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<td>Mitsutada Nakayama</td>
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Harnessing Satellite Technology For The Press

By

Mitsutada Nakayama
Harnessing Satellite Technology for the Press

by Mitsutada Nakayama
Supervisor, Cable and Radio Section,
Communication Dept.,
Kyodo News Service

Satellite communications has become a familiar means of communication today. Indeed, it has become an indispensable means of international communication. Japanese newspaper companies and news agencies are using satellite communications not only for reporting international news but also for voice, data, facsimile, and photo transmission.

In the use of satellite for domestic communications, Japan had long lagged behind the United States and other countries which are advanced in satellite communications. Following the successful launching in 1977-78 of experimental communications and broadcasting satellites for domestic use, Japan shot up a practical communications satellite, CS-2a (Sakura) in August 1983, the world's first high-powered practical broadcasting satellite BS-2a (Yuri) in January 1984, and a practical communications satellite, CS-2b (back-up) in August 1984. We are now using these three satellites.

The Japan Newspaper Publishers and Editors Association (NSK) is conducting various experiments in the practical use of these satellites under the guidance of the Ministry of Posts and Telecommunications (MPT) by using the Ministry's pilot plan transponder on the CS-2.
For six months from the middle of March next year, the International Exposition, Tsukuba, Japan, 1985, will be held in Tsukuba Science City in Ibaraki Prefecture north of Tokyo. During the exposition period, both the Asahi Shimbun and Yomiuri Shimbun will provide visitors to the exposition with the latest news by means of newspaper page facsimile transmission via the CS-2. It will be the first experiment in the world to publish a newspaper by using the 30GHz/20GHz K band.

For Japan, which has a highly-developed terrestrial communications network, the problems involved in switching over to satellite communications are excessively numerous.

On the subject of "Harnessing Satellite Technology for the Press", which is the title of my talk today, the Telecommunications Committee of NSK in June this year submitted a brief to the Space Telecommunications Policy Council, a private advisory organ to the director general of the Radio Regulatory Bureau of MPT. The brief elucidates very compactly the problems involved in the utilization of satellites by the Press and indicates what needs to be done. As such, it is pertinent to my subject. Therefore, I shall summarize a part of the brief here.
Problems Relating to the Use of Communications Satellite by the Press

(1) Major Features of Use of Communications Circuits by the Press

a) The hours of use are long -- from early morning to dawn of the following day.
b) Because of the fixed deadline, even the slightest delay is impermissible.
c) There are a number of communication peaks in each of the processes of news gathering, transmission, reception of news copy, and production.
d) The volume of communication increases whenever a disaster, an accident, or a big event takes place.

(2) Conditions Which Must Be Met by Circuits using Communications Satellite

a) The circuits must remain stable for a long period of time: Rain attenuation must be reduced; rate of unavailability must be reduced at least to 0.1%; countermeasures must be provided against eclipse and sun interference.
b) High-quality circuits are necessary: Because news is ultimately presented as hard copy, mistaken or blurred characters or pictures are impermissible.

For facsimile transmission of newspaper pages for
which a rigid production schedule is set, a Bit Error Rate of below $10^{-10}$ is desirable.

c) A back-up system in the event of interruption of telecommunications by rain attenuation is necessary. (In the case of the Nippon Telegraph and Telephone Public Corporation, the satellite communications circuit must be linked to high-speed digital circuit, making instant switchover possible in an emergency.)

d) Measures to accommodate increases and changes in the volume of communication: The communication capacity of the satellite circuit itself must be increased; DA/TDMA formula must be established.

3) Technological Problems

a) An effective formula to control errors must be established, such as in the case of page facsimile simultaneous transmission (or point to multi-point page facsimile transmission).

b) In order to ensure secrecy of communication, an effective privacy technology must be developed.

4) Re-examination of Frequencies in Use: In order to establish the conditions for "inexpensive and free" use of satellite communications, it is considered necessary to adopt the principle of competition to the maximum and create an environment in which a plural number of
telecommunications corporations will provide better technology and service. In order to bring down the cost of a communications satellite, it will be necessary to commission its launching to a foreign agency or to purchase a satellite from a foreign country.

a) The development of the K band (30GHz/20GHz) communications technology ahead of other countries is, in itself, significant. However, because K band communications still belongs to the high-tech area, its stability and reliability as a practical communications technology have not yet been adequately assured.

