

ICSSC2012
Panel Discussion
A Half Century of Satellite Communications:
The Past, Present and Future
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Satellite Communications Development in Japan: from Past to Future

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Initiation: Until 1964

- 1896: Establishment of Radio Res. Div., Electro-Test Lab, Dep. of Com.
- 1952: Establishment of Radio Res. Lab. (RRL), Min. of Posts & Telecom (Changed its name as Com. Res. Lab (CRL) in 1988)
- 1954: Start of Nuclear Electric Power Generation R&D
- 1955.4: Development of Pencil Rocket
- 1956: Establishment of Japan Nuclear Res Lab
- 1957.7-1958.12: IGY
- 1957: Received Sputnik's Signal by RRL
- 1958: Start of Antarctic Expedition
- 1958: Start of Shinkansen Railway Development
- 1962.3: Mr. Okazaki, Ambassador to UN, Announced to Want Satellite Development for Broadcasting Olympic Games to World
- 1962.11: Exchange Memorandum of Japan-U.S. Communication Experiment
- 1963.11.23: Completed KDD's Ibaraki Earth Station
First transmission of TV image about President Kennedy's assassination through Relay-1
- 1964.5: Completed RRL's Kashima 30 m Antenna
- 1964.7: Determined Relay of Tokyo Olympic games via satellite
- 1964.10: Succeeded in Relaying Tokyo Olympic Games via Syncom-III by RRL

- Initiation of Radio Com Research in Japan
- Whole Japan Heated in Science and Technology
- Strong Desire for Broadcasting Olympic Games via Satellite
- Presented Japanese Technology Level

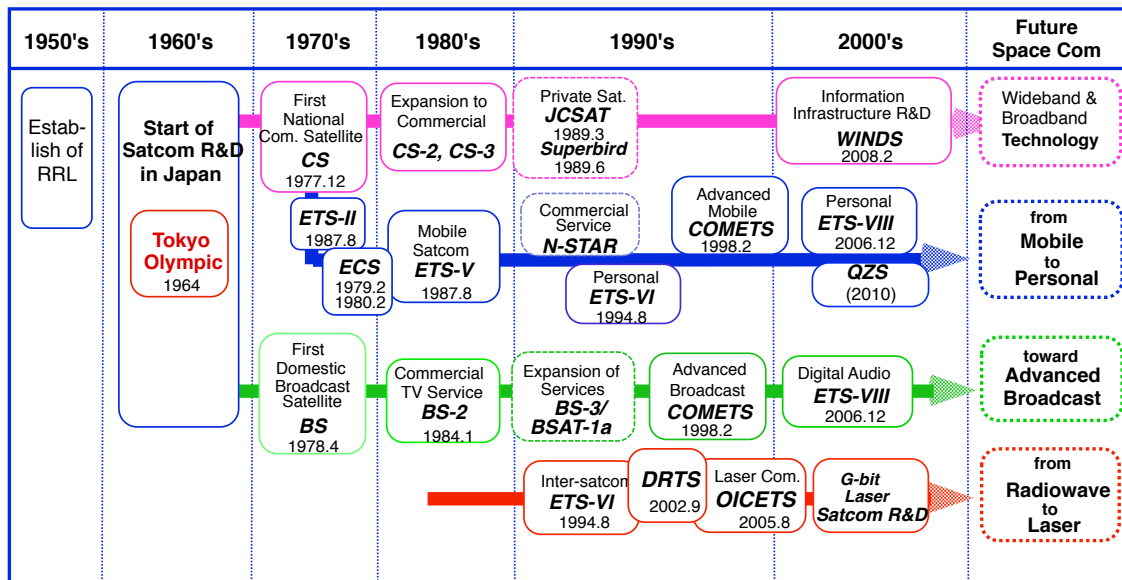
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Commencement of Satellite Development: 1965-1990

- 1968: Space Activities Commission
- 1969: Start of Receiving Alouette I&II Telemetry by RRL
- 1969: Start Development of ISS
- 1969: National Space Development Agency of Japan
- 1971-72: Start of Receiving ISIS I&II Telemetry by RRL
- 1972: Start Development of CS & BS
 - Secure com with remote islands
 - Disaster mitigation com
 - Eliminate of difficulty of TV viewing
- End of 1970s to 1980s: Development of Engineering Test Satellites
 - ETS-II, ETS-V, ETS-VI
- End of 1970s to 1980s: Flourishing of Establishing Operational Satellites
 - CS-2, CS-3, BS-2, BS-3
 - JCSAT, Superbird, N-STAR, BSAT
- Establishment of Space Development Organization in Japan
- Start of Satellite Development, under Special Condition
 - Limitation to the peaceful use
- Development by Close Collaboration with Government, NTT and NHK
- Ka-band Development
 - 1977: Launch of CS: World first Ka-band satellite
 - Use of Ka-band has not been expanded in Japan with an exception like N-STAR, because:
 - Its development might have been too early
 - Proper policy might have been not applied
 - Japanese character might have pursued too severe link availability

