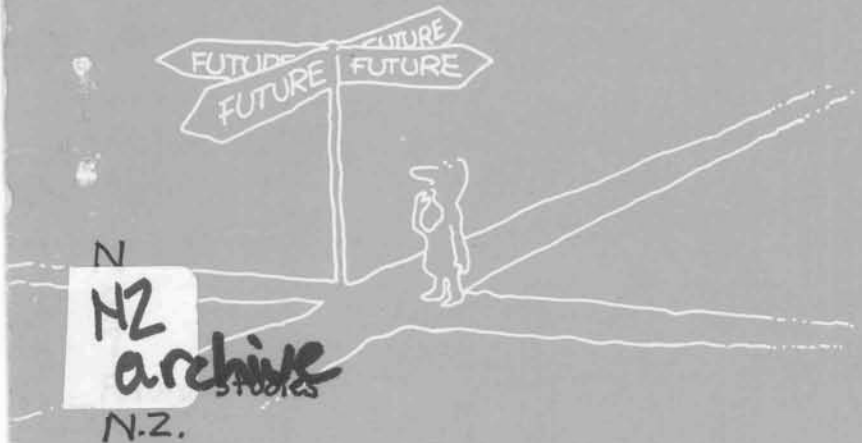
NETWORK NEW ZEALAND
WORKING PAPERS

Communications Policy Research Group



COMMISSION FOR THE FUTURE

Contributing papers to

NETWORK NEW ZEALAND

COMMUNICATIONS IN THE FUTURE

1. Towards a Communications and Information Policy for New Zealand. A discussion paper by Myra Harpham.

2. Information Occupations: The New Dominant in the New Zealand Work Force. An analysis by Michael Conway.

3. Communication Needs and Rights; Communications in four New Zealand Contexts. A working paper by P.W. Harpham, Marie Keir, Gerald E. Moriarty and George Van Valkenburg.

4. Communications to the Year 2010: Some Social, Political and Economic Issues. Marie Keir.

5. Computer Communications and Information Services. Notes by P.W. Harpham.

6. The Future of Broadcasting and Frequency Spectrum Usage in New Zealand. A working paper by Gerald E. Moriarty.

7. The New Zealand Daily Newspaper: An Endangered Species. A working paper by Michael Conway.

8. Point-to-Point Communication in New Zealand Over the Next 20 Years. A working paper by John P. Moriarty.

9. Space Satellite Distribution. An input paper by George Van Valkenburg.

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SPACE SATELLITE DISTRIBUTION

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Commission for the Future

Communications Policy Research Group
Space Satellite Distribution

an input paper by
George Van Valkenburg
February 27, 1981

"The experiments at NASA in the 60's that proved the worth of the geosynchronous orbit for communications have now fostered an entirely new business that occupies a principal position in the mainstream of commerce: affordable, wideband communications with distance insensitivity. It is the only such economically sustaining emergence from the space program."

Donald K. Dement, Manager
Advanced Communications Research
and Applications Office
NASA Headquarters. Unpublished paper.

INTRODUCTION

Ever since Sir William Pickering played the key role in launching America's first successful artificial satellite, New Zealand has been involved in Space Age, whether she wanted to be or not.

To comprehend the unique usefulness of the geostationary, or 24 hour satellite, the "prime real estate" in terms of communications, it is helpful to use two "props;" a classroom globe, and a string nearly as long as the equatorial circumference of that globe. By positioning your eye directly above the equator, as far out as the string will reach, you approximate the fulltime view of such a satellite.

Perform this exercise relative to New Zealand, and you find yourself looking directly down on Nauru, with a view that reaches from Tahiti on the East to Singapore on the West. Yesterday and today are split by the dateline. Tokyo is roughly the same distance northwest as Dunedin is to the southeast. All of Hawaii, Australia, Papua New Guinea and the Philippines are clearly visible, along with much of mainland China.

This is the new geography of the space age...the new "Hemisphere of common interest."

Immediately evident is the fact that some 80% of this hemisphere is open ocean. Unless patterns of human habitation change drastically, this implies that New Zealanders will continue to have access to relatively uncluttered airwaves and satellite orbital slots. Also obvious is the fact that a reticulated network over this region is an economic impossibility.

Satellites MUST have a major role to fill!