Continued efforts must be made in the form of practical experiments (1) to reduce occasional outage in the K band, (2) to increase the output power of satellite transponders and (3) to improve low noise amplifiers.

b) The 14GHz/12GHz Ku band or 6GHz/4GHz C band should be employed to realize more stable and less expensive satellite communications.

(5) Reduction of Cost: Because the development of the 30GHz/20GHz K band communications technology is being undertaken at the same time as practical application, the cost of domestic satellite communications equipment and facilities is exorbitantly high. This is a big
limiting factor in accelerating practical application of satellite communications.

Problems concerning System of Use: The Press will become involved in the new communications media and its relations with other industries will become deeper in the future. It is certain that there will be a greater diversification of news, data of all sorts, and distribution and exchange of information.

a) A system which will not limit the use of satellite communications only to in-house communication is necessary. It is hoped that a way will be opened for joint use of satellite circuits and earth stations.

b) In case of a satellite owned by a specific newspaper company, it is desirable to recognize its use by parties having different licenses under the Wireless Telegraphy Law.

c) It is hoped that a special system of rates would be applied to press communications.

How to Use Satellite Communications: By establishing a unified technical standard, the operation of satellite communications will be stabilized. When this is achieved, it will become possible for anybody to use satellite communications in any desired way.
a) Make it possible to use satellite communications for purposes other than satellite communications services offered by telecommunications corporations.

b) All or part of transponder will be leased or purchased for use. An earth station will be leased or self-owned.

c) A system will be established so that transponder and earth station may be used jointly by a plural number of users.

* Conceivable Use of Satellite by the Press

At present, terrestrial communication networks using the 48KHz and 240KHz bands are used for newspaper page facsimile transmission while a terrestrial communication network using the 3.4KHz band is employed for voice, data, facsimile and photo transmission. Even when the satellite is used, newspaper page facsimile transmission is concentrated in the time segments between 11:00 a.m. and 2:00 p.m. and between 4:00 p.m. and 2:00 a.m. the next day. We are thinking of developing ways to take the best advantage of point to multi-point transmission which is a feature of satellite communications.

It is conceivable that when the new information technology age becomes a reality, newspaper companies and news
agencies will use the satellite for distribution of various types of information and news. At the present stage, however, they are studying the use of the satellite as a substitute for their current terrestrial communications network from the standpoints of diversifying communications circuits, increasing the speed of information transmission, and coping with disasters.

In the case of news agencies, the volume of data and photo transmission is much smaller than the volume of page facsimile transmission of newspaper companies. Because news agencies transmit various information to various subscriber companies according to their needs, it is presumed they will use the satellite for segmented, multiplex transmission. The number of reception points of news agency transmissions is very large. Therefore, the cost of receiving sets would have to be brought down considerably so that they may be installed at the offices of subscribers at the smallest possible cost.

Wireless communication (VHF or UHF) is essential to speedy news gathering activities. Mobile radio, carried by reporters or mounted on cars and aircraft, is widely used for minute-by-minute reporting of news developments. But, at the present stage, the use of mobile radio is often limited by locality or terrain. When communications technology progresses to the point where a convenient portable
earth station is developed, it is likely that national newspaper companies and news agencies, which have to gather news in an extensive area and at numerous points will replace their mobile radios with a satellite communications system which can cover every corner of the country. However, the Press has not yet started studying this feasibility. Telephones are routinely employed for sending news, but in this case physical limitations restrict activities. It would be ideal if it becomes possible to use satellite-harnessed portable telephone for news and photo transmission.

* * * * *

I have just outlined the contents of the brief which the Japanese Press submitted to the Space Telecommunications Policy Council. The Council thereupon drafted an interim report on "Investigation and Research on the Development and Use of the Communications Satellite".

The interim report notes that a big change is taking place in the social environment surrounding communications satellites as evidenced by the presentation to the Diet of the Telecommunications Enterprises Bill designed to introduce the principle of competition into the telecommunications field. The report then states what needs to be done to promote the use of communications satellites. It says that the way should be opened for the entry into the public
telecommunications business by newcomers, such as the Daini Denden (Second NTT), and for the use of satellites for in-house communication by private sector corporations. This should be done also in the case of the CS-3 scheduled to be shot up in 1988. The report also proposes fiscal and financial support measures, such as the provision of low-interest loans by the Japan Development Bank.

As regards the desirable form of research and development of satellite communications technology, the interim report points out: "In order to promote research and development efficiently, the most efficient way is first to test new technology in space by using the experimental communications satellite before shooting up a practical communications satellite." Thus, it suggests a change in Japan's approach to the development of a practical communications satellite which so far was to use a satellite for the dual purposes of developing technology and putting it to practical use. It also states that the possibility of allowing private enterprises to purchase satellites should be made a subject for study.

