒ Inmarsat, Iridium, Globalstar, Garuda, Thuraya, etc.
 - ☒ Broadband/Internet satellite communications
 - ☒ Intelsat, Spaceway, Astrolink, Euroskyway, etc.

Current Program for SatCom.R & D in Japan

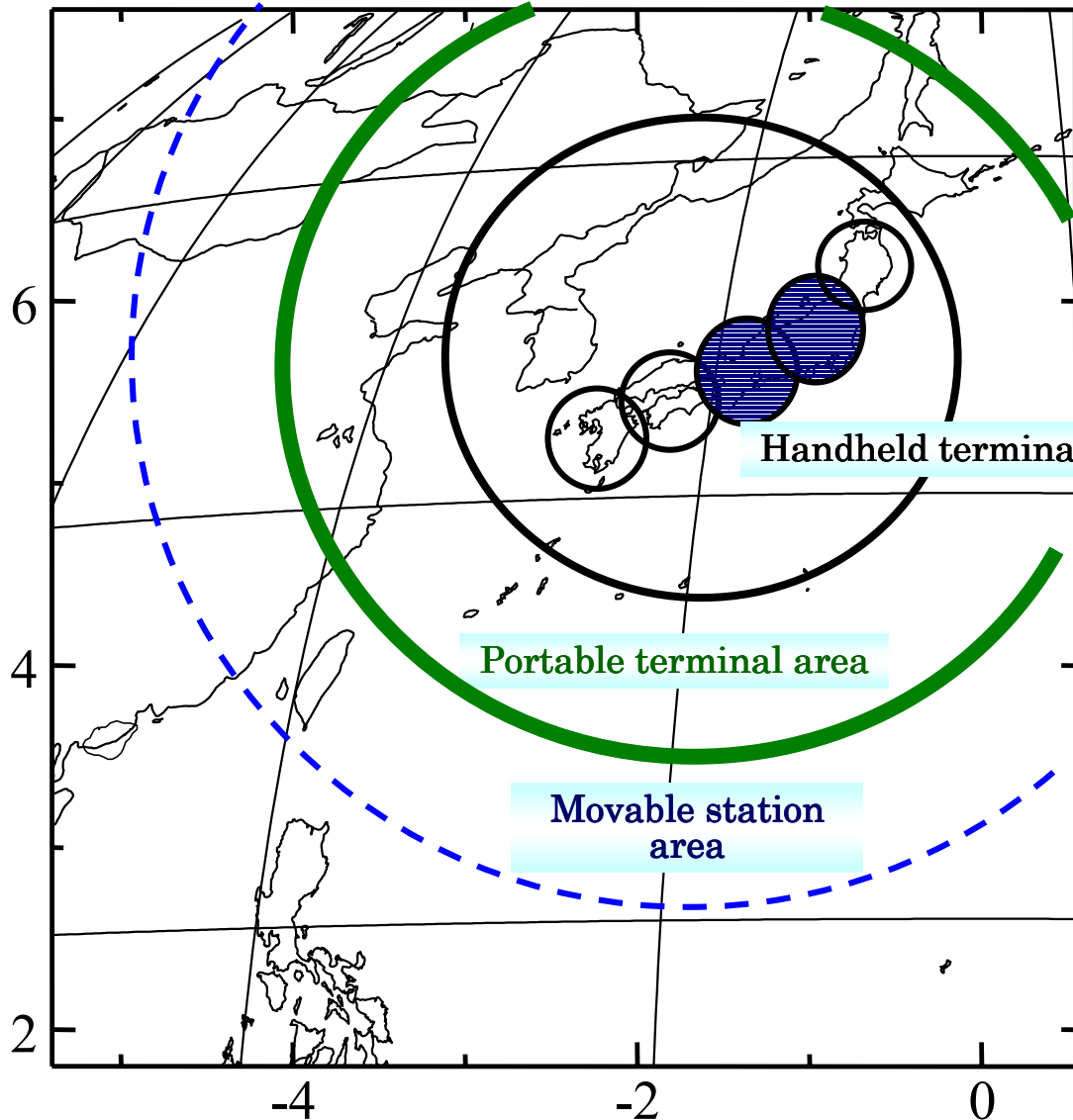
⌘ ETS-VIII: Engineering Test Satellite VIII