SATELLITE CHARACTERISTICS

In general terms, the satellite can be thought of as today's "high ground." It is a mountaintop from which to broadcast and receive signals. It is a vantage point for observing the earth below and all that moves upon it. It is the eye of God.

Compared to wired systems and terrestrial radio systems, the satellite has more advantages than disadvantages.

ADVANTAGES

Transmission cost is independent of distance. To link any two or more points within view of the satellite costs the same, as far as the space segment is concerned.

Any network can be constructed or changed simply by establishing receivers and terminals. With no hardwired links, a network can exist for a millisecond or for the lifetime of the satellite.

High bandwidths or bit rates can be brought directly to the point of need via a local antenna. Intercontinental colour television can travel by satellite, but not by today's underseas cables.

A satellite can broadcast its signal over its whole field of view, or to selective regions within it. A nation or region can be serviced with a single slice of the spectrum.

A satellite can gather raw data or processed information from ground stations, by both passive and active methods.

Characteristics and capacities of systems can be improved or changed rapidly by launching a new generation of satellites rather than by rebuilding a terrestrial network.

Satellites themselves are immune to weather and most physical disruptions, although some communications frequencies may be sensitive to rain attenuation.

DISADVANTAGES

The speed of light is too slow. The round trip path from earth to geostationary orbit introduces an annoying delay. This is a problem primarily for interactive systems such as ordinary telephone calls.

Because even a spot beam covers a substantial area on earth, it may be intercepted. Security and privacy must be ensured by encoding systems rather than physical protection of facilities.

USES

The most common unmanned space satellites fall in the areas of communications and data acquisition.

Communications satellites are subdivided into point-to-point or fixed service, and broadcast.

Point-to-point Electromagnetic signals from space replace traditional hardwired or microwave functions. Telephone systems can be linked across difficult land or sea barriers. Television programming can be carried from studio to cable head or terrestrial transmitter.

Personalvoice and/or locator systems will be a variation of point-to-point service.

Broadcast By increasing the radiated power of the satellite and using the appropriate combination of frequencies and antenna systems, it is possible to receive satellite signals on small, low cost terminals.

A current Japanese experimental satellite system functions well with 1 meter dish antennas for reception of colour television.

Radio services may soon reach portable and car radio sets directly from space. This service will be highly appropriate to the Pacific Island nations.

Data acquisition satellites can collect information from numerous unmanned ground or sea sensors, or can remotely sense phenomena from orbit. Both passive imaging or radiometric observations and active radar-type scans can be made. Often military and civilian applications are similar, but differ in requirements for resolution or immediacy of usable data.

New Zealand could benefit from satellite data acquisition systems such as:

200 mile zone surveillance
land use monitoring and study
crop disease monitoring
ocean resources monitoring
meterological observation and data gathering
geothermal mapping and monitoring
snowpack and lake level monitoring
high resolution mapping and geologic surveys

Within broad limits, selected functions of communications and data acquisition can be combined on the same space platform. Such customized national or regional satellites will become common.

Any New Zealand domestic satellite would probably combine these functions to be cost effective.

SOME CURRENT MODELS

The menu of possible satellite services is extremely broad, and bound to become more flexible as launch systems and electrical power supplies improve. Therefore, it is useful to look at some current systems.

AUSTRALIAN DOMESTIC SATELLITE

Scheduled for service in early 1985, the first generation system as envisioned in the Request for Tender, combines the following:

Remote Area Communications

Remote telephone service. Using 3 meter dish antennas, isolated subscribers would receive full Telecom Australia service including local access area calling, STD and ISD.

School of the Air. Either via separate earth stations or by modified telephone stations as above, the Australian HF radio network educational system would be converted to a satellite-delivered service.

Homestead and Community Broadcasting Service. Via 1.2 to 1.8 meter dishes, broadcast radio and television programming would be delivered to isolated homesteads and communities in 4 service areas covering the whole continent. Options within the system could provide two television services and three radio services.

General Broadcasting Uses

5 meter dishes would be used by both ABC and commercial broadcasters for interchange of television programming between studio centers and from originating studio to transmitter.

The capability will also exist to establish special interest (multicultural, etc.) radio networks as required.

Aeronautical Applications

The air traffic control system would use highly reliable (by redundancy) voice and data links between manned traffic control centers, and between the centers and remote air-to-ground repeaters covering the whole continent.