As regards the use of satellites, the interim report states that, as diversified use can be anticipated in the future, all companies which engage in public telecommunications business after the establishment of the Telecommunications Enterprises Bill should be accorded equal treatment.
It recommends that newcomers should be placed on the same footing as the New Denden Co. in the utilization of CS-3. It also states that a positive attitude should be adopted as regards the feasibility of private enterprises using a satellite for in-house communication.

As measures to promote the use of satellites, the interim report suggests that the Japan Development Bank's low-interest loans should be made available to facilitate the purchase of satellites and points out the necessity for various policy measures, such as standardization of satellite communications utilization technologies. Noting that satellite communications has so far been applied mainly to domestic communication, the interim report says that the feasibility of using satellites for international communication should be studied in the future.

The Council is scheduled to conduct further research and investigation and come up with a final report at the end of fiscal 1984 ending on March 31 next year. The Ministry of Posts and Telecommunications intends to work out concrete measures, such as re-examination of systems, on the basis of the Council's final report.

Next, I would like to explain the trend in the domestic use of satellites in Japan, because I think that you are interested in hearing about it.
On February 4 last year, the communications satellite CS-2a was shot up with an N-II rocket from the National Space Development Agency's Tanegashima Space Center in Kagoshima Prefecture in Kyushu. This marked the start in Japan of the age of full-scale practical use of the communications satellite. The CS-2a was successfully placed in a geosynchronous orbit about 36,000 kilometers (about 22,300 miles) above the equator northwest of New Guinea at 132° East Longitude. After the various instruments and equipment carried in the satellite were checked, the operation of the CS-2a was transferred in May last year from the National Space Development Agency (NASDA) to the Telecommunications Satellite Corporation of Japan (TSCJ).

NASDA's work is (1) to develop, launch and track artificial satellites and rockets, and (2) to develop and improve software as well as facilities and equipment needed for developing, launching and tracking satellites.

The business of the TSCJ consists of (1) commissioning to another party the launching of communications and broadcasting satellites, (2) controlling the positions and postures of communications and broadcasting satellites, and (3) letting any party which establishes a radio station to use the wireless facilities mounted in communications satellites.
Accordingly, TSCJ, which manages the satellite, has divided the eight transponders loaded in it for use among Nippon Telegraph and Telephone Public Corporation (NTT), National Police Agency, Construction Ministry, Ministry of Posts and Telecommunications, Fire Defense Agency, Japanese National Railways (JNR) and electric power companies.

The CS-2 is Japan's first practical communications satellite. Technically speaking, it is the world's first communications satellite using the K band. In August last year, a back-up satellite (CS-2b) was shot up successfully. The CS-2a and CS-2b are the sixth and seventh artificial satellites which Japan has launched into geosynchronous orbit and the third and fourth satellites shot up into orbit with domestically assembled rockets, the first two being the technical experimental satellite "Kiku 2" shot up in 1977 and the meteorological satellite "Himawari 2" shot up in 1981.

The CS-2 has functions almost the same as those of the CS, and therefore, it cannot be used during an eclipse. Because its circuit capacity is limited and its life is only five years, the CS-2 still falls short of the world standard.

As for the cost of development and launching, the satellite proper of the CS-2a, and of course its back-up, cost about ¥25.3 billion, and the rockets about ¥18.3 billion.
Indirect cost, including about ¥2 billion in insurance premiums, amounted to approximately ¥13.1 billion, bringing the total cost to approximately ¥56.7 billion. Of this total sum, 40% is borne by the government as development expenditure, while the remaining 60% is shared by NTT, JNR and electric power companies which are the satellite users other than the government agencies. In the case of JNR which uses one-10th of the K band of a transponder, its share of cost amounts to about ¥600 million.

The operation and control center of the Telecommunications Satellite Corporation of Japan is located in Kimitsu City in Chiba Prefecture. When the center develops some trouble, NASDA's Tsukuba Space Center will undertake the operation and control of the satellite on its behalf. All the users of the satellite are required to pay to TSCJ ¥195 million per transponder annually as utilization fee (¥175 million in the case of users other than government agencies.)

The CS-2 utilization policy stipulates three principal uses -- communication with remote islands, communication at times of disasters, and temporary communication.

Japan is made up of more than 340 islands. Except for big islands like Okinawa, most of them are small and remote. Because satellite communications is best suited for
communication with such remote islands, it is utilized very actively for this purpose.