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Brief History of Japan's Satcom Satellite R&D



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Difficult Era: 1990-

1990: Outbreak of Japan-U.S. Trade Issue

End of 1980s: Explosion of Bubble Economy in Japan

1990s: One after Another Occurrence of Failure of Satellite Launch

- ETS-VI, COMETS
- 2006: Launch of ETS-VIII
 - Succeeded in unfolding two large antennas
 - But S-band receiving system malfunctions

- Need to Procure a Satellite with an Open, Transparent and Inside and Outside Non-discriminated Procedures
 - Special environment for space development in Japan
 - Japanese government develops only R&D satellite
 - Satcom R&D encounters two limitations both with non-military and with Super 301
- Beginning of Two 'Lost' Decades in Japan
- Japanese Satcom Researchers had No Opportunity of Full-scale Satellite Communication Experiments for More Than 10 Years

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Preparation for Future in Difficult Era: 1990-

1987: ISY Conference for 1992
Space Year Project

1990: First Meeting of Japan-U.S.
Cooperation in Space

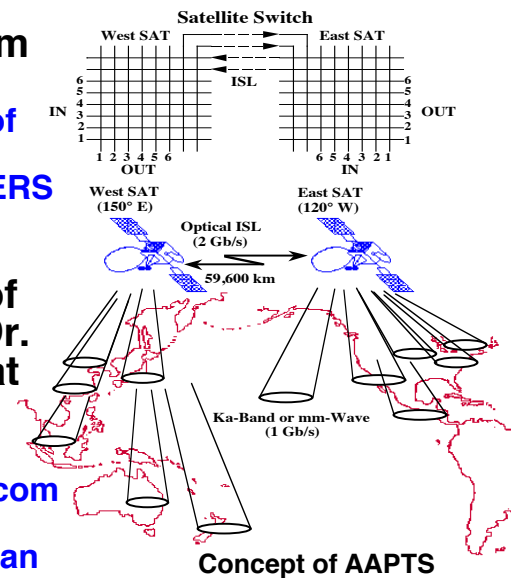
1990: Simple, Inexpensive Satcom
System Experiment

- Collaboration with PEACESAT of Univ. of Hawaii
- 1992-2002: ISY project: PARTNERS
- ✓ Network with Asia-Pacific countries

1991-1992: Collaborative Study of
Adv. Satcom Concept with Dr.
Pelton at Univ. of Colorado at
Boulder

- Creation of concept APTS*
- Trans-Pacific high data rate satcom experiment
- Gigabit satellite proposal in Japan

○ JUCS was Established
Thanks to Dr. Edelson's
Excellent Consideration

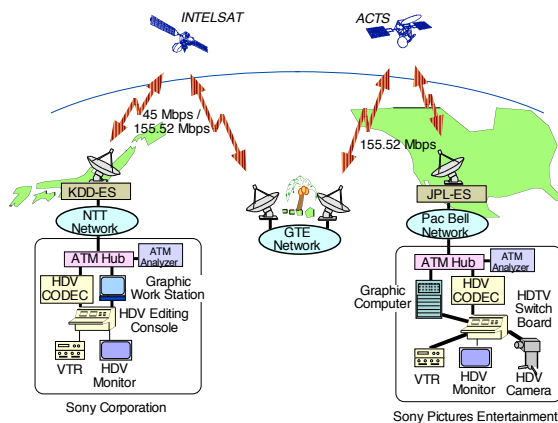


*T.Iida and J.N.Pelton: "Conceptual Study of Advanced Asia-Pacific Telecommunications Satellite for Future Gigabit Transmission", Space Communications, IOS Press, Vol.11, No.3, pp.193-203, 1993.

