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

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# *Satellite Communication Technology*

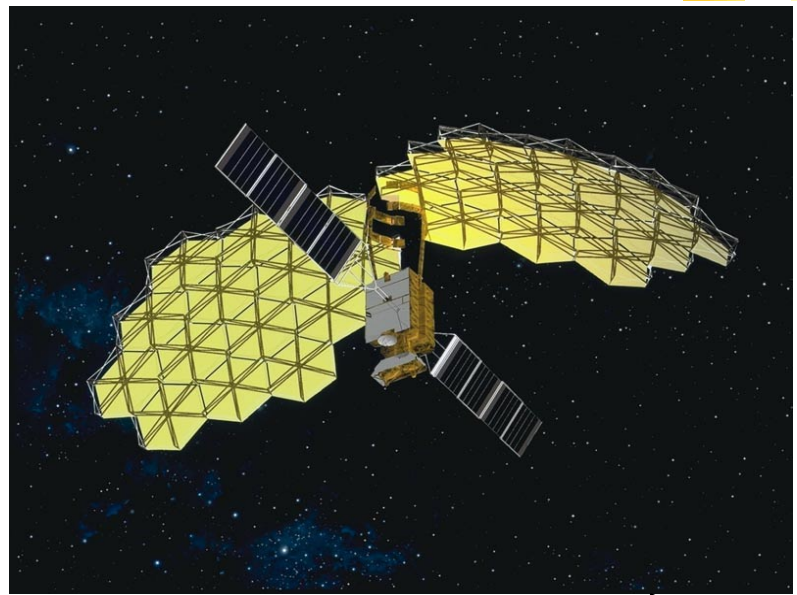
- Important infrastructure for wide coverage services
- More user friendly by technology development
  - Services for voice, Internet, video, via satellite directory
- Examples in the world
  - Mobile satellite communications
    - Inmarsat, Iridium, Globalstar, Garuda, Thuraya, etc.
  - Broadband/Internet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

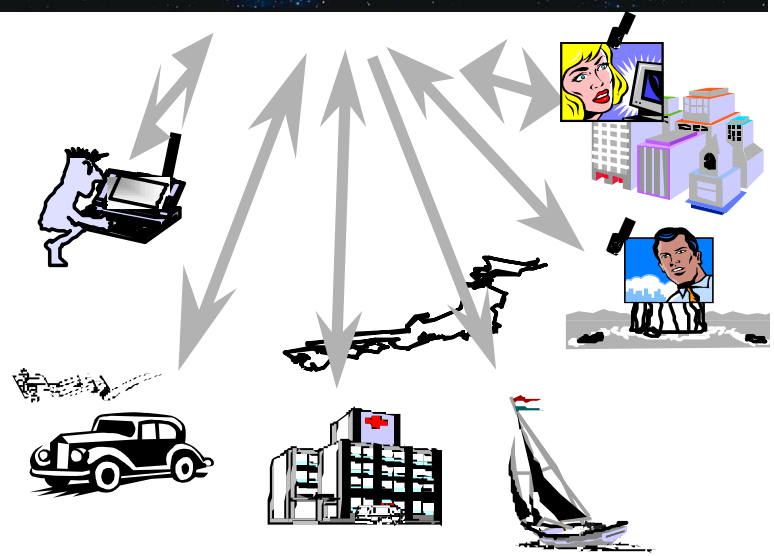
# *Current Program for SatCom.R & D in Japan*