- ☒ R &D project in cooperation with NASDA for mobile satcom. technology
- ☒ 3 ton class geo-stationary satellite (146°E)
- ☒ To be launched in 2004 by H-IIA rocket

⌘ WINDS: Wideband Inter-Networking Engineering Test & Demonstration Satellite

- ☒ R &D project in cooperation with NASDA for broadband satcom. technology
- ☒ 2 ton class geo-stationary satellite (143°E Tentative)
- ☒ To be Launched in 2005 by H-IIA rocket

Beam Coverage of ETS-VIII



Feeder link: 20/30GHz

Service link: 2.5/2.6GHz

Handheld terminal area

Portable terminal area

Movable station
area

- Portable terminal:
Notebook size
- Movable station:
1m ϕ antenna

Experiment Plan by ETS-VIII



- ⌘ Voice comm. with handheld satellite phone
- ⌘ Mobile data transmission
 - ☒ Mobile medical care
 - ☒ Delivery of meteorological information for ships
- ⌘ Tele-education (Low speed)
- ⌘ Remote-sensing data transmission
 - ☒ Sea-surface data in-situ measurement and transmission
 - ☒ Monitoring network for volcanic ashes and flood problems
 - ☒ Forest-fire warning and damage assessment using remote-sensing data
- ⌘ etc.

WINDS: Wideband Inter-Networking Engineering Test & Demonstration Satellite

⌘ Objectives:

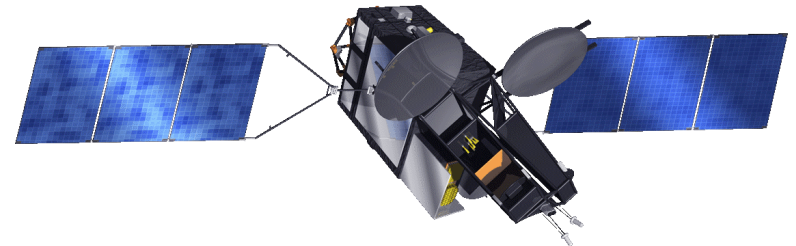
- ☒ Development of high speed broadband satcom system

⌘ Main Characteristics:

- ☒ Mission Duration: 5 years
- ☒ Weight: 2,300kg (BOL)
- ☒ Electrical Power: 7,500W (EOL)

⌘ Technology Development:

- ☒ On-board ATM Switch
- ☒ Active phased array antenna for scanning in Ka-band
- ☒ Fixed spot-beam antenna



Major Communications Specifications

Frequency 28.05±0.55GHz(up)

18.25±0.55GHz(down)