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Trans-Pacific High Data Rate Satellite Communication Experiment*

- Discussed at the Japan-U.S. Cooperation in Space Workshop in 1992
- 45 Mbps post-production high definition video transmission experiment was successfully conducted between Tokyo and California using INTELSAT and ACTS via Hawaii on March 28, 1997
- Awarded NASA Group Achievement Award for Japan-U.S. High Data Rate Satellite Communications Experiments on April 4, 1998

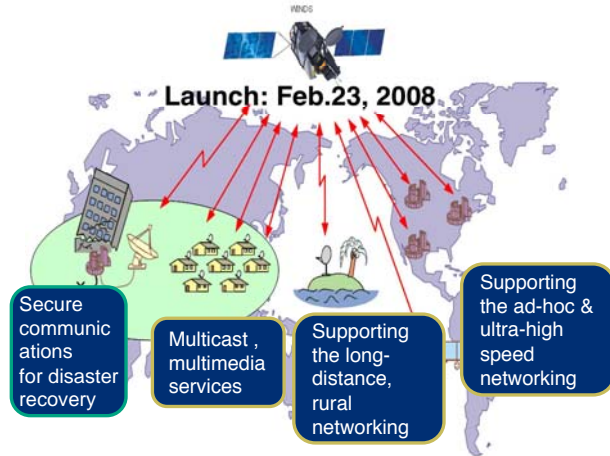


*N. Kadowaki, N. Yoshimura, N. Nishinaga, R. Gilstrap and M. Foster, "Trans-Pacific Demonstration (TPD): Network Architecture, Engineering and Results", Space Communications, Vol. 17, No. 4, pp. 293-302, 2001.

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Initiation of Gigabit Satellite Project in Japan

- Most of Japanese People Concerned Satellite were Not Interested in Gigabit Satellite in 1992
- In January 1995, Tragic Disaster, the Hanshin-Awaji Great Earthquake was Occurred
 - The satellite communication was focused
 - It was recognized that high speed satellite communication is needed for info-com infrastructure
- Advanced Information and Communication Society Promotion Council (Chair: Prime Minister)
 - Recommended to construct the high speed satellite communication infrastructure in February 1995
- Gigabit Satellite Project was Begun in CRL in 1996
 - 1.2 Gbps satcom
- Gigabit Satellite was Expanded to WINDS in 2002
 - In accordance with "e-Japan Priority Policy Program"
 - Also 155 Mbps satcom using USAT



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Criticism for WINDS in Japan

- Nikkei Shimbun Said on Feb. 4, 2008
 - Network satellite has no business chance
 - High speed satellite communications are not necessary due to spread of terrestrial high speed network
 - There is no commercial prospect to use the satellite developed
 - Technology of WINDS is obsolete
- These seem to be Almost the Same Criticism as NASA's ACTS*
- Opposing Opinion from Points:
 - Bridge of digital divide
 - Security

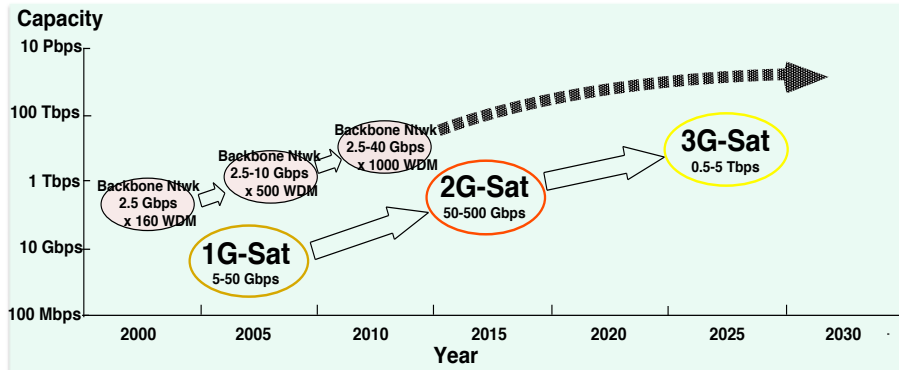


*R. T. Gedney, R. Schertler and F. Gargione, "The Advanced Communications Technology Satellite", Scitech, 2000.