- 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

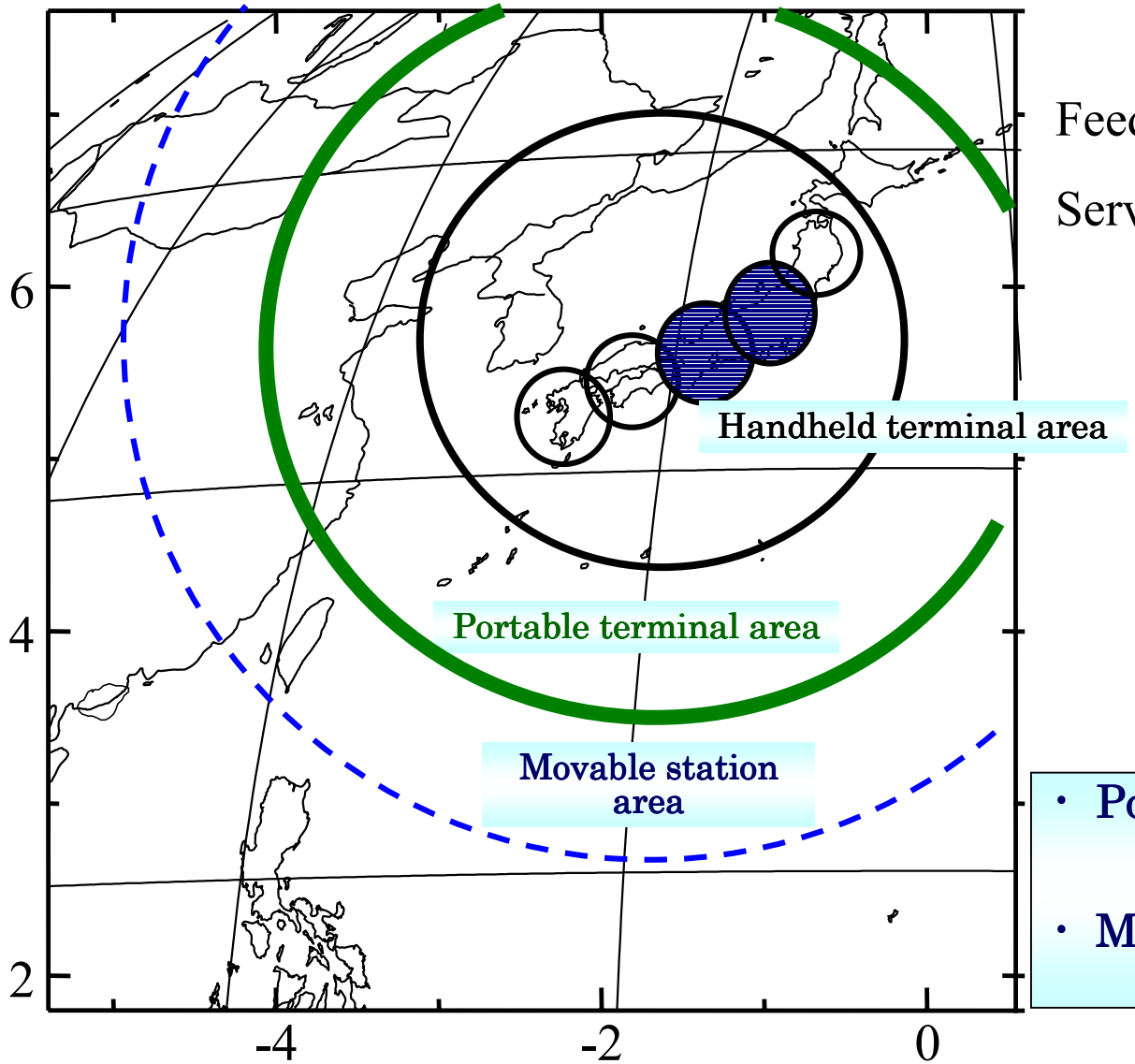
# *Engineering Test Satellite-VIII*

- Objectives:
  - Development of advanced Mobile Satcom using S-band frequency.
- Main Characteristics:
  - Mission Duration: 3 years
  - Weight: 2,800kg (BOL)
  - Electrical Power:7,500W(EOL)
- Technology Development:
  - An advanced 3-ton-class spacecraft bus.
  - Large-scale deployable reflector. (17m×19m)
  - Onboard signal processing





# *Beam Coverage of ETS-VIII*




Feeder link: 20/30GHz

Service link: 2.5/2.6GHz

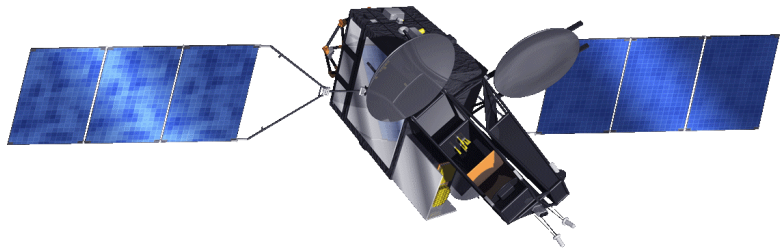
- Portable terminal: Notebook size
- Movable station: 1mϕ antenna