Except for remote islands, the entire territory of Japan can be covered by dial telephone using the terrestrial communication network. There is sufficient channel capacity for this. Therefore, satellite communications is utilized as an effective back-up system when the basic trunk circuit of the terrestrial communication network should develop trouble at the time of an earthquake or a typhoon.

A temporary and localized sharp increase in the volume of telephone calls can be expected in the event of an accident or a disaster. In order to deal with extraordinary traffic under such circumstances and to prevent breakdown of telephone exchange functions, provisional circuits are established via the communications satellite. Moreover, provisional circuits are established via the satellite with the aid of a mobile earth station when a large-scale event is held or when necessity arises for news reporting from the scene of an accident or for liaison communication.

The CS-2 is to be used for public services, too, and NTT started from November 7 tentative digital and video services for use by private enterprises and organizations.

The communications satellite is not the only type of domestically launched artificial satellite that Japanese newspaper companies and news agencies are contemplating to
use. The one which has aroused their interest and touched off heated discussions is the domestic broadcasting satellite (DBS). Because the number of internationally allocated channels are limited (Japan is allocated eight channels of independent TV waves), the DBS is regarded as a valuable national source of radio waves. Thus, not only the broadcasters but also various circles and industries concerned engaged in heated discussions as regards how it should be used.

The next broadcasting satellite BS-3 is scheduled to be launched in 1988. Two channels have been assigned to NHK as a continuation of its current license to use two channels of the BS-2. The remaining one channel of the BS-3 are to be used by a commercial TV station. Altogether 13 companies, including newspaper companies, have applied for a license to use the one channel. As a result of consultations among the companies concerned, and thanks to the coordination efforts of the Federation of Economic Organizations (Keidanren) at the request of the Ministry of Posts and Telecommunications, agreement has been reached to establish a new commercial satellite broadcasting company whose broadcasting area will cover the entire country.

The use of the broadcasting satellite is not confined to TV. Because of its point to multi-point capability, it can be used for providing diverse and comprehensive new communications media services. It can also be used to transmit newspaper pages by
multiplexed facsimile broadcast to replace the hand delivery of newspapers to each subscriber's home. For such reasons, newspapers and news agencies cannot but be deeply interested in the use of the domestic broadcasting satellite.

Finally, I would like to touch on NSK's activities regarding the harnessing of satellite technology for the press and to express my personal view on the subject.

In the autumn of 1977, NSK set up the Communications Satellite Problem Study Group within its Telecommunications Committee. I served as a member of this study group from the time of its establishment to the summer of 1983 and conducted a wide-ranging study on the use, system and utilization fees of satellites in Japan and in other countries. Each member was given a research theme. At meetings held once a month, reports were read on the progress of research. At the same time, we went on inspection tours of space-related facilities in Japan. During the period I served on the study group, three reports were made. I regret that here I cannot go into the contents of those reports. The study group is even now continuing its research, including a study on the problem of the domestic broadcasting satellite.

While engaging in this research, one thought always coursed through my mind. That was, how wonderful it would be if we could put in geosynchronous orbit a Press satellite
expressly for use in exchanging news, jointly owned by the
countries of the Asian region, and accessible directly to
mass media organizations of all related countries. I fully
realize that its materialization will be difficult because
of the differing circumstances in each country. However, it
is technically feasible. I believe that such a Press satel­
lite participated in by a large number of news organizations
in the Asian region will have far greater merit than a sa­
tellite used only by the news organizations of a single
country.

It is my hope that the satellite will be used effec­
tively to promote peace and friendship among all peoples.
<table>
<thead>
<tr>
<th>ITEM</th>
<th>Communications Satellite</th>
<th>Launching Date</th>
<th>Operation Period</th>
<th>Frequency</th>
<th>Number of Transponders</th>
<th>Transmission Power</th>
<th>Capacity (in Megahertz)</th>
<th>Power Source</th>
<th>Life</th>
<th>Specific Application</th>
<th>Purpose</th>
<th>Users of CS-2 and NHK (Japan Broadcasting Corp.)</th>
<th>Other new users</th>
</tr>
</thead>
</table>

**Note:** The table above provides a summary of the launchings of Japanese Domestic Communications and Broadcast Satellites. The table includes details such as the satellite name, launch date, operation period, frequency, number of transponders, transmission power, capacity, power source, life, specific application, purpose, and users.
### FIGURE 2