No.of Beams 4

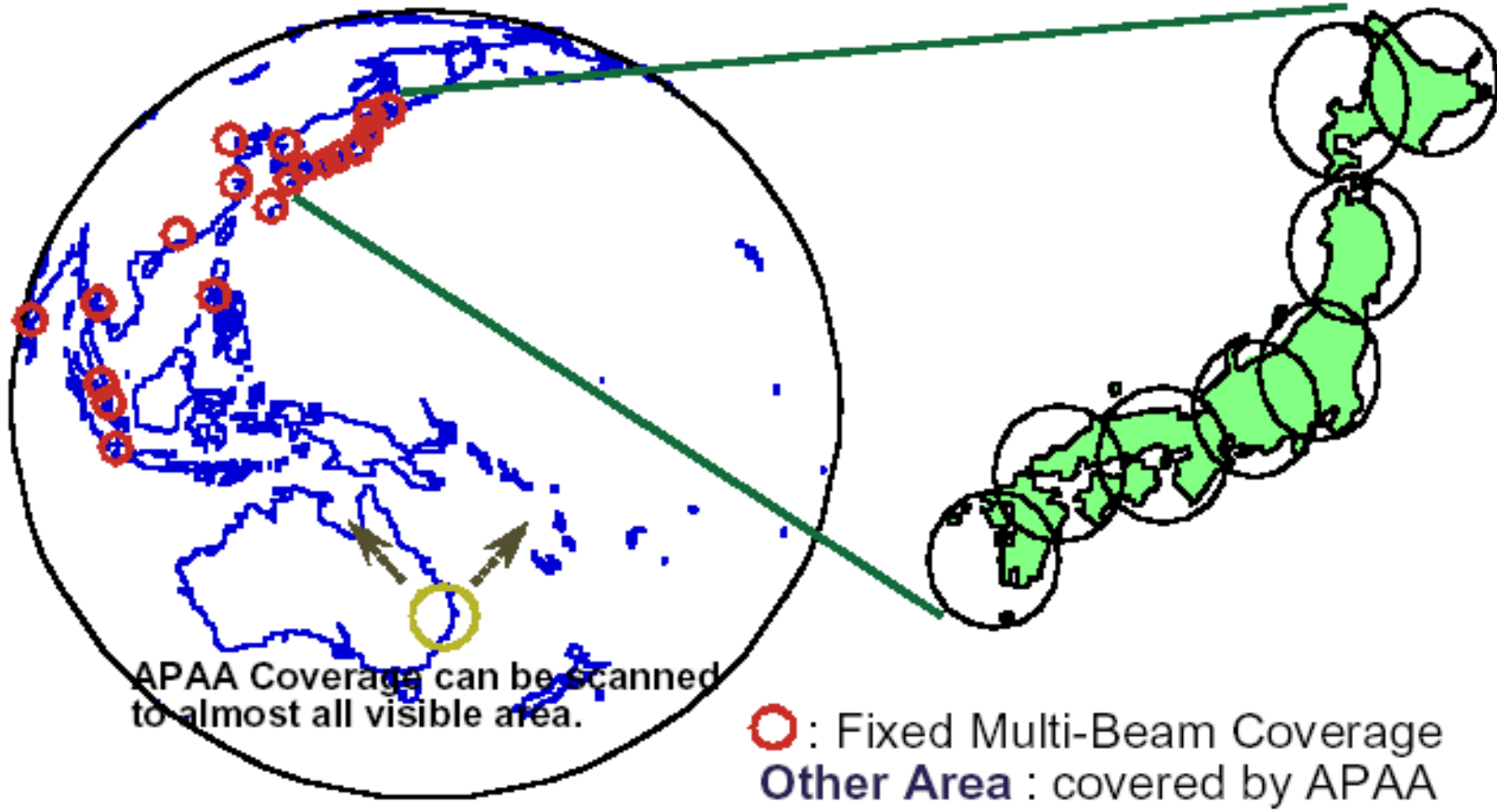
ATM Switching Data Rate: 1.5~155Mbps

Throughput: ~622Mbps

IF Switching Bandwidth: 1.1GHz

Data Rate: 1.2Gbps

Beam Coverage of WINDS



APAA:Active Phased Array Antenna

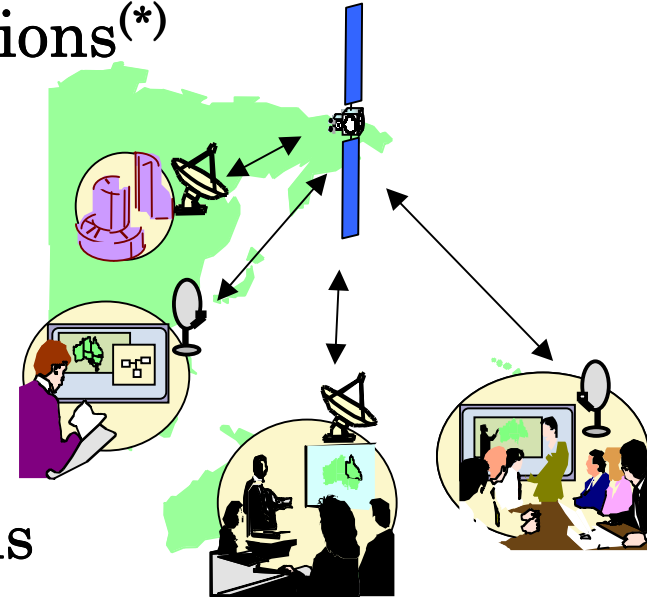
Experiment Plan by WINDS

⌘ Gbit application using large earth stations(*) (600M~1.2Gbps)

- ⌘ Large-scale distributed databases
- ⌘ Distributed super-computing
- ⌘ etc.

⌘ High data rate multimedia applications using small earth stations (**) (1.5Mbps ~ 155 Mbps)

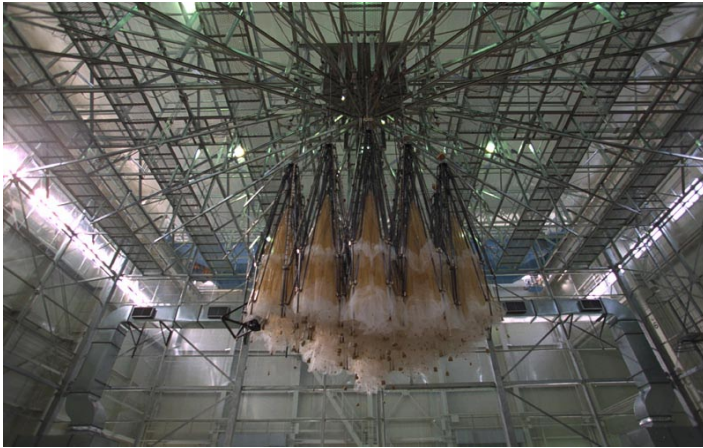
- ⌘ Tele-medicine, home Care
- ⌘ Distance learning by high definition video
- ⌘ High speed Internet access
- ⌘ etc.



(*) antenna size of the earth station is larger than 2m ϕ