# *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*

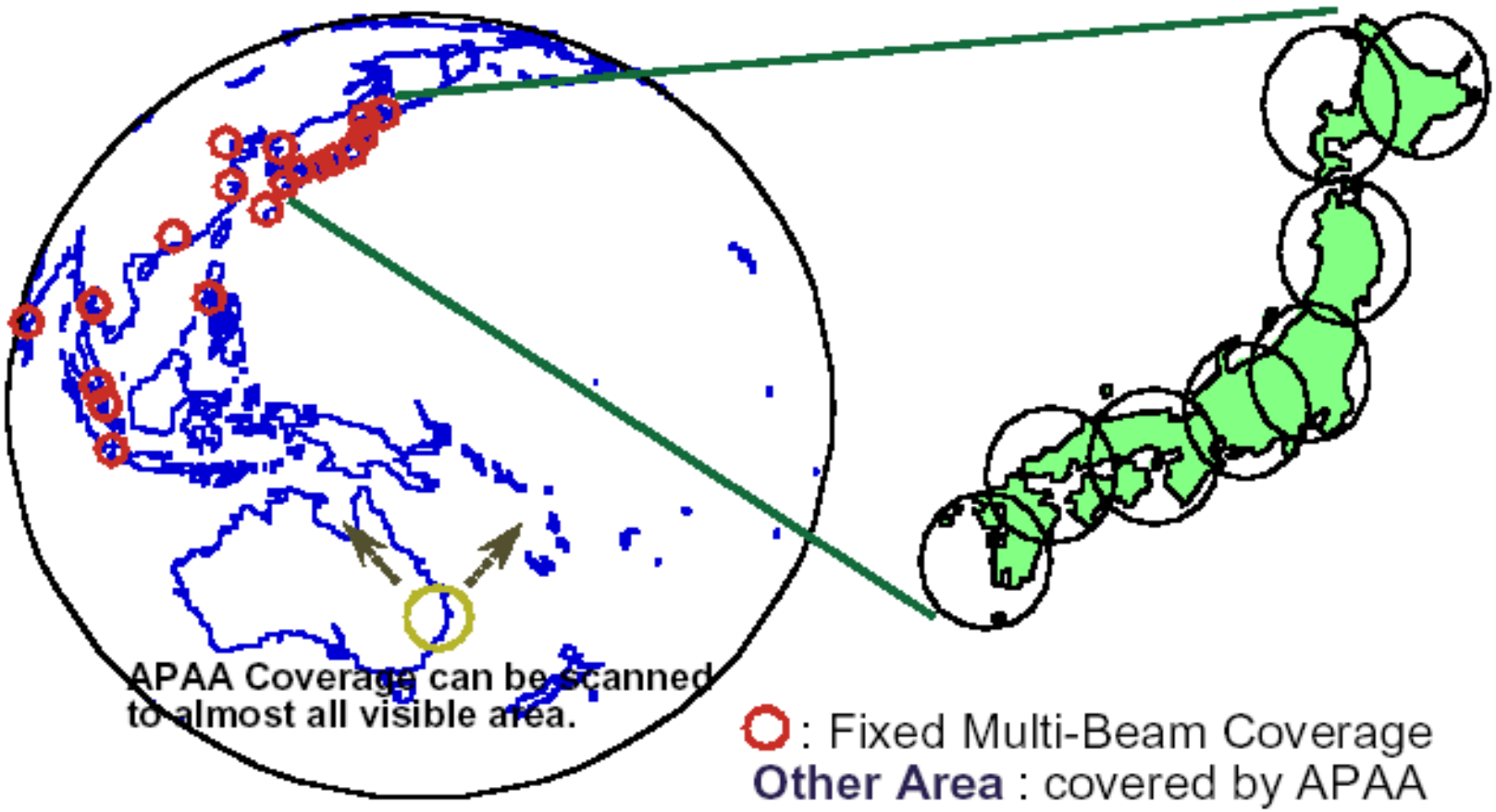
- Objectives:
  - Development of high speed broadband satcom system
- Main Characteristics:
  - Mission Duration: 5 years
  - Weight: 2,300kg (BOL)
  - Electrical Power:7,500W(EOL)
- Technology Development:
  - On-board ATM Switch
  - Active phased array antenna for scanning in Ka-band
  - Fixed spot-beam antenna