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Study for Future and Problems

- **Future View on the Broadband Satellite***
 - Defined 1st generation, 2nd generation, and 3rd generation satellites
 - From a security point of view, it need construct communications system with harmony of satellite systems and terrestrial systems
 - Thus, the satellite capacity should be increased in harmony with the terrestrial capacity, although the complete follow up is impossible
 - Satellite would need to share at least 1% of a fiber capacity
- **Problems in Japan**
 - Future project beyond WINDS is still obscured
 - Recent decrease of radio communication engineers
 - Become unpopular of electronics and information engineering of university among young people



*T.Iida and Y.Suzuki: "Communications Satellite R&D for Next 30 Years", 19th AIAA ICSSC, No.233, Apr. 18, 2001 (also Space Communications, an International Journal, Vol.17, No.4, pp.271-277, 2001)

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Recent Change of Japan's Space Policy

2003-2004: Carry Out

Administrative Reform

- NASDA, ISAS and NAL were merged to JAXA
- CRL and TAO were merged to NICT

2008: Space Basic Law was Concluded

- Establishment of Headquarters of Space Development Strategy, Cabinet Office (Chair: Prime Minister)
- 2012: JAXA Law was changed to eliminate text "limitation to only peaceful use"

2012: Establishment of Space Policy Council, Cabinet Office

- Start of making Space Basic Plan

- Meaning of "Peaceful Use of Space" was Changed from "Non-military" to "Non-aggression"

- Space Development Policy System has been Prepared, but Full-scale Activities has not yet be Started, Because Space Basic Plan has not yet Determined

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Shock of 3.11 East Japan Great Earthquake

- **Satcom People Made Great Effort to Contribute to Disaster Communications.**
- **Shocks of the Great Disaster**
 - #1: Situation of 'SOS' characters on the roof
 - #2: No Japanese robot which can be used immediately at Fukushima nuclear power plant
 - #3: No database of how much a botanical plant absorbs radioactive material in Japan
- **My Personal View for Science and Technology Policy* that is not Symptomatic Treatment of the Great Disaster**
 - To shift the purpose of national R&D to the national security
 - To breed 'deep craft' to wake up technology innovation to turn on the offensive



High data rate disaster communication between Matsushima Base and Iruma Base of JSDF using WINDS VSAT



An isolated disaster sanatorium (photo by Yomiuri airplane on Mar. 13, 2011)

*T. Iida, "Methodology of R&D (4)", Space Japan Review, No.78, Feb./Mar., 2012.
<http://satcom.jp/English/e-78/spacejapanopinione.pdf>

Conclusions

I hope that we Japanese overcome the great disaster and long-term economic stagnation in Japan and promote developing satellite communications technology.

Acknowledgements: Extremely grateful to those who promoted the Japanese satellite communications.

Appendix: Glossary of Terms

1G-SAT: First Generation Satellite
 2G-SAT: Second Generation Satellite
 3G-SAT: Third Generation Satellite
 AAPTS: Advanced Asia Pacific Telecommunications Satellite
 ACTS: Advanced Communications Technology Satellite
 BS: Broadcasting Satellite
 BSAT: Broadcasting Satellite System Corporation
 COMETS: COMMunication and broadcasting Engineering Test Satellite
 CRL: Communications Research Laboratory
 CS: Communications Satellite
 DRTS: Data Relay Test Satellite
 ECS: Experimental Communications Satellite
 ETS: Engineering Test Satellite
 IGY: International Geophysical Year
 ISAS: Institute of Space and Astronautical Science
 ISIS: International Satellites for Ionospheric Studies
 ISS: Ionosphere Sounding Satellite
 ISY: International Space Year
 JAXA: Japan Aerospace Exploration Agency
 JCSAT: Japan Communication Satellite Co. Inc.
 JSDF: Japan Self-Defense Forces

JUCS: Japan-U.S. Cooperation in Space, now JUSTSAP
 KDD: Kokusai Denshin Denwa Co. Ltd.
 NAL: National Aerospace Laboratory
 NASDA: National Space Development Agency of Japan
 NICT: National Institute of Information and Communications Technology
 NHK: Nippon Hoso Kyokai (Japan Broadcasting Corporation)
 NTT: Nippon Telegraph And Telephone Corporation
 OICETS: Optical Inter-orbit Communications Engineering Test Satellite
 PARTNERS: Pan-Pacific Regional Telecommunication Network Experiments and Research by Satellite
 PEACESAT: Pan-Pacific Education and Communication Experiments by Satellite
 QZS: Quasi-Zenith Satellite
 R&D: Research and Development
 RRL: Radio Research Laboratories
 Satcom: Satellite communication
 TAO: Telecommunications Advancement Organization
 UN: The United Nations
 USAT: Ultra Small Aperture Terminal, 45 cm diameter for WINDS
 VSAT: Very Small Aperture Terminal
 WINDS: Wideband InterNetworking engineering test and Demonstration Satellite