Private Services

Commercial interests are highly interested in leasing circuits for high speed data transmission and private line voice applications. Flexible systems of leased facilities and capabilities as well as privately owned earth stations have been discussed.

Data Acquisition

The capability will exist to receive data from robot meteorological and other observation stations.

Papua New Guinea

PNG has expressed interest, and will have the capability to implement telephone and direct broadcasting services similar to those listed above for Australia.

Regretfully, New Zealand did not respond when queried in early 1980, and therefore no provisions have been included for similar services to this country, even though the satellite will be positioned directly over the center of the Tasman, closer to New Zealand than to most of Australia.

SECOND GENERATION AUSTRALIAN SATELLITE

Additional services targeted for possible implementation later in the '80s include:

satellite to mobile links for public safety agencies
remote data collection and field surveys
transmission of meteorological information to ships
meteorological imaging
defense strategic and tactical communications
Antarctic communications

(New Zealand Post Office makes the general statement that it might be interested in participating in the second generation system.... if anyone asks them a second time.

An interesting implication can be drawn from a confidential BBC paper on the subject of Direct Broadcasting Satellites: "Failure to be involved in satellite broadcasting at this stage makes the launching of a service at a later date less economically viable.")

INDIAN NATIONAL SATELLITE

The Insat 1 system, scheduled for first launching in 1982, goes slightly farther toward hybrid capabilities than the Australian system described above.

Insat provides 6000 voice channels linking 35 locations now poorly serviced by telephone, plus two transponders for direct broadcast of television into 3 meter dishes.

It also carries high resolution radiometers that will create visible light and infrared images of the full earth every 30 minutes. One major advantage will be an additional 12 to 24 hour warning of tropical cyclones. The warnings can go out on the television service.

Insat will also collect data from more than 100 unmanned stations for meteorological, hydrological and oceanographic data.

PEACESAT

While the Peacesat project has been described so often as to be a cliche, it remains as the most impressive South Pacific-wide satellite demonstration. It displays an interesting combination of nationally funded low cost ground stations, with an internationally provided (NASA) space segment. Essentially one single party-line telephone simplex service accessible from Australia to California, the ATS-1 satellite link has demonstrated the potential value of public service satellite communications for the island nations of the Pacific.

It is possible that international agencies may eventually take up the challenge of continuing the work of Dr. John Bystrom and fund an expanded Peacesat-type service. New Zealand should, by history and by geography, take a leadership role in any such project.

INTELSAT

This international consortium works so efficiently that it is sometimes taken for granted. While its international service is highly regulated, it is not widely realized that INTELSAT is free to provide domestic services within its member nations on much less stringent standards.

Using New Zealand as an example, as of January 1981 it was possible to access the Intelsat IV or IVA satellites for domestic use only, on the following terms:*

	Per year on 5 yr lease
Full transponder, 36 MHz, Global beam,	$800,000
" " " " Hemispheric beam	960,000
" " " " Spot beam	1,600,000
Half transponder, 18 MHz, Global beam	400,000
" " " " Hemispheric beam	480,000
" " " " Spot beam	800,000
Quarter transponder, 9MHz Global beam	200,000
" " " " Hemispheric beam	240,000
" " " " Spot beam	400,000

Estimated current cost per ground station for such a system, $150,000 each. The only restriction being that there is no interference created with other Intelsat traffic. Thus, domestic ground stations would be significantly lower in cost than the Standard A and B Intelsat terminals required for international service.

The Half-transponder service would carry one television channel plus some additional voice or data.

The Hemispheric beam option would appear to be the most cost-effective for New Zealand.

It is evident from the above rough figures, that even today an Intelsat-distributed video or data network would probably be competitive within New Zealand. It can be assumed that the past curve of cost reduction will continue, thereby tipping the economic scales even more in the direction of satellite distribution.

*Private conversation with Marcel Perras, Intelsat Director of Business Planning.

A NEW DIRECT BROADCAST TELEVISION STANDARD ?

The BBC is considering the establishment of satellite direct broadcasting of television and/or radio, possibly as early as 1985. The question has been raised whether this should include an edited National Programme type service plus a "subscription television service" whose profit would help support public service broadcasting.