(**) Antenna size of smallest earth station is 45cm ϕ

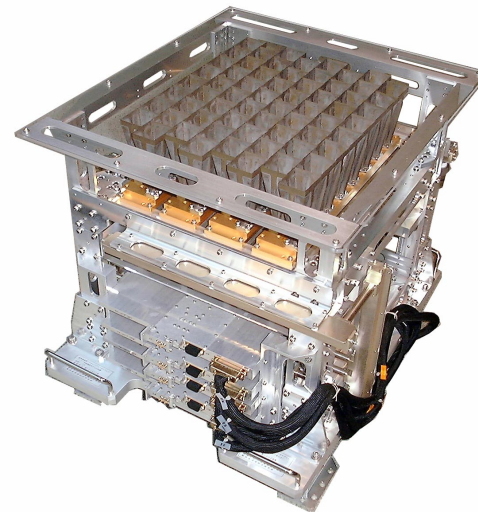
Examples of technology development



Onboard large deployable antenna reflector of ETS-VIII



Developed handheld phone for ETS-VIII experiments



Active Phased Array Antenna for WINDS

Application Experiment using R & D Satellite



- ⌘ Objectives: Promoting satcom utilization in nation wide
International cooperation through experiments
- ⌘ Promoted by: Space Policy Div. of MPHPT
- ⌘ Participants: Universities / Research institutes /
Private companies
- ⌘ Earth stations: Be prepared by participants basically
- ⌘ Announcement: 2002 Autumn for ETS-VIII
2003 Autumn for WINDS
- ⌘ Overseas participants: Joint research with Japanese research
institute or universities is welcome.