**Major Communications Specifications**

| | |
|---|---|
| Frequency | 28.05±0.55GHz(up)<br>18.25±0.55GHz(down) |
| No.of Beams | 4 |
| ATM Switching | Data Rate:1.5~155Mbps<br>Throughput:~622Mbps |
| IF Switching | Bandwidth:1.1GHz<br>Data Rate:1.2Gbps |

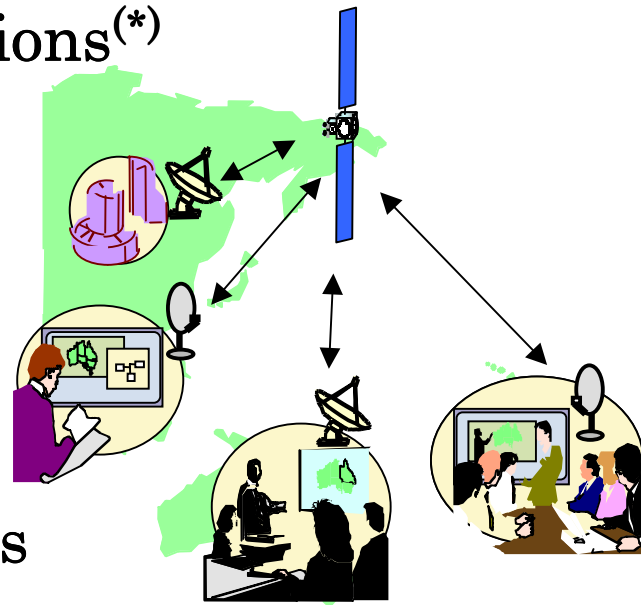
# *Beam Coverage of WINDS*




APAA:Active Phased Array Antenna

# *Experiment Plan by WINDS*

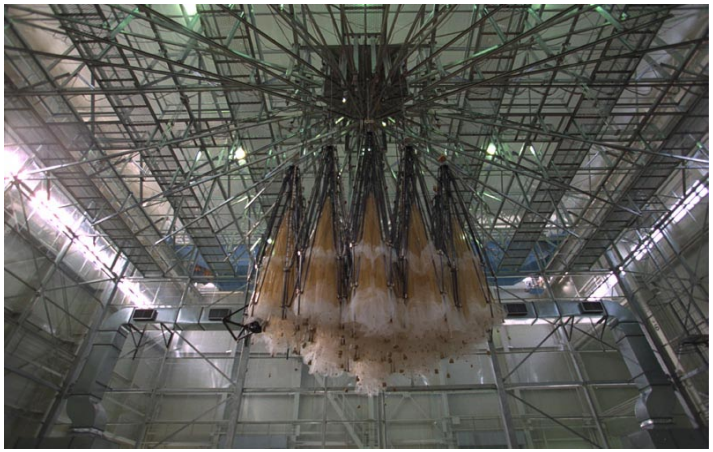
- Gbit application using large earth stations(*) (600M~1.2Gbps)
  - Large-scale distributed databases
  - Distributed super-computing
  - etc.



- 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.

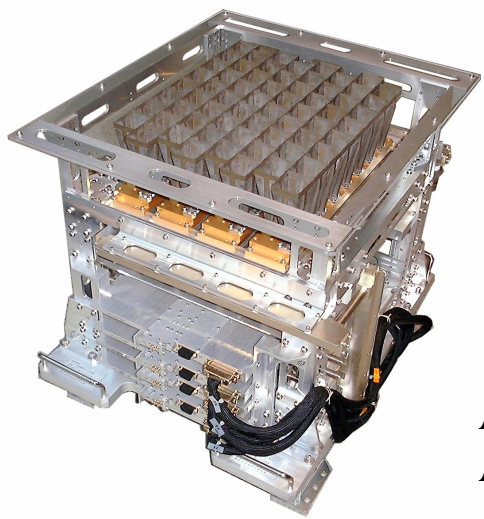
(*)antenna size of the earth station is larger than 2mϕ
(**) Antenna size of smallest earth station is 45cmϕ

# *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.

MPHPT:Ministry of Public Management, Home Affairs, Posts and Telecommunication