This early DBS service would probably be conventional as far as signal encoding and compatibility with today's receivers are concerned.

However, the BBC points out that the global switch to direct broadcasting of television from space may represent the next appropriate landmark for introducing a greatly improved picture and sound standard.

An SMPTE article has postulated a conventional raster-scan picture system with 1501 lines, 60 fields per second, with an aspect ratio of 8:3. Translated, this would imply a virtually flickerless television picture with resolution comparable to magazine colour printing, and a shape much like a cinemascope screen.

Such a broadcasting standard would then truly justify display on large screen TV sets such as the projection systems now coming into use overseas.

It is probable, however, that a global advanced standard would also include improvements over the raster scan sytem. Improvements in information processing, and reductions in cost for local memory suggest that television sets of the future will be much more "intelligent" than today. The results might be savings in broadcasting bandwidth as well as the better picture and sound standards that would be so highly desirable.

If such an improved standard were adopted in PAL countries, it may be hoped that New Zealanders would be able to receive and display them whether from New Zealand sources or international services.

Presumably the transition would be over a considerable period of time, possibly with a compatible signal system which could be displayed in lower fidelity on existing receivers.

SATELLITES AND NEW ZEALAND

While it can be generally stated and defended that satellite technology is highly appropriate to the South Pacific, different services, nations and regions have different levels of appropriateness.

Australia, for example, is characterized by a large land mass spread longitudinally, with vast areas difficult to service by conventional broadcasting and telephone systems. A domestic satellite is virtually the only way to make a quantum leap in communications capability across the miles and the time zones.

Because of its geography, New Zealand is probably servicable with a single satellite spot beam, and is located within one time zone. However, it has a highly developed infrastructure of broadcasting and Post Office Telecoms. Therefore, while satellites may offer economic and technical advantages over yet-to-be-installed terrestrial services, they must compete with existing sunk investments and human resources. In such cases, the justifications become more complex.

The international scene between New Zealand and the rest of the world, as well as New Zealand vis a vis the Pacific Island nations, is more straightforward. As detailed earlier, distance insensitivity, broadband capability, direct broadcasting possibilities, and uncrowded spectrum and orbital slots imply that international telecommunications will rapidly gravitate to satellite delivery throughout Oceania.

NEW ZEALAND APPLICATIONS

Satellite technology can be used to facilitate and expand conventional services:

- More international telephone and Oasis-type data links
- Reduced cost services
- More overseas television news and sports
- Better weather forecasting
- More reliable radio service

Satellites can enable new services:

- Broadband to point-of-need anywhere in the region
- Mobile communications, personal communicator and locators
- Global interactive systems including videotex and access to centralized data banks
- Random access systems, temporary terminals, flexible networks
- Direct broadcasting, radio and TV, domestic and regional
- Earth resources survey and surveillance systems
- Data collection and transfer systems
- Navigation, search and rescue
- Military communications and information gathering

NEW ZEALAND OPTIONS

There are numerous paths by which New Zealand as a nation, or its residents and resident companies might benefit from future satellite technology.

Bi-lateral or Multilateral systems: While it would appear too late for involvement in Phase I of the Australian domestic satellite system, a strong expression of New Zealand interest might still be useful.

It is not too early to start planning for involvement in Phase II of the Australian system.

Initiatives might be taken with other neighbors along the geostationary arc: China, Japan, Indonesia, Philippines, Hawaii (USA).

Future INTELSAT systems: These may include direct broadcasting as well as more powerful and complex fixed services. As a member of Intelsat, New Zealand might be able to influence and capitalize on new Pacific capabilities. As noted earlier, use of fractions of Intelsat transponders may represent an affordable first step.

Commercial satellite systems: Services such as the American SBS may soon be offered on a regional or global basis. Freedom to subscribe to these systems may enhance the international trading ability of New Zealand-based companies.

A New Zealand Domestic Satellite: By combining communications and data acquisition functions, and assuming that launch costs are reduced in the era of the Space Shuttle, it may become feasible for New Zealand to consider a tailor-made satellite of its own beyond 1990.

POLICY IMPLICATIONS

Assuming that tomorrow's world in general benefits from the advantages to be gained from satellite delivery and mediation of services, then New Zealanders will be justified in expecting equitable and affordable access to these same services.