Users & its Capacity on CS-2

<table>
<thead>
<tr>
<th>Users</th>
<th>Frequency</th>
<th>Transponder</th>
<th>Capacity (telephone channels)</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Telephone &amp; Telegraph Corp.</td>
<td>K band</td>
<td>4</td>
<td>2000</td>
</tr>
<tr>
<td></td>
<td>C band</td>
<td>2</td>
<td>1000</td>
</tr>
<tr>
<td>National Police Agency</td>
<td>K band</td>
<td>1</td>
<td>500</td>
</tr>
<tr>
<td>Construction Ministry</td>
<td>K band</td>
<td>0.4</td>
<td>200</td>
</tr>
<tr>
<td>Ministry of Posts &amp; Telecommunications</td>
<td>K band</td>
<td>0.2</td>
<td>100</td>
</tr>
<tr>
<td>Fire Defense Agency</td>
<td>K band</td>
<td>0.2</td>
<td>100</td>
</tr>
<tr>
<td>Japanese National Railways</td>
<td>K band</td>
<td>0.1</td>
<td>50</td>
</tr>
<tr>
<td>Electric Power Companies</td>
<td>K band</td>
<td>0.1</td>
<td>50</td>
</tr>
</tbody>
</table>
FIGURE 3

Outward CS-2

despun antenna for communication

branching filter
wobble collector
despun motor assembly
loading box
platform
fuel tank
for 2nd propulsion
aposee motor

Antenna Pattern

Angle of elevation

50° 40° 30° 20°

58° 48° 39°

Okinawa Tokyo Sappor
FREQUENCY for a communication satellite

up-link: earth station → satellite
down-link: satellite → earth station

<table>
<thead>
<tr>
<th>BAND</th>
<th>down-link GHz</th>
<th>up-link GHz</th>
<th>band (NASA)</th>
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<tbody>
<tr>
<td>4/6 GHz</td>
<td>3.7 - 4.2</td>
<td>5.925 - 6.425</td>
<td>C band</td>
</tr>
<tr>
<td>11/14 GHz</td>
<td>10.95 - 11.2</td>
<td>14.0 - 14.5</td>
<td>Ku band</td>
</tr>
<tr>
<td>20/30 GHz</td>
<td>17.7 - 21.2</td>
<td>27.5 - 31.0</td>
<td>K band</td>
</tr>
</tbody>
</table>
EX.1 One Way (1 ch) Use

EX.2 One Way (2 ch) Use
Terrestrial Circuits and Satellite Network

Figure 6

Page Facsimile Transmission using Satellite

48Kbps line x 5

Tokyo-Kita Kyushu
(Goya, Osaka branch)
48KHz band line

Kita Kyushu

Sapporo

Aomori

Tokyo-Sapporo (Aomori branch)
48KHz band line
This news copy is received via satellite. A newspaper company, ASAHI, tested its digitalized page facsimile satellite transmission techniques using CS-2, on 12th November. The report says this "Online Digital System" is first trial in the world, under the MPT's Pilot Plan with NEC. Other leading newspapers including YOMIURI, MAINICHI and NICHKEIZAI and news agencies including KYODO and JIJI, have decided to participate in the MPT's tests.
**Police Launch Weekend Stakeout for Axiontesters**

The National Police Agency on Saturday placed some 110 officers on a weekend stakeout for the sixth consecutive weekend to uncover maneuvers of a mysterious group calling itself "The Man With 21 Faces," made up of more than 400 people who have allegedly been involved in the poisoning of Morinaga Misakin, a 32-year-old woman, and the burning of Morinaga's house.

**Police said they hoped to, through emergency measures such as assembling movable radio stations from various parts of the country or using the communications satellite, NTT hopes to restore 50,000 circuits by next weekend.**

**NTT maintenance men, in coordination with the communications called cable tunnel in front of the Setagaya Police Department**

**Firemen and policemen Saturday inspected the damage caused by the underground utility tunnel fire in Setagaya Ward. The fire, which broke out Friday, knocked out the on-line systems of 45 telecommunications service companies in the area.**

**Two companies, one of which has placed some 400 officers on a market.
Ideal Figure of Satellite Communications System

- **Private Use Communication**
- **Control**
- **TV conference**
- **high speed data transmission**
- **high speed facsimile transmission**
- **A corp. branch**
- **B corp.**
- **A corp. head office**
- **Disaster**
- **Remote Island**
- **Telephone Office**
- **Home**
- **Telecommunications Satellite Corporation of Japan**

- **Telephone Office**
- **C corp. head office**
- **C corp. branch**