Since it is difficult to legislate against electromagnetic radiation (such as short wave broadcasts) it may be assumed that unless the New Zealand government takes a leadership role in providing such services, a vacuum will develop. Global commercial services will tend to fill that vacuum.

Therefore, the first policy decision is whether to take a national leadership role in the use of satellite technology, or by abdicating that role, insure that the services will be provided by multinational entities.

In the case of direct broadcasting of radio and TV from satellites, a New Zealand-originated service for the South Pacific could be a powerful arm of Foreign Affairs. An abdication of such a role would insure that other space-minded nations would have first access to the eyes and ears of our nearest trading partners.

Because of the geography and population of the South Pacific, we may assume that there will continue to be a surplus of spectrum and orbital slots appropriate to New Zealand. However, inaction in occupying these resources may mean that other entities may lay claim to the "prime" or most easily exploited slots and frequencies. Thus, if New Zealand adopts a policy of reticence, itmay have to make do with leftovers.

Direct broadcasting offers an unique combination of equality of access over the whole nation or region, and a major conservation of spectrum.

Assuming that the New Zealand electronics industry might be interested in, and capable of producing suitable direct broadcast radio and TV receivers and antennae, a major industry might be stimulated, although the space segment and uplink facilities most probably would be of foreign supply. If productivity were competitive with the Orient, there might be a regional export market as well.

Recognizing that Post Office Telecoms, Broadcasting and the data acquisition and utilization functions of other government departments might all benefit from satellites, particularly a New Zealand domestic satellite, a major policy consideration will be to designate the lead agency to oversee such development. Internecine strife has been one of the artificial barriers to Australia's early application of satellite technology.

One of the recurring policy questions in New Zealand telecommunications is that of attempted equality of access over the whole nation. While no politician would promise reticulated sewers or paved roadways to every property owner everywhere, they somehow feel bound to offer AM/FM radio and multi-channel colour television to every corner of the land. Direct broadcasting via satellite inherently caters to this quirk.

(A sidelight: one of the issues at the moment in Australia is whether Telecoms is responsible for the cost of the ground station for telephone use, or whether this is the responsibility of the outback resident. The question is muddied by the probability

that a multi-purpose ground station will be developed that combines telephone, School of the Air, and television reception. Does this all come at government cost? Is it maintained by government?)

If a national energy policy were to suggest that telecommuting should be encouraged, it is possible that two-way satellite links could bring the necessary broadband communications highways to isolated regions faster than reticulation of optical guideways could be installed.

If public policy decides that the broadband communications highways are to be provided as a public service, while the terminals and traffic are private matters, the question arises just as in Australia whether ground stations should be public, private or optional.

The problem of interception of satellite signals would suggest a thorough review of privacy legislation, copyright laws and penalties for willful violations.

When direct broadcasting sets and antennae are commonplace, the way is open for deliberate insertion of propoganda services in the South Pacific, much as the numerous short wave services are used today. Concepts of libel, pornography and other matters of domestic legislation may become meaningless if the signal sources are untouchable in space.

The presence, absence or extent of government subsidy to the provision of broadband communications highways to a"Network New Zealand" will be a key underlying issue. If it were administered as an instrument of indirect taxation, the whole exercise might be counterproductive.

The implementation of a reticulated optical system throughout the nation would require large amounts of conventional employment over a multi-year period; the establishment of satellite terminals in isolated communities could bring the capability of dispersed workplaces and dispersed employment much more rapidly.

We may assume that the ultimate effect of such a policy on employment would be to facilitate upgrading of jobs in the information sector regardless of physical location.

The possibility for delivery of one-way (DBS) and two-way (such as Plato) educational services will be implicit in satellite technology. The actual use will depend on the enthusiasm and funding ability of the Department of Education.

If the government opted at an early date for a Network New Zealand, that is, the facilitation of affordable, broadband communications highways, plus de-regulated access and terminals, I believe that this country could leapfrog North America and Western Europe, with immense benefits to be reaped. Policy decisions which might take decades through the machinery of the EEC or the United Nations, or the commercial marketplace of the USA, can be implemented overnight in New Zealand.

Thus, just as geographic isolation and low population density are no longer liabilities in the age of satellite services, a monolithic decisionmaking process and limited public debate become virtues in the cause of progress.